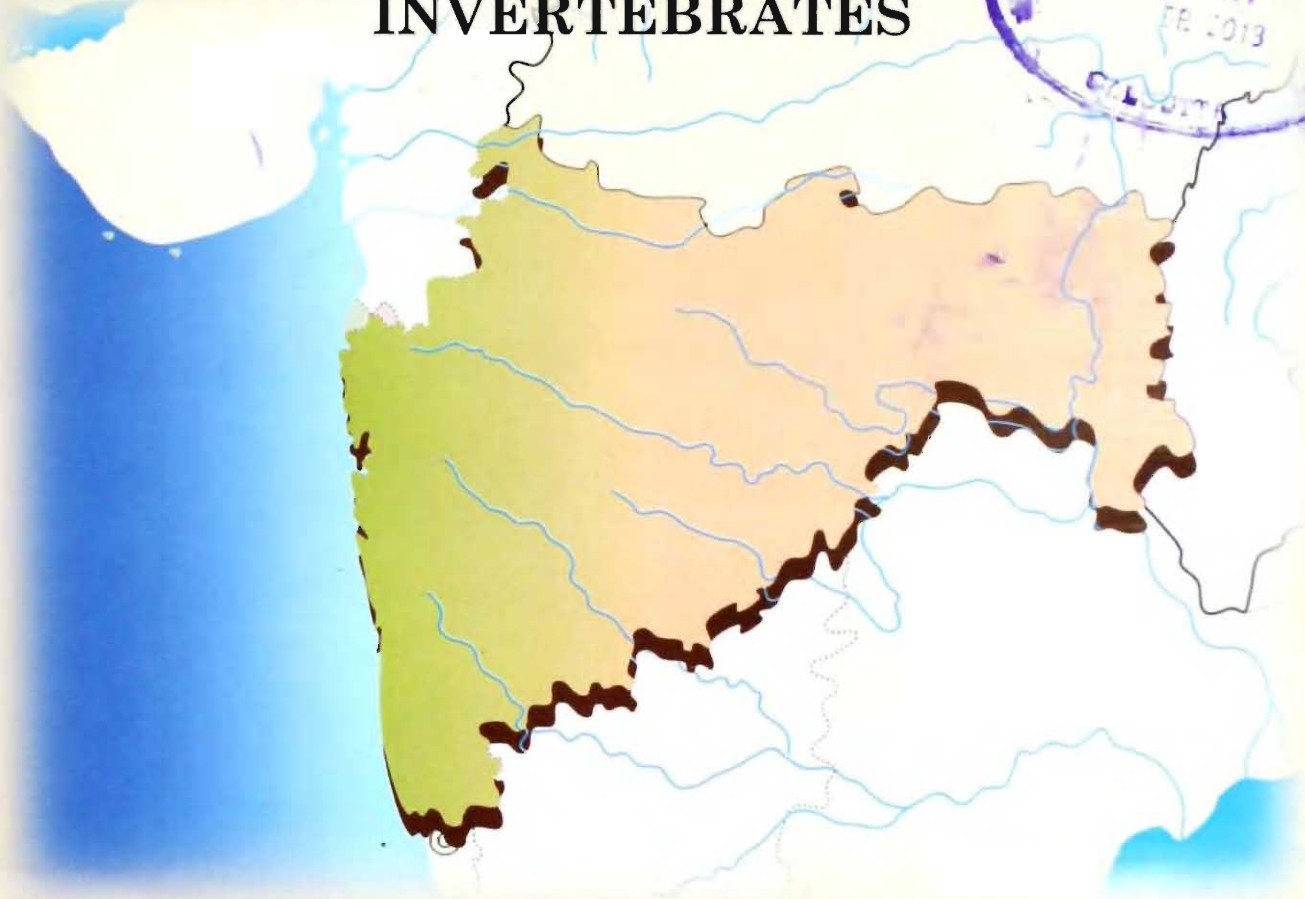


STATE FAUNA SERIES 20

FAUNA OF MAHARASHTRA

PART - 2 INVERTEBRATES



ZOOLOGICAL SURVEY OF INDIA



State Fauna Series, 20

FAUNA OF MAHARASHTRA

(PART-2)

INVERTEBRATES

Edited by
The Director, Zoological Survey of India, Kolkata

Zoological Survey of India
Kolkata

CITATION

Editor–Director, 2012. *Fauna of Maharashtra, State Fauna Series, 20(Part-2) :1-673* (Published by the Director, Zool. Surv. India, Kolkata)

Published : November, 2012

ISBN 978-81-8171-306-1

Project Co-ordinators

Dr. Anil Mahabal, Scientist-F (Retd.)
and

Dr. R.M. Sharma, Scientist-D & Officer-in-charge

© Govt. of India, 2012

ALL RIGHTS RESERVED

- No part of this publication may be reproduced, stored in a retrieval system or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording or otherwise without the prior permission of the publisher.
- This book is sold subject to the condition that it shall not, by way of trade, be lent, re-sold hired out or otherwise disposed of without the publisher's consent, in any form of binding or cover other than that in which it is published.
- The correct price of this publication is the price printed on this page. Any revised price indicated by a rubber stamp or by a sticker or by any other means is incorrect and should be unacceptable.

PRICE

**India : ₹ 2,250/
Foreign : \$ 125; £ 90**

Published at the Publication Division by the Director, Zoological Survey of India, M-Block, New Alipore, Kolkata-700 053 and printed at Calcutta Repro Graphics, Kolkata-700 006.

STATE FAUNA SERIES
FAUNA OF MAHARASHTRA

No. 20 (Part-2)

2012

1-673

CONTENTS

1. PARASITIC PROTOZOA	1-193
N.C. Nandi, C. Kalavati, S. Nikam, L. Bindu, R. Nandi and R. Ghosh	
2. FREELIVING PROTOZOA	195-214
L. Bindu and D. Saha	
3. FRESHWATER SPONGES	215-216
H.V. Ghate	
4. NEMATODA	217-248
Padma Bohra	
5. LAND AND FRESHWATER MOLLUSCA	249-289
S.G. Patil and S.S. Talmale	
6. MARINE GASTROPODS (MOLLUSCA : GASTROPODA)	291-302
S.K. Pati and R.M. Sharma	
7. MARINE BIVALVES (MOLLUSCA : BIVALVIA)	303-308
S.K. Pati and R.M. Sharma	
8. FRESHWATER OSTRACODS	309-319
S.G. Patil and S.S. Talmale	
9. CLADOCERA	321-359
Pramod D. Rane	
10. FRESHWATER PRAWNS (ATYIDAE : PALAEMONIDAE : DECAPODA)	361-363
S.K. Pati and R.M. Sharma	
11. FRESHWATER CRABS (GECARCINUCIDAE : BRACHYURA : DECAPODA)	365-366
S.K. Pati and R.M. Sharma	
12. CRUSTACEA : ISOPODA	367-373
M.K. Dev Roy, S. Mitra and S.K. Pati	
13. BARNACLES (CRUSTACEA : MAXILLOPODA : CIRRIPIEDIA)	375-377
S.K. Pati and R.M. Sharma	
14. MARINE WOOD BORERS	379-380
D. Swain, S.K. Pati, M.V. Rao and R.M. Sharma	
15. MARINE CRABS (DECAPODA : ANOMURA AND BRACHYURA)	381-385
S.K. Pati, K.C. Sahu, D. Swain, S.K. Baliarsingh and R.M. Sharma	
16. SHRIMPS (CRUSTACEA: DECAPODA: DENDROBRANCHIATA: PENAEIDAE)	387-393
M.K. Dev Roy and S. Rath	

17.	INSECTA : EPHEMEROPTERA (MAYFLIES)	395-396
	R.M. Sharma and Kailash Chandra	
18.	INSECTA : ODONATA	397-428
	P.P. Kulkarni, R. Babu, S.S. Talmale, Chhaya Sinha and S.B. Mondal	
19.	INSECTA : ORTHOPTERA	429-436
	Kailash Chandra and S.K. Gupta	
20.	INSECTA : DERMAPTERA	437-438
	M.J. Jadhav, S.S. Jadhav and R.M. Sharma	
21.	INSECTA : EMBIOPTERA (WEB SPINNERS)	439-440
	R.M. Sharma and Kailash Chandra	
22.	INSECTA : MANTODEA	441-445
	H.V. Ghate, S.S. Jadhav and R.M. Sharma	
23.	INSECTA : BLATTODEA	447-448
	S.S. Jadhav and R.M. Sharma	
24.	INSECTA : HEMIPTERA : APHIDIDAE	449-463
	B.C. Das and P.P. Kulkarni	
25.	INSECTA : HOMOPTERA : MEMBRACIDAE	465-466
	G. Thirumalai, S. Prabakaran and R.M. Sharma	
26.	INSECTA : HEMIPTERA (AQUATIC and SEMI AQUATIC)	467-472
	G. Thirumalai and R.M. Sharma	
27.	INSECTA : HEMIPTERA : PENTATOMIDAE	473-475
	Girish Pathak, H.V. Ghate and R.M. Sharma	
28.	INSECTA : HEMIPTERA : REDUVIIDAE ASSASSIN BUGS	477-478
	R.M. Sharma and R. Bano	
29.	INSECTA : HOMOPTERA SCALE INSECTS AND MEALY BUGS	479-483
	M.J. Jadhav and R.M. Sharma	
30.	INSECTA : NEUROPTERA	485-488
	R.M. Sharma and Kailash Chandra	
31.	INSECTA : COLEOPTERA : SCARABAEIDAE SCARABAEID BEETLES	489-494
	M.J. Jadhav and R.M. Sharma	
32.	INSECTA : COLEOPTERA : BRUCHIDAE BRUCHIDS	495-497
	R. Bano, Kavita Gupta, Charan Singh and R.M. Sharma	
33.	INSECTA : COLEOPTERA (AQUATIC)	499-501
	R.M. Sharma and R. Bano	
34.	INSECTA : COLEOPTERA : CERAMBYCIDAE	503-505
	H.V. Ghate	
35.	INSECTA : COLEOPTERA : COCCINELLIDAE	507-509
	S.S. Jadhav and R.M. Sharma	
36.	INSECTA : COLEOPTERA : CICINDELIDAE	511-512
	S.S. Jadhav and R.M. Sharma	

37. INSECTA : COLEOPTERA : ELATERIDAE	513-516
Amol Patwardhan and R.P. Athalye	
38. INSECTA : COLEOPTERA : CHRYSOMELIDAE	517-522
Priyanka Dutta Saha, M.J. Jadhav and R.M. Sharma	
39. INSECTA : COLEOPTERA : CHRYSOMELOIDEA : CHRYSOMELIDAE : CASSIDINAE	523-526
H.V. Ghate	
40. INSECTA : COLEOPTERA : RHYNCHOPHORA : CURCULIONIDAE	527-528
S.S. Jadhav and R.M. Sharma	
41. INSECTA : MECOPTERA (SCORPIONFLIES)	529
R.M. Sharma and Kailash Chandra	
42. INSECTA : DIPTERA	531-538
Priyanka Dutta Saha, R.M. Sharma and Bulganin Mitra	
43. INSECTA : DIPTERA : CECIDOMYIIDAE (GALL MIDGES)	539-548
R.M. Sharma	
44. INSECTA : DIPTERA : TABANIDAE	549-550
R.M. Sharma	
45. INSECTA : LEPIDOPTERA : RHOPALOCERA AND GRYPOCERA	551-562
R.M. Sharma	
46. INSECTA : TRICHOPTERA (CADDISFLIES)	563-565
R.M. Sharma and Kailash Chandra	
47. INSECTA : HYMENOPTERA : FORMICIDAE	567-586
S. Sheela and A. Chattopadhyay	
48. INSECTA : HYMENOPTERA : ENCYRTIDAE : ENCYRTINAE	587-604
S.I. Kazmi and P. Girish Kumar	
49. INSECTA : HYMENOPTERA : ENCYRTIDAE : TERACNEMINAE	605-618
S.I. Kazmi and P. Girish Kumar	
50. INSECTA : HYMENOPTERA : SCOLIIDAE	619-625
P. Girish kumar and S.I. Kazmi	
51. INSECTA : HYMENOPTERA : ICHNEUMONIDAE	627-636
S.M. Nikam and A.J. Kharat	
52. CHILOPODA : SCOLOPENDROMORPHA : SCOLOPENDRIDAE	637-659
B.E. Yadav	
53. ACARINA : ARACHNIDA	661-665
A.N. Sirsikar and D.D. Wanule	
54. ARACHNIDA : ACARINA : ASTIGMATA (HOUSE DUST MITES)	667-668
S.B. Jogdand	
55. ARACHNIDA : ACARINA : TROMBICULIDAE (CHIGGER MITES)	669-670
R. Bano and R.M. Sharma	
56. ARACHNIDA : SCORPIONIDA	671-673
D.B. Bastawade	

PARASITIC PROTOZOA

N.C. NANDI, C. KALAVATI*, S. NIKAM**, L. BINDU, R. NANDI and R. GHOSH

Zoological Survey of India, M-Block, New Alipore, Kolkata-700 053

INTRODUCTION

Maharashtra state which spreads over an area of about 308,000 sq km, lies between 12°37' and 19°54' N latitudes and between 76°46' and 84°46' E longitudes, is the 3rd largest state in India and has 61,939 sq km under forest cover. It is the second most populous state in India with 96,752,247 persons (2001 provisional census report), distributed under 35 districts with state capital in Mumbai (erstwhile Bombay). Topographically, Maharashtra state has a uniform landscape with little rocky hills in some places along with prominent physical features like Western Ghats, Deccan Plateau and Konkan coast. The river systems of Krishna, Godavari, Tapi-Purna and Wardha-Wainganga have converted the plateau region into well defined river valleys, while Konkan region is dominated with many fast flowing streams that end up as estuaries. As a state it offers a wide variety of habitats for wild animals including protozoan parasites and their hosts.

Protozoa fauna of Maharashtra, particularly parasitic protozoa of this state, though have been initiated from the first half of the twentieth century by Berestneff (1903), Lingard (1904), Bezzenberger (1904), Bosanquet (1910), Bhatia and Chatterjee (1925), Setna (1927), Setna and Bana (1935), Zargar (1945), etc., but intensively investigated during the second half mainly by Prof

R. Krishnamurthy and his co-workers (1967-1978). Subsequently, Nandi (1976), Sultana (1976-1978), McClure *et al.* (1978), Wahul (1980-87), Kshirsagar (1984) and recently Nikam and her associates (2000-2005) have added an appreciable number of species of protozoan parasites from this state. These research reports, as well as our own faunistic survey results including those from Prof Susheel R. Nikam's research work during 2000 onwards are collated and presented as a consolidated document from this 3rd largest state of the country. As a result, in the present communication, a total of 474 species of parasitic protozoa belonging to 4 phyla viz., Sarcocystophora (186 species), Apicomplexa (236 species), Myxozoa (32 species), and Ciliophora (20 species), mainly belonging to intestinal flagellates, haemoflagellates, haemogregarines, gregarines, coccidians, haemosporidians, piroplasms and ciliates were recorded. Amongst these, five coccidian species viz., *Eimeria hemidactyli*, *E. knowlesi*, *E. columbae*, *E. deblickei* and *E. zuernii* constitute first report from this state.

A systematic list, a host-parasite list and a systematic account of these parasites inhabiting both vertebrate and invertebrate host species are included in this paper to indicate the occurrence of microscopic unicellular parasitofauna hitherto known from this state.

*Department of Zoology, Andhra University, Visakhapatnam-530 003

**Department of Zoology, Dr. B.A.M. University, Aurangabad-431 002, Maharashtra

MATERIAL AND METHODS

Although an earlier survey in 1973 (Nandi, 1976) and a few recent surveys have been made on protozoan parasites by researchers of Zoological Survey of India, the present study has been augmented and enriched through the collaboration from Marathwada University (SN) who had the privilege to examine materials over the years with her students and co-workers collecting samples mainly during 1990 onwards and also due to expert collaboration from Andhra University (CK). Besides these, references related to protozoan parasites of Maharashtra State have also been collected from Zoological Records as well as Bibliography of Indian Zoology and consulted to compile this document. As such, besides earlier studies, literatures on parasitic protozoa fauna of Maharashtra, mostly of Krishnamurthy and his co-workers (1966-1977), Sultana (1976-1978), Wahul (1980-85), Kshirsagar (1984) and recently Nikam and her associates (2000-2005) form the basis of this paper.

For collection and preservation of parasitic protozoa, methodology given by Mandal and Nandi (1980), Mandal *et al.* (1990), Das *et al.* (1993), Nandi (2004) and Nandi *et al.* (2004) were adopted for parasitological study. However, the methods for staining and examining blood protozoa employed during earlier survey work can be consulted from Nandi (1976). The classification followed in this document mostly based on Levine *et al.* (1980), while Wenyon (1926), Bhatia (1936, 1938), Kudo (1966), Levine (1967, 1988), Corliss (1979), Kreier (1978), Nandi *et al.* (1983, 2002), Nandi (1984), Mandal *et al.* (1993) and Kreier and Baker (1994) were consulted for reference study.

Coverage

The coverage extends to four phyla viz., Sacomastigophora, Apicomplexa, Myxozoa and

Ciliophora. The entire text of this document was divided under different parts to distribute amongst the authors for the purpose of preparation of the manuscript as follows :

- N.C. Nandi : Introductory and concluding part, Phyla Apicomplexa (except Coccidia and Gregarinea) Ciliophora and Myxozoa and editing of the text.
- C. Kalavati : Preparing write up of the Phylum Sarcomastigophora as well as figures and literature collection on Ciliophora.
- S. Nikam : Order Coccidia and Gregarinea.
- L. Bindu : Survey work, setting figures, reference collection and coordination
- R. Nandi : Order Coccidia, survey work and library work.
- R. Ghosh : Library consultation and reference collection

A systematic list of parasitic species occurring in the state is provided for quick reference to host and locality (district). A host parasite list is also provided for reference to parasites occurring in the respective host in addition to authors. A bibliography of all the references is cited at the end for convenience of the readers, which include research papers, articles, Ph.D. and M. Phil. Theses so that one may know the extent of work done on this subject from this state.

SYSTEMATIC LIST OF PARASITIC PROTOZOA

The systematic list of species of parasitic protozoa along with locality (district) of occurrence hitherto known/recorded from the state of Maharashtra is as follows :

PARASITE	HOST	LOCALITY
Kingdom PROTISTA Subkingdom PROTOZOA Phylum SARCOMASTIGOPHORA Subphylum MASTIGOPHORA Class ZOOMASTIGOPHOREA Order KINETOPLASTIDA Suborder BODONINA Family BODONIDAE Genus <i>Cryptobia</i> Leidy, 1846 Subgenus <i>Trypanoplasma</i> Laveran and Mesnil, 1901		
1. <i>C. (T.) attui</i> Wahul, 1986	<i>Wallago attu</i>	Purna, Parbhani, Aurangabad
2. <i>C. (T.) cavacii</i> Wahul, 1985	<i>Mystus cavacius</i>	Aurangabad
3. <i>C. (T.) krishnamurthyi</i> Wahul, 1985	<i>Mystus cavacius</i>	Purna, Parbhani
4. <i>C. (T.) lomi</i> Wahul, 1986	<i>Puntius hexastichus</i>	Purna, Parbhani
5. <i>C. (T.) qadrii</i> Krishnamurthy and Wahul, 1986	<i>Labeo calbasu</i> <i>Labeo dyocheilus</i>	Purna, Parbhani Purna, Parbhani
6. <i>C. (T.) saranae</i> Wahul, 1986	<i>Puntius sarana</i>	Aurangabad
7. <i>C. (T.) seenghali</i> Wahul, 1985	<i>Mystus seenghala</i>	Purna, Parbhani
8. <i>C. (T.) solapurensis</i> Wahul, 1986	<i>Puntius jerdoni</i>	Solapur
9. <i>C. (T.) vidyai</i> Wahul, 1985	<i>Mystus seenghala</i>	Purna, Parbhani
10. <i>C. (T.) wallagoi</i> Wahul, 1986	<i>Wallago attu</i>	Purna, Parbhani
11. <i>C. (T.)</i> sp.	<i>Puntius kolus</i>	Purna, Parbhani
Genus <i>Blastocrithidia</i> Laird, 1959		
12. <i>B.</i> sp.	<i>Hyalomma antolicum</i>	Parbhani
13. <i>B.</i> sp.	<i>Ranatra filiformis</i>	Marathwada
14. <i>B.</i> sp.	<i>Laccotrephes maculates</i>	Marathwada
15. <i>B.</i> sp.	<i>Dysdercus cingulatus</i>	Marathwada
Suborder TRYPANOSOMATINA Family TRYPANOSOMATIDAE Genus <i>Trypanosoma</i> Gruby, 1843		
A. <i>Trypanosoma</i> of fishes		
16. <i>T. aurangabadensis</i> Wahul, 1987	<i>Mastacembelus armatus</i>	Aurangabad
17. <i>T. joshii</i> Wahul, 1986	<i>Mystus cavacius</i>	Parbhani
18. <i>T. mandali</i> Wahul, 1986	<i>Mystus seenghala</i>	Parbhani
19. <i>T. marathwadensis</i> Wahul, 1986	<i>Puntius hexastichus</i>	Parbhani
20. <i>T. mastacembeli</i> Wahul, 1987	<i>Mastacembelus armatus</i>	Solapur
21. <i>T. misrai</i> Wahul, 1986	<i>Channa gachua</i>	Aurangabad
22. <i>T. murtii</i> Wahul, 1987	<i>Mastacembelus armatus</i>	Aurangabad, Solapur

PARASITE	HOST	LOCALITY
23. <i>T. punctati</i> Wahul, 1986	<i>Channa gachua</i>	Aurangabad
24. <i>T. puntii</i> Wahul, 1986	<i>Puntius kolus</i>	Purna, Parbhani
25. <i>T. purensis</i> Wahul, 1986	<i>Mystus senhala</i>	Purna, Parbhani
26. <i>T. rayi</i> Wahul, 1986	<i>Puntius sarana</i>	Aurangabad
27. <i>T. sp.</i>	<i>Channa gachua</i>	Aurangabad
28. <i>T. sp.</i>	<i>Channa punctatus</i>	Solapur, Aurangabad
29. <i>T. sp.</i>	<i>Glossogobius giuris</i>	Solapur
30. <i>T. sp.</i>	<i>Notopterus notopterus</i>	Purna, Parbhani
31. <i>T. sp.</i>	<i>Channa striatus</i>	Pune
B. Trypanosoma of birds		
32. <i>T. sp.</i>	<i>Buteo vulpinus</i>	Maharashtra
33. <i>T. sp.</i>	<i>Copsychus saularis saularis</i>	Maharashtra
34. <i>T. sp.</i>	<i>Pycnonotus jocosus</i>	Maharashtra
35. <i>T. sp.</i>	<i>Streptopelia chinensis</i>	Maharashtra
36. <i>T. sp.</i>	<i>Tockus griseus griseus</i>	Maharashtra
C. Trypanosoma of mammals		
37. <i>T. evansi</i> (Steel, 1885)	<i>Homo sapiens</i>	Chandrapur
	<i>Bubalus bubalis</i>	Marathwada
	<i>Ovis aires</i>	Marathwada
	<i>Capra hircus</i>	Marathwada
	<i>Canis familiaris</i>	Marathwada
38. <i>T. theileri</i> Laveran, 1902	<i>Bos indicus</i>	Marathwada
39. <i>T. sp.</i>	Khandhari cow calf	Purna and Parbhani
	<i>Bos indicus</i>	Marathwada
40. <i>T. sp.</i>	<i>Rattus rattus</i>	Beed
Genus <i>Leptomonas</i> Kent, 1880		
41. <i>L. sp.</i>	<i>Ranatra sp.</i>	Maharashtra
42. <i>L. sp.</i>	<i>Nepa sp.</i>	Maharashtra
43. <i>L. sp.</i>	<i>Dysdercus cingulatus</i>	Maharashtra
44. <i>L. sp.</i>	<i>Periplaneta americana</i>	Maharashtra
45. <i>L. sp.</i>	<i>Laccotrephes maculatus</i>	Marathwada
46. <i>L. sp.</i>	<i>Lucila sp.</i>	Marathwada
47. <i>L. sp.</i>	<i>Ranatra filiformis</i>	Marathwada
Genus <i>Herpetomonas</i> Kent, 1880		
48. <i>H. sp.</i>	<i>Lucilia sp.</i>	Maharashtra
49. <i>H. sp.</i>	<i>Calliphora sp.</i>	Maharashtra
50. <i>H. sp.</i>	<i>Musca domestica</i>	Maharashtra

PARASITE	HOST	LOCALITY
Order PROTEROMONADIDA Family PROTEROMONADIDAE Genus <i>Proteromonas</i> Kunstler, 1883		
51. <i>P. chameleoni</i> Krishnamurthy, 1963	<i>Chameleon zeylanicus</i>	Maharashtra
52. <i>P. uromastixi</i> Jankidevi, 1961	<i>Uromastix hardwicki</i>	Maharashtra
53. <i>P. sp.</i>	<i>Hemidactylus brooki</i>	Aurangabad and Nanded
54. <i>P. sp.</i>	<i>Hemidactylus cactaei</i>	Maharashtra
55. <i>P. sp.</i>	<i>Hemidactylus giganteus</i>	Aurangabad and Nanded
56. <i>P. sp.</i>	<i>Chameleon zeylanicus</i>	Aurangabad and Nanded
57. <i>P. sp.</i>	<i>Calotes versicolor</i>	Aurangabad and Nanded
58. <i>P. sp.</i>	<i>Calotes sp.</i>	Aurangabad and Nanded
59. <i>P. sp.</i>	<i>Eublepharus sp.</i>	Maharashtra
Order RETORTAMONADIDA Family RETORTOMONADIDAE Genus <i>Retortomonas</i> Grasse, 1879		
60. <i>R. aurangabadensis</i> Sultana, 1976	<i>Gryllotalpa africana</i>	Aurangabad
61. <i>R. indica</i> Krishnamurthy and Sultana, 1977	<i>Polyphaga indica</i>	Aurangabad
62. <i>R. masoodi</i> Mali, 1993	<i>Gryllotalpa africana</i>	Maharashtra
63. <i>R. nagabhushani</i> Sultana, 1976	<i>Gryllotalpa africana</i>	Aurangabad
64. <i>R. viperae</i> Krishnamurthy and Madre, 1976	<i>Vipera russeli</i>	Aurangabad
65. <i>R. wenrichi</i> Stabler, 1944	<i>Gryllotalpa africana</i>	Aurangabad
66. <i>R. sp.</i>	<i>Spirotreptus sp.</i>	Maharashtra
67. <i>R. sp.</i>	<i>Blatta gemminica</i>	Maharashtra
68. <i>R. sp.</i>	<i>Gryllotalpa sp.</i>	Maharashtra
69. <i>R. sp.</i>	<i>Periplaneta Americana</i>	Maharashtra
70. <i>R. sp.</i>	<i>Oryctes rhinoceros</i>	Maharashtra
71. <i>R. sp.</i>	<i>Gryllus domesticus</i>	Maharashtra
Family CHILOMASTIGIDAE Genus <i>Chilomastix</i> Alexeiff, 1912		
72. <i>C. qadrii</i> Krishnamurthy, 1970	<i>Rana cyanophlictis</i>	Aurangabad and Nanded
73. <i>C. hemidactyli</i> Madre, 1979	<i>Hemidactylus giganteus</i>	Aurangabad
74. <i>C. sp.</i>	<i>Varanus indica</i>	Aurangabad and Nanded
75. <i>C. sp.</i>	<i>Hemidactylus giganteus</i>	Aurangabad and Nanded
76. <i>C. sp.</i>	<i>Calotes versicolor</i>	Aurangabad and Nanded
77. <i>C. sp.</i>	<i>Bufo melanostictus</i>	Aurangabad and Nanded

PARASITE	HOST	LOCALITY
Order DIPLOMONADIDA Family HEXAMITIDAE Genus <i>Hexamitus</i> Dujardin, 1841		
A. <i>Hexamitus</i> of insects		
78. <i>H. murthii</i> Sultana, 1976	<i>Periplaneta americana</i>	Aurangabad
79. <i>H. sp.</i>	<i>Periplaneta americana</i>	Aurangabad
B. <i>Hexamitus</i> of amphibians and reptiles		
80. <i>H. cyanophlycti</i> Krishnamurthy and Shete, 1981	<i>Rana cyanophlyctis</i>	Aurangabad
81. <i>H. melanosticti</i> Krishnamurthy and Shete, 1981	<i>Bufo melanostictus</i>	Aurangabad
82. <i>H. sp.</i>	<i>Rana tigrina</i>	Aurangabad and Nanded
83. <i>H. sp.</i>	<i>Rana cyanophlyctes</i>	Aurangabad and Nanded
84. <i>H. sp.</i>	<i>Bufo melanostictus</i>	Aurangabad and Nanded
85. <i>H. sp.</i>	<i>Calotes versicolor</i>	Aurangabad and Nanded
Genus <i>Giardia</i> Kuntzler		
86. <i>G. intestinalis</i> (Lambl, 1859)	<i>Homo sapiens</i>	Aurangabad
87. <i>G. sp.</i>	<i>Rana cyanophlyctes</i>	Aurangabad and Nanded
88. <i>G. canis</i> Hegner, 1922	<i>Canis familiaris</i>	Parbhani
Order OXYMONADIDA Family POLYMASTIGIDAE Genus <i>Monocercomonoides</i> Travis, 1932		
A. <i>Monocercomonoides</i> of insects		
89. <i>M. adarshii</i> Mali, Kulkarni and Mali, 2001	<i>Oryctes rhinoceros</i>	Aurangabad
90. <i>M. aurangabadae</i> Mali and Patil, 2003	<i>Blattella germanica</i>	Aurangabad
91. <i>M. blattae</i> Sultana and Krishnamurthy, 1979	<i>Blatta sp.</i>	
92. <i>M. chakravartii</i> Krishnamurthy and Sultana, 1976	<i>Polyphaga indica</i>	Aurangabad
93. <i>M. ganapatii</i> Bhaskar Rao, 1969	<i>Gryllotalpa africana</i>	Aurangabad
94. <i>M. gryllusae</i> Sultana and Krishnamurthy, 1978	<i>Gryllus bimaculatus</i>	Aurangabad
95. <i>M. krishnamurthii</i> Sultana 1976	<i>Pycnoscelus surinamensis</i>	Aurangabad
96. <i>M. khultabadae</i> Mali and Mali, 2004	<i>Pycnoscelus surinamensis</i>	Aurangabad
97. <i>M. marthwadensis</i> Krishnamurthy and Sultana, 1976	<i>Periplaneta americana</i>	Aurangabad
98. <i>M. omergae</i> Mali, Kulkarni and Mali, 2001	<i>Oryctes rhinoceros</i>	Osmanabad

PARASITE	HOST	LOCALITY
99. <i>M. oryctesae</i> Krishnamurthy and Sultana, 1977	<i>Oryctes rhinoceros</i>	Aurangabad
100. <i>M. polyphagae</i> Krishnamurthy and Sultana, 1976	<i>Polyphaga indica</i>	Aurangabad
101. <i>M. qadrii</i> Bhaskar Rao, 1969	<i>Oryctes rhinoceros</i>	Aurangabad
102. <i>M. spirostreptae</i> Krishnamurthy and Sultana, 1980	<i>Spirostreptus</i> sp.	Aurangabad
103. <i>M. termitis</i> Krishnamurthy and Sultana, 1980	Termite	Maharashtra
104. <i>M. sp.</i>	<i>Spirostreptus</i> sp.	Maharashtra
105. <i>M. sp.</i>	<i>Blaberus</i> sp.	Maharashtra
106. <i>M. sp.</i>	<i>Gryllus</i> sp.	Maharashtra
107. <i>M. sp.</i>	<i>Blatta germanica</i>	Maharashtra
108. <i>M. sp.</i>	<i>Blatta</i> sp.	Maharashtra
109. <i>M. sp.</i>	<i>Grylotalpa</i> sp.	Maharashtra
110. <i>M. sp.</i>	<i>Periplaneta americana</i>	Maharashtra
111. <i>M. sp.</i>	<i>Oryctes rhinoceros</i> larva	Maharashtra
112. <i>M. sp.</i>	<i>Gryllus domestica</i>	Maharashtra
B. Monocercomonides of amphibians		
113. <i>M. dobelli</i> Krishnamurthy and Madre, 1979	<i>Bufo melanostictus</i>	Aurangabad
114. <i>M. sp.</i>	<i>Bufo melanostictus</i>	Aurangabad and Nanded
C. Monocercomonides of reptiles		
115. <i>M. mehdii</i> Krishnamurthy, 1967	<i>Calotes</i> sp.	Aurangabad and Nanded
116. <i>M. viperae</i> Madre and Krishnamurthy, 1976	<i>Vipera russeli</i>	Aurangabad
117. <i>M. sp.</i>	<i>Calotes versicolor major</i> ♀	Aurangabad and Nanded
118. <i>M. sp.</i>	<i>Eublepharus</i> sp.	Aurangabad
Genus <i>Polymastix</i> Butschli, 1884		
119. <i>P. ganapati</i> Sultana, 1976	Scarabaeid larvae	Aurangabad
120. <i>P. indica</i> Krishnamurthy and Sultana, 1978	<i>Polyphaga indica</i>	Aurangabad
121. <i>P. jadhavii</i> Mali, 1993	<i>Periplaneta americana</i>	Aurangabad
122. <i>P. krishnamurthyi</i> Sultana and Hulsurkar, 1995	<i>Oryctes rhinoceros</i>	Aurangabad
123. <i>P. oryctesae</i> Krishnamurthy, Sultana and Hulsurkar, 1995	<i>Oryctes rhinoceros</i>	Aurangabad
124. <i>P. rayi</i> Sultana, 1976	<i>Periplaneta americana</i>	Aurangabad
125. <i>P. sp.</i>	<i>Grylotalpa</i> sp.	

PARASITE	HOST	LOCALITY
Order TRICHOMONADIDA Family MONOCERCOMONADIDAE Genus <i>Monocercomonas</i> Grassi, 1879		
A. <i>Monocercomonas</i> of insects		
126. <i>M. digranulae</i> Krishnamurthy and Sultana, 1976	<i>Gryllotalpa africana</i>	Aurangabad
127. <i>M. indica</i> Krishnamurthy and Sultana, 1976	<i>Pycnoscelus surinamensis</i>	Aurangabad
128. <i>M. nathi</i> Sultana and Krishnamurthy, 1976	<i>Polyphaga indica</i>	Aurangabad
129. <i>M. sp.</i>	<i>Blaberus sp.</i>	Maharashtra
130. <i>M. sp.</i>	<i>Gryllotalpa sp.</i>	Maharashtra
131. <i>M. sp.</i>	<i>Oryctes rhinoceros</i> larvae	Maharashtra
B. <i>Monocercomonas</i> of amphibians		
132. <i>M. cyanophlycti</i> Krishnamurthy and Madre, 1979	<i>Rana cyanophlyctis</i>	Aurangabad and Nanded
133. <i>M. melanosticti</i> Krishnamurthy and Madre, 1979	<i>Bufo melanostictus</i>	Aurangabad and Nanded
134. <i>M. aurangabadensis</i> Krishnamurthy and Madre, 1979	<i>Bufo melanostictus</i>	Aurangabad and Nanded
135. <i>M. maharashtrae</i> Krishnamurthy and Shete, 1981	<i>Rana cyanophlyctis</i>	Aurangabad
136. <i>M. sultanae</i> Krishnamurthy and Shete, 1981	<i>Rana tigrina</i>	Aurangabad
137. <i>M. sp.</i>	<i>Rana cyanophlyctis</i>	Aurangabad and Nanded
138. <i>M. spp</i> (2).	<i>Bufo melanostictus</i>	Aurangabad and Nanded
C. <i>Monocercomonas</i> of reptiles		
139. <i>M. breviflagellata</i> Madre, 1978	<i>Naja naja</i>	Aurangabad
140. <i>M. garnhami</i> Krishnamurthy, 1968	<i>Lycodon aulicus</i> , <i>Vipera russeli</i>	Maharashtra
141. <i>M. marthwadensis</i> Mali, 1978	<i>Hemidactylus giganteus</i>	Aurangabad
142. <i>M. calotesi</i> Mali, 1978	<i>Calotes versicolor</i>	Aurangabad
143. <i>M. (Alimonas) hemidactyli</i> Madre, 1979	<i>Hemidactylus giganteus</i>	Maharashtra
144. <i>M. najae</i> Krishnamurthy, 1968	<i>Naja naja</i>	Maharashtra
145. <i>M. shortii</i> Krishnamurthy, 1968	<i>Hemidactylus brooki</i>	Maharashtra
146. <i>M. longiflagellata</i> Krishnamurthy, 1968	<i>Calotes versicolor</i>	Maharashtra
147. <i>M. desh mukhi</i> Krishnamurthy and Desmukh, 1971	<i>Eublepharus sp.</i>	Aurangabad

PARASITE	HOST	LOCALITY
148. <i>M. elaphae</i> Krishnamurthy, 1968	<i>Elapha</i> (= <i>Coluber</i>) <i>helena</i>	Maharashtra
149. <i>M. sp.</i>	<i>Chameleon zeylanicus</i>	Aurangabad and Nanded
150. <i>M. spp</i> (2).	<i>Calotes versicolor</i>	Aurangabad and Nanded
151. <i>M. sp.</i>	<i>Hemidactylus brooki</i>	Aurangabad and Nanded
152. <i>M. sp.</i>	<i>Hemidactylus coctaei</i>	Maharashtra
153. <i>M. spp</i> (3).	<i>Hemidactylus giganteus</i>	Aurangabad and Nanded
154. <i>M. sp.</i>	<i>Varanus indica</i>	Aurangabad and Nanded
155. <i>M. sp.</i>	<i>Varanus sp.</i>	Maharashtra
156. <i>M. spp</i> (2)	<i>Naja naja</i>	Aurangabad and Nanded
157. <i>M. sp.</i>	<i>Vipera russeli</i>	Aurangabad and Nanded
Genus <i>Hexamastix</i> Alexeieff, 1912		
A. <i>Hexamastix</i> species from insects		
158. <i>H. alexeieffi</i> Sultana, 1975	<i>Pycnoscelus surinamensis</i>	Aurangabad
159. <i>H. marthwadensis</i> Krishnamurthy and Sultana, 1977	<i>Polyphaga indica</i>	Aurangabad
160. <i>H. polyphagae</i> Sultana, 1976	<i>Polyphaga indica</i>	Aurangabad
161. <i>H. sanagappae</i> Mali, 1995	<i>Pycnoscelus surinamensis</i>	Aurangabad
B. <i>Hexamastix</i> species from reptiles		
162. <i>H. sp.</i>	<i>Gryllotalpa sp.</i>	Maharashtra
163. <i>H. lacerate</i> Janakidevi, 1961	<i>Uromastix hardwickii</i>	Maharashtra
164. <i>H. dobelli</i> Janakidevi, 1961	<i>Testudo elegans</i>	Aurangabad
Family CALONYMPHIDAE		
Genus <i>Metastephanonympha</i> De Mello and De Brito, 1929		
165. <i>M. karnataki</i> De Mello and Uttangi, 1959	<i>Thyropagus nigrolabiatu</i> s	Mumbai
Family TRICHOMONIDIDAE		
Genus <i>Pentatrichomonas</i> Mesnil, 1914		
166. <i>P. sp.</i>	<i>Canis familiaris</i>	Parbhani
167. <i>P. sp.</i>	<i>Lobivanellus indicus</i>	Maharashtra
168. <i>P. sp.</i>	<i>Ketupa zeylonensis</i>	Maharashtra
Genus <i>Trichomit</i> us Swezy, 1915		
169. <i>T. aurangabadensis</i> Krishnamurthy and Shete, 1981	<i>Rana tigrina</i>	Aurangabad
170. <i>T. batrachorum</i> (Perty, 1852)	<i>Rana cyanophlyctes</i>	Aurangabad and Nanded
	<i>Rana tigrina</i>	Aurangabad and Nanded
	<i>Bufo melanostictus</i>	Aurangabad and Nanded
	<i>Hemidactylus brooki</i>	Aurangabad and Nanded
	<i>H. giganteus</i>	Aurangabad and Nanded
171. <i>T. granulae</i> Krishnamurthy and Madre, 1977	<i>Rana cyanophlyctis</i>	Maharashtra
172. <i>T. sp.</i>	<i>Vatranus indica</i>	Aurangabad and Nanded

PARASITE	HOST	LOCALITY
173. <i>T. sp.</i>	<i>Rana cyanophlyctes</i>	Aurangabad and Nanded
Genus <i>Tritrichomonas</i> Kafoid, 1920		
174. <i>T. augusta</i> Alexeieff, 1911	<i>Rana tigrina</i>	Aurangabad and Nanded
	<i>Bufo melanostictus</i>	Aurangabad and Nanded
<i>Incertae sedis</i> Class ZOOMASTIGOPHOREA Genus <i>Rhizomastix</i> Alexeieff, 1911		
175. <i>R. dastagiri</i> Sultana, 1976	<i>Periplaneta americana</i>	Aurangabad
176. <i>R. murthii</i> Mali, kulkarni and Mali, 2002	<i>Periplaneta americana</i>	Aurangabad
177. <i>R. ranae</i> Krishnamurthy, 1969	<i>Rana tigrina</i>	Aurangabad
178. <i>R. sp.</i>	<i>Rana tigrina</i>	Aurangabad and Nanded
179. <i>R. sp.</i>	<i>Gryllotalpa sp.</i>	Maharashtra
180. <i>R. sp.</i>	<i>Periplaneta americana</i>	Maharashtra
Genus <i>Tubulimonoides</i> Krishnamurthy and Sultana, 1976		
181. <i>T. aurangabadae</i> Mali et al., 2003	<i>Oryctes rhinoceros</i>	Aurangabad
182. <i>T. gryllotalpae</i> Krishnamurthy and Sultana, 1976	<i>Gryllotalpa africana</i>	Aurangabad
183. <i>T. shivamurthi</i> Mali, 1993	<i>Oryctes rhinoceros</i>	Aurangabad
Subphylum OPALINATA Class OPALINATEA Order OPALINIDA Family OPALINIDAE Genus <i>Protoopalina</i> Metcalf, 1918		
184. <i>P. caudata microhyla</i> Nie, 1935	<i>Microhyla ornate</i>	Harnai, Ratnagiri
Subphylum SARCODINA Class LOBOSEA Subclass GYMNAMEOBIA Order AMOEBIDA Suborder TUBULINA Family ENDAMOEBIDAE Genus <i>Entamoeba</i> Casagrandi and Barbagallo, 1985		
185. <i>E. coli</i> (Grassi, 1879)	<i>Homo sapiens</i>	Aurangabad
186. <i>E. histolytica</i> Schaudinn, 1903	<i>Homo sapiens</i>	Aurangabad
Phylum APICOMPLEXA Class SPOROZOEIA Subclass GREGARINIA Order EUGREGARINIA Suborder ASEPTATINA Family LECUDINIDAE Genus <i>Lankesteria</i> Mingazzini, 1891		
187. <i>L. sp.</i>	<i>Aedes albopictus</i>	Pune

PARASITE	HOST	LOCALITY
188. <i>L. sp.</i>	<i>Armigeres subalbatus</i>	Pune, Raigad, Thane and Aurangabad
189. <i>L. sp.</i>	<i>Aedes aegypti</i>	Raigad, Thane and Aurangabad
Genus <i>Ascogregarina</i> Ward, Levine and Craig, 1982		
190. <i>A. cheopisi</i> Mourya, Geevarghese and Gokhale, 1996	<i>Xenopsylla (Xenopsylla) cheopis</i>	Beed
Family MONOCYSTIDAE Subfamily MONOCYSTINAE Genus <i>Monocystis</i> Stein, 1848		
191. <i>M. pheretimi</i> Bhatia and Chatterjee, 1925	<i>Pheretima posthuma</i>	Mumbai
Genus <i>Apolocystis</i> Cognetti, 1923		
192. <i>A. matheii</i> (Bhatia and Setna, 1926)	<i>Megascolex tribolatus</i>	Mumbai
Subfamily RHYNCHOCYSTINAE Genus <i>Rhynchocystis</i> Hesse, 1909		
193. <i>R. awatii</i> Bhatia and Setna, 1926	<i>Pheretima elongata</i>	Mumbai
194. <i>R. mammillata</i> Bhatia and Setna, 1926	<i>Pheretima elongata</i>	Mumbai
Genus <i>Dirhynchocystis</i> Cognetti de Martiis, 1921		
195. <i>D. globosa</i> (Bhatia and Chatterjee, 1925)	<i>Pheretima posthuma</i>	Mumbai
Genus <i>Grayallia</i> Setna, 1927		
196. <i>G. quadruspina</i> Setna, 1927	<i>Pheretima heterochaeta</i>	Mumbai
Subfamily STOMATOPHORINAE Genus <i>Stomatophora</i> Drazhevetskii, 1907		
197. <i>S. bulbifera</i> Bhatia and Setna, 1926	<i>Pheretima elongata</i>	Mumbai
Suborder SEPTATINA Superfamily GREGARINICAE Family GREGARINIDAE Genus <i>Gregarina</i> Dufour, 1828		
198. <i>G. biddari</i> Patil, 1982	<i>Rhytinota</i> sp.	Beed
199. <i>G. blattarum</i> Siebold, 1839	<i>Periplaneta americana</i>	Beed
200. <i>G. havanuri</i> Amoji, 1976	<i>Rhytinota</i> sp.	Beed
Family HIRMOCYSTIDAE Genus <i>Hirmocystis</i> Laabe, 1899		
201. <i>H. (?) parapeneopsis</i> Setna and Bhatia, 1934	<i>Parapeneopsis sculptilis</i>	Mumbai
Genus <i>Protomagalhaensia</i> Pinto, 1918		
202. <i>P. (?) attenuata</i> Setna and Bhatia, 1934	<i>Pheretima elongata</i>	Mumbai

PARASITE	HOST	LOCALITY
Superfamily STENOPHORICAE Family STENOPHORIDAE Genus <i>Stenophora</i> Laäbe, 1899		
203. <i>S. mruthunjayi</i> Rodgi and Amoji, 1970	<i>Chondromorpha kelaarti</i>	Beed
204. <i>S. ozakii</i> Hukui, 1955	<i>Chondromorpha reverini</i>	Beed
205. <i>S. mahabaleshwari</i> Amoji and Rodgi, 1972	<i>Chondromorpha reverini</i>	Beed
206. <i>S. nematoides</i> Leger and Dubosq, 1903	<i>Chondromorpha reverini</i>	Beed
Family MONODUCTIDAE Genus <i>Monoductus</i> Ray and Chakravarty, 1933		
207. <i>M. lunatus</i> Ray and Chakrvarty, 1933	<i>Chondromorpha kelaarti</i>	Beed
Genus <i>Stenoductus</i> Ramachandran, 1976		
208. <i>S. sp.</i>	<i>Chondromorpha kelaarti</i>	Beed
Family STYLOCEPHALIDAE Genus <i>Xiphocephalus</i> Theodorides, 1964		
209. <i>X. africanus</i> Theodorides, 1964	<i>Rhytinota sp.</i>	Beed
Subclass COCCIDIA Order EUCOCCIDA Suborder ADELEINA Family HAEMOGREGARINIDAE Genus <i>Haemogregarina</i> Danilewsky, 1885		
A. <i>Haemogregarina</i> of amphibians		
210. <i>H. berestneffi</i> Castallani and Willey, 1905	<i>Rana tigrina</i>	Maharashtra
211. <i>H. magna</i> (Grassi and Feletti, 1892)	<i>Rana tigrina</i>	Maharashtra
B. <i>Haemogregarina</i> of reptiles		
212. <i>H. mirabilis</i> Castellani and Willey, 1904	<i>Xenochrophis piscator</i>	Maharashtra
213. <i>H. sp.</i>	<i>Ptyas mucosus</i>	Maharashtra
214. <i>H. sp.</i>	<i>Ptyas karolini</i>	Maharashtra
Genus <i>Hepatozoon</i> Miller, 1908		
215. <i>H. canis</i> (James, 1995)	<i>Canus familiaris</i>	Mumbai
216. <i>H. funambuli</i> (Patton, 1908)	<i>Funambulus pennati</i>	Maharashtra
Suborder EIMERINA Family AGGREGATIDAE Genus <i>Aggregata</i> Frenzel, 1885		
217. <i>A. sp.</i>	<i>Parapeneopsis sculptilis</i>	Mumbai

PARASITE	HOST	LOCALITY
Family EIMERIIDAE Genus <i>Eimeria</i> Schneider, 1875		
A. Eimeria of fishes		
218. <i>E. harpodoni</i> Setna and Bana, 1935	<i>Harpodon nehereus</i>	Maharashtra
219. <i>E. southwelli</i> Halwani, 1930	<i>Aetobatis narinari</i>	Maharashtra
220. <i>E. sp.</i>	<i>Trichiurus savala</i>	Maharashtra
221. <i>E. sp.</i>	<i>Batrachus grunniens</i>	Maharashtra
222. <i>E. sp.</i>	<i>Epinephalus tauvina</i>	Maharashtra
223. <i>E. sp.</i>	<i>Epinephalus diacanthus</i>	Maharashtra
224. <i>E. sp.</i>	<i>Engraulus mystax</i>	Maharashtra
225. <i>E. sp.</i>	<i>Otolithus ruber</i>	Maharashtra
226. <i>E. sp.</i>	<i>Sillago sihama</i>	Maharashtra
227. <i>E. sp.</i>	<i>Plotossus canius</i>	Maharashtra
228. <i>E. sp.</i>	<i>Coilia dussumieri</i>	Maharashtra
B. Eimeria of reptiles		
229. <i>E. flaviviridis</i> Setna and Bana, 1935	<i>Hemidactylus faviviridis</i>	Mumbai
230. <i>E. hemidactyli</i> Knowles and Dasgupta, 1935	<i>Hemidactylus faviviridis</i>	Ratnagiri
231. <i>E. knowlesi</i> Bhatia, 1936	<i>Hemidactylus faviviridis</i>	Nasik
C. Eimeria of birds		
232. <i>E. acervulina</i> Tyzzer, 1929	<i>Gallus gallus</i>	Mumbai
233. <i>E. columbae</i> Mitra and Das Gupta, 1937	<i>Columba livia intermedia</i>	Jalgaon
234. <i>E. hagini</i> Levine, 1938	<i>Gallus domesticus</i>	Maharashtra
235. <i>E. maxima</i> Tyzzer, 1929	<i>Gallus gallus</i>	Aurangabad
236. <i>E. mitis</i> Tyzzer, 1929	<i>Gallus gallus</i>	Aurangabad
237. <i>E. necatrix</i> Johnson, 1930	<i>Columba livia intermedia</i>	Aurangabad, Amaravati
238. <i>E. praecox</i> Johnson, 1930	<i>Gallus gallus</i>	Aurangabad
239. <i>E. tenella</i> (Railliet and Lucet, 1891)	<i>Gallus domesticus</i>	Maharashtra
240. <i>E. sp.</i>	<i>Alauda gulgula</i>	Aurangabad
241. <i>E. sp.</i>	<i>Columba livia intermedia</i>	Aurangabad
242. <i>E. sp.</i>	<i>Coturnix coturnix coturnix</i>	Aurangabad
243. <i>E. sp.</i>	<i>Francolinus francolinus</i>	Aurangabad
244. <i>E. sp.</i>	<i>Alauda gulgula</i>	Aurangabad
245. <i>E. sp.</i>	<i>Perdicula asiatica</i>	Aurangabad
D. Eimeria of mammals		
246. <i>E. ahsata</i> Honess, 1942	<i>Capra hircus</i>	Aurangabad
247. <i>E. alabamensis</i> Christensen, 1941	<i>Bubalus bubalus</i>	Aurangabad

PARASITE	HOST	LOCALITY
248. <i>E. arloingi</i> Marotel, 1905	<i>Capra hircus</i>	Aurangabad
249. <i>E. auburensis</i> Christensen and Porter, 1939	<i>Bubalus bubalus</i>	Aurangabad
250. <i>E. bareillyi</i> Gill, Chhabra and Lall, 1963	<i>Bubalus bubalus</i>	Aurangabad
251. <i>E. bovis</i> (Zublin, 1908)	<i>Bubalus bubalus</i>	Aurangabad
252. <i>E. brasiliensis</i> Torres and Ramos, 1939	<i>Bos indicus</i>	Aurangabad
253. <i>E. bukidnonensis</i> Tubangui, 1931	<i>Bubalus bubalus</i>	Aurangabad
254. <i>E. canadensis</i> Bruce, 1921	<i>Bubalus bubalus</i>	Aurangabad
255. <i>E. canis</i> Wenyon, 1923	<i>Felis domestica</i>	Aurangabad
256. <i>E. christenseni</i> Levine, Ivens and Fritz, 1962	<i>Capra hircus</i>	Aurangabad
257. <i>E. coecicola</i> Cheissin, 1947	<i>Bubalus bubalus</i>	Aurangabad
258. <i>E. crandallis</i> Honess, 1942	<i>Ovis aries</i>	Aurangabad
259. <i>E. cylindrica</i> Wilson, 1931	<i>Bubalus bubalis</i>	Aurangabad
260. <i>E. deblickei</i> Douwes, 1921	<i>Sus scrofa</i>	Aurangabad, Amaravati
261. <i>E. ellipsoidalis</i> Becker and Frye, 1929	<i>Bubalus bubalus</i>	Aurangabad
262. <i>E. faurei</i> (Moussu and Marotel, 1902)	<i>Ovis aries</i>	Aurangabad
263. <i>E. granulosa</i> Christensen, 1938	<i>Capra hircus</i> <i>Ovis aries</i>	Aurangabad
264. <i>E. intestinalis</i> Cheissin, 1948	<i>Oryctolagus cuniculus</i>	Aurangabad
265. <i>E. intricata</i> Spiegel, 1925	<i>Capra hircus</i> <i>Ovis aries</i>	Aurangabad Aurangabad
266. <i>E. irresidua</i> Kossel and Jankiewicz, 1931	<i>Oryctolagus cuniculus</i>	Aurangabad
267. <i>E. leuckarti</i> (Flesch, 1883)	<i>Equus caballus</i>	Aurangabad
268. <i>E. levinei</i> Bray, 1958	<i>Rattus rattus rattus</i>	Aurangabad
269. <i>E. nagpurensis</i> Gill and Ray, 1960	<i>Rattus rattus rattus</i>	Aurangabad
270. <i>E. ninakohlyakimovae</i> Yakimoff and Rastegaieff, 1930	<i>Capra hircus</i> <i>Ovis aries</i>	Aurangabad Aurangabad
271. <i>E. ovina</i> Levine and Ivens, 1970	<i>Ovis aries</i>	Aurangabad
272. <i>E. parbhaniensis</i> Kshirsagar, 1976	<i>Capra hircus</i>	Parbhani, Aurangabad
273. <i>E. parva</i> Koltan, Mocsy and Vajda, 1929	<i>Capra hircus</i> <i>Ovis aries</i>	Aurangabad Aurangabad
274. <i>E. pellita</i> Supperer, 1952	<i>Bos indicus</i>	Aurangabad
275. <i>E. perforans</i> (Leuckart, 1879)	<i>Oryctolagus cuniculus</i>	Aurangabad
276. <i>E. punctata</i> Landers, 1955	<i>Ovis aries</i>	Aurangabad
277. <i>E. subspherica</i> Christensen, 1941	<i>Bubalus bubalus</i>	Aurangabad

PARASITE	HOST	LOCALITY
278. <i>E. tuberculata</i> Krishnamurthy and Kshirsagar, 1980	<i>Rattus rattus rattus</i>	Aurangabad
279. <i>E. weybridgensis</i> Norton, Joyner and Catchpole, 1974	<i>Ovis aries</i>	Aurangabad
280. <i>E. zuernii</i> (Rivolta, 1878)	<i>Bos indicus</i>	Aurangabad
281. <i>E. sp.</i>	<i>Oryctolagus cuniculus</i>	Aurangabad
282. <i>E. sp.</i>	<i>Capra hircus</i>	Aurangabad
283. <i>E. sp.</i>	<i>Funambulus palmarum</i>	Maharashtra
Genus <i>Isospora</i> Schneider, 1881		
A. <i>Isospora</i> of reptiles		
284. <i>I. calotesi</i> Bhatia, 1938	<i>Calotes versicolor</i>	Mumbai
B. <i>Isospora</i> of birds		
285. <i>I. lacazei</i> Labbe, 1893)	<i>Passer domesticus</i>	Aurangabad
286. <i>I. sp.</i>	<i>Alauda gulgula</i>	Aurangabad
287. <i>I. sp.</i>	<i>Turdoides somervillei</i>	Aurangabad
288. <i>I. sp.</i>	<i>Amandava amandava</i>	Aurangabad
289. <i>I. sp.</i> 1	<i>Pycnonotus cafer</i>	Aurangabad
290. <i>I. sp.</i> 2	<i>Pycnonotus cafer</i>	Aurangabad
291. <i>I. sp.</i>	<i>Sylina eurruca</i>	Aurangabad
292. <i>I. sp.</i>	<i>Temenuchus pagodarum</i>	Aurangabad
293. <i>I. sp.</i>	<i>Micropus affinis</i>	Aurangabad
B. <i>Isospora</i> of mammals		
294. <i>I. aurangabadensis</i> Kshirsagar, 1980	<i>Rattus rattus rattus</i>	Aurangabad
295. <i>I. begemina</i> (Stiles, 1891)	<i>Canis familiaris</i>	Mumbai
296. <i>I. belli</i> Wenyon, 1923	<i>Homo sapiens</i>	Mumbai
297. <i>I. felis</i> (Wasilewsky, 1904)	<i>Canis sp.</i>	Mumbai
298. <i>I. krishnamurthyi</i> Kshirsagar, 1980	<i>Rattus rattus rattus</i>	Aurangabad
299. <i>I. rivolta</i> (Grassi, 1879)	<i>Felis catus</i> (= <i>F. domestica</i>)	Mumbai
Family LANKESTERELLIDAE Genus <i>Lankesterella</i> Labbe, 1899		
300. <i>L. minima</i> (Chaussat, 1850) (Syn. <i>L. monilis</i> (Labbe, 1894)	<i>Rana tigrina</i>	Mumbai
Family SARCOCYSTIDAE Subfamily SARCOCYSTINAE Genus <i>Sarcocystis</i> Lankester, 1882		
301. <i>S. capraecanis</i> Fischer, 1979	<i>Capra hircus</i>	Aurangabad
302. <i>S. sp.</i>	<i>Capra hircus</i>	Aurangabad
303. <i>S. sp.</i>	<i>Canis familiaris</i>	Parbhani

PARASITE	HOST	LOCALITY
Genus <i>Toxoplasma</i> Nicolli and Manceaux		
304. <i>T. gondi</i> (Nicolle and Manecaus)	<i>Felis catus</i>	Parbhani
305. <i>T. hammondi</i> (Frenkel, 1974)	<i>Felis catus</i>	Parbhani
306. <i>T. sp.</i>	<i>Cat</i>	Parbhani
307. <i>T. sp.</i>	<i>Homo sapiens</i>	Mahathwada
Suborder HAEMOSPORINA Family PLASMODIIDAE Genus <i>Plasmodium</i> Marchiafava and Celli, 1885		
A. <i>Plasmodium</i> of birds		
308. <i>P. relictum</i> (Grassi and Feletti, 1891)	<i>Picoides m. mahrattensis</i>	Nasik
309. <i>P. vauhani</i> Novy and MacNeal, 1904	<i>Acridotheres tristis tristis</i>	Nasik
310. <i>P. sp.</i>	<i>Pitta brachyuran</i>	Maharashtra
311. <i>P. sp.</i>	<i>Hypsipetes madagascariensis</i>	Maharashtra
312. <i>P. sp.</i>	<i>Pycnonotus cafer</i>	Maharashtra
313. <i>P. sp.</i>	<i>Prinia socialis</i>	Maharashtra
314. <i>P. sp.</i>	<i>Rhipidura albogularis</i>	Maharashtra
315. <i>P. sp.</i>	<i>Lanius schach</i>	Maharashtra
316. <i>P. sp.</i>	<i>Nectarina asiatica</i>	Maharashtra
317. <i>P. sp.</i>	<i>Ploceus philippinus</i>	Maharashtra
B. <i>Plasmodium</i> of mammals		
318. <i>P. bubalis</i> Sheather, 1919	<i>Bubalus bubalis</i>	Marathwada
319. <i>P. ratufoe</i> Donovan, 1920	<i>Ratufa indica</i>	Maharashtra
C. <i>Plasmodium</i> of man		
320. <i>P. falciparum</i> (Welch, 1897)	<i>Homo sapiens</i>	Maharashtra
321. <i>P. malariae</i> (Grassi and Feletti, 1892)	<i>Homo sapiens</i>	Maharashtra
322. <i>P. vivax</i> (Grassi and Feletti, 1890)	<i>Homo sapiens</i>	Maharashtra
Family HAEMOPROTEIDAE Genus <i>Haemoproteus</i> Kruse, 1870		
323. <i>H. aegithinae</i> De Mello, 1937	<i>Aegithina tiphia</i>	Maharashtra
324. <i>H. anthi</i> De Mello, 1935	<i>Anthus hodgsoni</i>	Maharashtra
325. <i>H. borgesii</i> Tendeiro, 1947	<i>Picoides m. mahrattensis</i>	Nasik
326. <i>H. centropi</i> De Mello, 1935	<i>Centropus sinensis parroti</i>	Maharashtra
327. <i>H. columbae</i> Kruse, 1890	<i>Columba livia intermedia</i>	Nasik
328. <i>H. coraciae</i> De Mello and Afonso, 1935	<i>Coracias b. benghalensis</i>	Nasik
329. <i>H. cornuata</i> Bennett and Nandi, 1981	<i>Megalaima viridis</i>	Maharashtra

PARASITE	HOST	LOCALITY
330. <i>H. lanii</i> De Mello, 1937	<i>Lanius tigrinus</i>	Maharashtra
331. <i>H. manwelli</i> Bennett, 1978	<i>Merops orientalis</i>	Maharashtra
332. <i>H. meropis</i> (Zargar, 1945)	<i>Merops o. orientalis</i>	Nagpur
333. <i>H. pastoris</i> De Mello, 1935	<i>Acridotheres tristis tristis</i> <i>Sturnus pagodarum</i>	Nasik
334. <i>H. philippinensis</i> Rahul, Bishop and Bennett, 1987	<i>Hypsipetes</i> <i>madagascariensis</i>	Maharashtra
335. <i>H. plateleae</i> de Mello, 1935	<i>Pseudibis p. papillosa</i>	Ahmednagar
336. <i>H. thereicercis</i> de Mello, 1935	<i>Megalaima zeylanicus</i>	Maharashtra
337. <i>H. tinnunculi</i> (Wasielewski and Wulker, 1918)	<i>Falco tinnunculus</i> <i>tinnunculus</i>	Nasik
338. <i>H. velans</i> Coatney and Roudabush, 1937	<i>Picoides m. mahrattensis</i>	Nasik
339. <i>H. xantholaemae</i> (zargar, 1945)	<i>Megalaima haemacephala</i> <i>Megalaima viridis</i>	Nagpur Maharashtra
340. <i>H. zosteropis</i> Chakravarty and Kar, 1945	<i>Zosterops palpebrosa</i>	Maharashtra
341. <i>H. sp.</i>	<i>Accipiter badius</i>	Maharashtra
342. <i>H. sp.</i>	<i>Galloperdix spadicea</i>	Maharashtra
343. <i>H. sp.</i>	<i>Streptopelia decaocto</i>	Maharashtra
344. <i>H. sp.</i>	<i>Sreptopelia orientalis</i>	Maharashtra
345. <i>H. sp.</i>	<i>Sreptopelia senegalensis</i>	Maharashtra
346. <i>H. sp.</i>	<i>Centropus sinensis</i>	Maharashtra
347. <i>H. sp.</i>	<i>Clamator jacobinus</i>	Maharashtra
348. <i>H. sp.</i>	<i>Halcyon smyrnensis</i>	Maharashtra
349. <i>H. sp.</i>	<i>Merops orientalis</i>	Maharashtra
350. <i>H. sp.</i>	<i>Megalaima haemacephala</i>	Maharashtra
351. <i>H. sp.</i>	<i>Megalama viridis</i>	Maharashtra
352. <i>H. sp.</i>	<i>Megalaima zeylanica</i>	Maharashtra
353. <i>H. sp.</i>	<i>Tephrodornis pondiecrianus</i>	Maharashtra
354. <i>H. sp.</i>	<i>Dicrurus caeruleus</i>	Maharashtra
355. <i>H. sp.</i>	<i>Dicrurus paradiseus</i>	Maharashtra
356. <i>H. sp.</i>	<i>Corvus macrorhynchus</i>	Maharashtra
357. <i>H. sp.</i>	<i>Dendrocitta vagabunda</i>	Maharashtra
358. <i>H. sp.</i>	<i>Turdoides striatus</i>	Maharashtra
359. <i>H. sp.</i>	<i>Hypsipetes</i> <i>madagascariensis</i>	Maharashtra
360. <i>H. sp.</i>	<i>Pycnonotus cafer</i>	Maharashtra
361. <i>H. sp.</i>	<i>Pycnonotus jocosus</i>	Maharashtra

PARASITE	HOST	LOCALITY
362. <i>H. sp.</i>	<i>Aegithina tiphia</i>	Maharashtra
363. <i>H. sp.</i>	<i>Monticola cinclorhynchus</i>	Maharashtra
364. <i>H. sp.</i>	<i>Saxicoloides fulicata</i>	Maharashtra
365. <i>H. sp.</i>	<i>Turdus merula</i>	Maharashtra
366. <i>H. sp.</i>	<i>Orthotomus sutorius</i>	Maharashtra
367. <i>H. sp.</i>	<i>Prinia hodgsoni</i>	Maharashtra
368. <i>H. sp.</i>	<i>Prinia socialis</i>	Maharashtra
369. <i>H. sp.</i>	<i>Prinia sylvatica</i>	Maharashtra
370. <i>H. sp.</i>	<i>Muscicapa tickelliae</i>	Maharashtra
371. <i>H. sp.</i>	<i>Rhipidura albogularis</i>	Maharashtra
372. <i>H. sp.</i>	<i>Anthus hodgsoni</i>	Maharashtra
373. <i>H. sp.</i>	<i>Motacilla alba</i>	Maharashtra
374. <i>H. sp.</i>	<i>Lanius schach</i>	Maharashtra
375. <i>H. sp.</i>	<i>Lanius vittatus</i>	Maharashtra
376. <i>H. sp.</i>	<i>Acridotheres tristis</i>	Maharashtra
377. <i>H. sp.</i>	<i>Sturnus pagodarum</i>	Maharashtra
378. <i>H. sp.</i>	<i>Nectarina asiatica</i>	Maharashtra
379. <i>H. sp.</i>	<i>Nectarina lotenia</i>	Maharashtra
380. <i>H. sp.</i>	<i>Nectarina zeylanica</i>	Maharashtra
381. <i>H. sp.</i>	<i>Dicaeum erythronotus</i>	Maharashtra
382. <i>H. sp.</i>	<i>Zosterops palpebrosa</i>	Maharashtra
383. <i>H. sp.</i>	<i>Carpodacus erythrinus</i>	Maharashtra
384. <i>H. sp.</i>	<i>Melophus lathami</i>	Maharashtra
385. <i>H. sp.</i>	<i>Lonchura malabariça</i>	Maharashtra
386. <i>H. sp.</i>	<i>Lonchura punctulata</i>	Maharashtra
387. <i>H. sp.</i>	<i>Passer domesticus</i>	Maharashtra
388. <i>H. sp.</i>	<i>Petronia xantocollis</i>	Maharashtra
389. <i>H. sp.</i>	<i>Ploceus philippinus</i>	Maharashtra
Family LEUCOCYTOZOIDAE		
Genus <i>Leucocytozoon</i> Sambon, 1908		
390. <i>L. capitonis</i> Bennett, Earle and Peirce, 1993	<i>Megalaima viridis</i>	Maharashtra
391. <i>L. sp.</i>	<i>Accipiter badius</i>	Maharashtra
392. <i>L. sp.</i>	<i>Francolinus pictus</i>	Maharashtra
393. <i>L. sp.</i>	<i>Francolinus pondicerianus</i>	Maharashtra
394. <i>L. sp.</i>	<i>Perdicula argoondah</i>	Maharashtra
395. <i>L. sp.</i>	<i>Streptopelia decaoto</i>	Maharashtra
396. <i>L. sp.</i>	<i>Streptopelia orientalis</i>	Maharashtra

PARASITE	HOST	LOCALITY
397. <i>L. sp.</i>	<i>Streptopelia senegalensis</i>	Maharashtra
398. <i>L. sp.</i>	<i>Centropus sinensis</i>	Maharashtra
399. <i>L. sp.</i>	<i>Clamator jacobinus</i>	Maharashtra
400. <i>L. sp.</i>	<i>Megalaima viridis</i>	Maharashtra
401. <i>L. sp.</i>	<i>Tephrodornis pondicerianus</i>	Maharashtra
402. <i>L. sp.</i>	<i>Parus major</i>	Maharashtra
403. <i>L. sp.</i>	<i>Turdoides striatus</i>	Maharashtra
404. <i>L. sp.</i>	<i>Pycnonotus cafer</i>	Maharashtra
405. <i>L. sp.</i>	<i>Pycnonotus jocosus</i>	Maharashtra
406. <i>L. sp.</i>	<i>Turdus merula</i>	Maharashtra
407. <i>L. sp.</i>	<i>Zoothera citrine</i>	Maharashtra
408. <i>L. sp.</i>	<i>Muscicapa tickelliae</i>	Maharashtra
409. <i>L. sp.</i>	<i>Melophus lathamii</i>	Maharashtra
Subclass PIROPLASMIA Order PIROPLASMIDA Family BABESIIDAE Genus <i>Babesia</i> Starcovici, 1893		
410. <i>B. bigemina</i> (Smith and Kilbourne, 1893)	<i>Bubalus bubalis</i> (cross-bred calve)	Marathwada
411. <i>B. bovis</i> (Babes, 1888)	<i>Bubalus bubalis</i>	Maharashtra
Family THEILERIIDAE Genus <i>Theileria</i> Bettencocurt, Franca and Borgess, 1907		
412. <i>T. annulata</i> Dschunkovsky and Luhs, 1904)	<i>Bos indicus</i>	Maharashtra
413. <i>T. hirci</i> Dschunkovsky and Urodshevich, 1924	<i>Ovis aries</i>	Maharashtra
414. <i>T. mutans</i> (Theiler, 1906)	<i>Bos indicus</i>	Aurangabad
415. <i>T. orientalis</i> (Yakimov and Sudachenkov, 1931)	Bovine hosts, <i>Bos sp.</i>	Maharashtra
416. <i>T. ovis</i> Rodhain, 1916	<i>Ovis aries</i> <i>Capra hircus</i>	Maharashtra Maharashtra
417. <i>T. sp.</i> (Shastri <i>et al.</i> , 1985)	<i>Bubalus bubalis</i>	Maharashtra
418. <i>T. sp.</i>	<i>Bos indicus</i>	Aurangabad
419. <i>T. sp.</i>	<i>Ovis aries</i>	Aurangabad
420. <i>T. sp.</i>	<i>Capra hircus</i>	Aurangabad
Incertae sedis to Order Piroplasmida Genus <i>Anaplasma</i> Theiler, 1910		
421. <i>A. marginale</i> Theiler, 1910	<i>Bos indicus</i>	Aurangabad

PARASITE	HOST	LOCALITY
422. <i>A. ovis</i>	<i>Ovis aries</i> <i>Capra hircus</i>	Aurangabad
Phylum MYXOZOA Class MYXOSPOREA Order BIVALVULIDA Suborder VARIISPORINA Family MYXIDIIDAE Genus <i>Myxidium</i> Butschli, 1882		
423. <i>M. mackie</i> Bosanquet, 1910	<i>Trionyx gangeticus</i>	Mumbai
Family CERATOMYXIDAE Genus <i>Ceratomyxa</i> Thelohan, 1892		
424. <i>C. sp.</i>	<i>Carcharinus bleekeri</i>	Maharashtra
425. <i>C. sp.</i>	<i>C. limbatus</i>	Maharashtra
426. <i>C. sp.</i>	<i>C. melanopterus</i>	Maharashtra
427. <i>C. sp.</i>	<i>C. menisorrah</i>	Maharashtra
428. <i>C. sp.</i>	<i>C. pleurotaenia</i>	Maharashtra
429. <i>C. sp.</i>	<i>Cestraction blochii</i>	Maharashtra
430. <i>C. sp.</i>	<i>C. zygaena</i>	Maharashtra
431. <i>C. sp.</i>	<i>Hemigaleus balfouri</i>	Maharashtra
432. <i>C. sp.</i>	<i>Hypoprion macloiti</i>	Maharashtra
433. <i>C. sp.</i>	<i>Pristis cuspidatus</i>	Maharashtra
434. <i>C. sp.</i>	<i>Rhynchobatus djeddensis</i>	Maharashtra
435. <i>C. sp.</i>	<i>Scoliodon palasorrah</i>	Maharashtra
436. <i>C. sp.</i>	<i>S. sorrakowah</i>	Maharashtra
437. <i>C. sp.</i>	<i>S. walbeehmi</i>	Maharashtra
438. <i>C. sp.</i>	<i>S. sp.</i>	Maharashtra
Family CHLOROMYXIDAE Genus <i>Chloromyxum</i> Mingazini, 1890		
439. <i>C. sp.</i>	<i>Carcharinus bleekeri</i>	Maharashtra
440. <i>C. sp.</i>	<i>C. limbatus</i>	Maharashtra
441. <i>C. sp.</i>	<i>C. melanopterus</i>	Maharashtra
442. <i>C. sp.</i>	<i>Cestraction blochii</i>	Maharashtra
443. <i>C. sp.</i>	<i>C. zygaena</i>	Maharashtra
444. <i>C. sp.</i>	<i>Chiloscyllium griseum</i>	Maharashtra
445. <i>C. sp.</i>	<i>Hemigaleus balfouri</i>	Maharashtra
446. <i>C. sp.</i>	<i>Pristis cuspidatus</i>	Maharashtra
447. <i>C. sp.</i>	<i>Rhynchobatus djeddensis</i>	Maharashtra
448. <i>C. sp.</i>	<i>Rhynotera javanica</i>	Maharashtra
449. <i>C. sp.</i>	<i>Scoliodon palasorrah</i>	Maharashtra

PARASITE	HOST	LOCALITY
450. <i>C. sp.</i>	<i>S. sorrakowah</i>	Maharashtra
451. <i>C. sp.</i>	<i>S. walbeehmi</i>	Maharashtra
452. <i>C. sp.</i>	<i>S. sp.</i>	Maharashtra
453. <i>C. sp.</i>	<i>Trygon bleekeri</i>	Maharashtra
Suborder PLATYSPORINA Family MYXOBOLIDAE Genus <i>Myxobolus</i> Butschli, 1882		
454. <i>M. cerebralis</i> Hofer, 1903	<i>Cirrihina mrigala</i>	Wardha
Phylum CILIOPHORA Class KINETOFRAGMINIPHOREA Order TRICHOSTOMATIDA Family BALANTIDAE Genus <i>Balantidium</i> Claparede and Lachman, 1858		
455. <i>B. aurangabadensis</i> Shete and Krishnamurthy, 1984	<i>Rana tigrina</i>	Aurangabad
456. <i>B. corlissi</i> Shete and Krishnamurthy, 1984	<i>Rana cyanophlyctis</i>	Aurangabad
457. <i>B. cyanophlyctis</i> Shete and Krishnamurthy, 1984	<i>Rana cyanophlyctis</i>	Aurangabad
458. <i>B. ganapati</i> Shete and Krishnamurthy, 1984	<i>Rana cyanophlyctis</i>	Aurangabad
459. <i>B. megastomae</i> Shete and Krishnamurthy, 1984	<i>Rana cyanophlyctis</i>	Aurangabad
460. <i>B. mininucleatum</i> Shete and Krishnamurthy, 1984	<i>Rana cyanophlyctis</i>	Aurangabad
461. <i>B. ranae</i> Shete and Krishnamurthy, 1984	<i>Rana tigrina</i>	Aurangabad
462. <i>B. tigrinae</i> Shete and Krishnamurthy, 1984	<i>Rana tigrina</i>	Aurangabad
463. <i>B. sp.</i>	<i>Rana cyanophlyctis</i>	Maharashtra
Class OLIGOHYMENOPHOREA Subclass HYMENOSTOMATA Order SCUTICOCILIATIDA Suborder THIGMOTRICHINA Family HYSTEROGINETIDAE Genus <i>Protychostomum</i> Raabe, 1949		
464. <i>P. sp.</i>	<i>Perionyx sansibaricus</i>	Aurangabad
Class POLYHYMENOPHOREA Order HETEROTRICHIDA Family NYCTOTHERIDAE Genus <i>Nyctotherus</i> Leidy, 1849		
465. <i>N. hardwickii</i> Janakidevi, 1961	<i>Uromastix hardwickii</i>	Mumbai

PARASITE	HOST	LOCALITY
466. <i>N. sp.</i>	<i>Polyphaga indica</i>	Aurangabad
Genus <i>Nyctotheroides</i> Grasse, 1928 Subgenus <i>Nyctotheroides</i> Grasse, 1928		
467. <i>N. (N.) ameroi</i> Shete, 1982	<i>Rana cyanophlyctis</i>	Aurangabad
468. <i>N. (N.) indicum</i> Shete, 1982	<i>Bufo melanostictus</i>	Aurangabad
469. <i>N. (N.) ratnagiriensis</i> Shete, 1982	<i>Rana cyanophlyctis</i>	Ratnagiri
Subgenus <i>Aduncuperistomatus</i> Amaro and Sena, 1968		
470. <i>N. (A.) aurangabadensis</i> Shete, 1982	<i>Bufo melanostictus</i>	Aurangabad
471. <i>N. (A.) cyanophlyctis</i> Shete, 1982	<i>Rana cyanophlyctis</i>	Ratnagiri
472. <i>N. (A.) marathwadensis</i> Shete, 1982	<i>Rana tigrina</i>	Aurangabad
473. <i>N. (A.) melanosticti</i> Shete, 1982	<i>Bufo melanostictus</i>	Ratnagiri
Family SICUOPHORIDAE Genus <i>Sicuophora</i> de Puytorac and Grain, 1969		
474. <i>S. macropharyngea</i> (Bezenberger, 1904) (Syn. <i>Nyctotherus macropharyngeus</i>)	<i>Rana tigrina</i>	Mumbai

HOST-PARASITE LIST

The host-parasite list of protozoan parasites recorded from Maharashtra state along with references is presented hereunder.

HOST	PARASITE	REFERENCE
Phylum ANNELIDA		
Class OLIGOCHAETA		
<i>Megascolex tribolatus</i>	<i>Apolocystis matheii</i>	Bhtia and Setna (1926)
<i>Pereionyx excavatus</i>	<i>Protoptychostomum</i> sp.	Krishnamurthy <i>et al.</i> (1981)
<i>Pheretima elongata</i>	<i>Rhynchocystis awatii</i>	Bhatia and Setna (1926)
	<i>Rhynchocystis mammillata</i>	Bhatia and Setna (1926)
	<i>Stomatophora bulbifera</i>	Bhatia and Setna (1926)
	<i>Protomagalhaensia</i> (?) <i>attenuata</i>	Setna and Bhatia (1934)
<i>Pheretima heterochaeta</i>	<i>Grayallia quadruspina</i>	Setna (1927)
<i>Pheretima posthuma</i>	<i>Dirhynchocystis globosa</i>	Bhatia and Chatterjee (1925) ?
	<i>Monocystis pheretimi</i>	Bhatia and Chatterjee (1925) ?
Phylum ARTHROPODA		
Class CRUSTACEA		
<i>Parapeneopsis sculptilis</i>	<i>Aggregata</i> sp.	Setna and Bhatia (1934)
	<i>Hirmocystis parapeneopsis</i>	Setna and Bhatia (1934)
Class INSECTA		
Order ORTHOPTERA		
<i>Gryllotalpa</i> sp.	<i>Hexamastix</i> sp.	Krishnamurthy and Sultana (1972)

HOST	PARASITE	REFERENCE
	<i>Monocercomonas</i> sp.	Krishnamurthy and Sultana (1972)
	<i>Monocercomonoides</i> sp.	Krishnamurthy and Sultana (1972)
	<i>Polymastix</i> sp.	Krishnamurthy and Sultana (1972)
	<i>Retortamonas</i> sp.	Krishnamurthy and Sultana (1972)
	<i>Rhizomastix</i> sp.	Krishnamurthy and Sultana (1972)
<i>Gryllotalpa africana</i>	<i>Monocercomonas digranulae</i>	Krishnamurthy and Sultana (1972)
	<i>Monocercomonoides ganapatii</i>	Sultana (1975)
	<i>Retortamonas aurangabadensis</i>	Sultana (1976c)
	<i>Retortamonas masoodi</i>	Mali (1993)
	<i>Retortamonas nagabhusani</i>	Sultana (1976)
	<i>Retortamonas wenrichi</i>	Sultana (1976)
	<i>Tubulimonoides gryllotalpae</i>	Krishnamurthy and Sultana (1972)
<i>Gryllus bimaculatus</i>	<i>Monocercomonoides gryllusae</i>	Sultana and Krishnamurthy (1978)
<i>Gryllus domestica</i>	<i>Monocercomonoides</i> sp.	Krishnamurthy and Sultana (1972)
	<i>Retortamonas</i> sp.	Krishnamurthy and Sultana (1972)
Order DICTYOPTERA		
<i>Blatta germanica</i>	<i>Monocercomonoides</i> sp.	Krishnamurthy and Sultana (1972)
	<i>Retortamonas</i> sp.	Krishnamurthy and Sultana (1972)
<i>Blatta</i> sp.	<i>Monocercomonoides blattae</i>	Krishnamurthy and Sultana (1972)
	<i>Monocercomonoides</i> sp.	Krishnamurthy and Sultana (1972)
<i>Blatella germanica</i>	<i>Monocercomonoides aurangabadiae</i>	Krishnamurthy and Sultana (1972)
<i>Blaberus</i> sp.	<i>Monocercomonas</i> sp.	Krishnamurthy and Sultana (1972)
	<i>Monocercomonoides</i> sp.	Krishnamurthy and Sultana (1972)
<i>Dysdercus singulatus</i>	<i>Leptomonas</i> sp.	Krishnamurthy and Sultana (1972)
<i>Periplaneta americana</i>	<i>Gregarina blattarum</i>	Nikam (2001)
	<i>Hexamitus murthii</i>	Sultana (1976)
	<i>Hexamitus</i> sp.	Krishnamurthy and Sultana (1972)
	<i>Leptomonas</i> sp.	Krishnamurthy and Sultana (1972)
	<i>Monocercomonoides krishnamurthii</i>	Sultana (1976)
	<i>Monocercomonoides khultabadae</i>	Mali and Mali (2004)
	<i>Monocercomonoides marthwadensis</i>	Krishnamurthy and Sultana (1976)
	<i>Monocercomonoides</i> sp.	Krishnamurthy and Sultana (1976)
	<i>Polymastix jadhavi</i>	Mali (1993)
	<i>Polymastix rayi</i>	Sultana (1976)
	<i>Retortamonas</i> sp.	Krishnamurthy and Sultana (1972)
	<i>Rhizomastix dastagiri</i>	Sultana (1976)
	<i>Rhizomastix murthii</i>	Mali <i>et al</i> (2002)
	<i>Rhizomastix</i> sp.	Krishnamurthy and Sultana (1972)
<i>Polyphaga indica</i>	<i>Hexamastix alexeieffi</i>	Sultana (1975)
	<i>Hexamastix marthwadensis</i>	Krishnamurthy and Sultana (1972)
	<i>Hexamastix polyphagae</i>	Sultana (1976)
	<i>Monocercomonas nathi</i>	Krishnamurthy and Sultana (1972)
	<i>Monocercomonoides chakravartii</i>	Krishnamurthy and Sultana (1972)

HOST	PARASITE	REFERENCE
	<i>Monocercomonoides polyphagae</i>	Krishnamurthy and Sultana (1972)
	<i>Nyctotherus</i> sp.	Adavant <i>et al.</i> (1981)
	<i>Polymastix indica</i>	Krishnamurthy and Sultana (1978)
	<i>Retortamonas indica</i>	Krishnamurthy and Sultana (1978)
<i>Pycnoscelus surinamensis</i>	<i>Hexamastix alexeieffi</i>	Sultana (1975)
	<i>Hexamastix sanagappae</i>	Mali (2003)
	<i>Monocercomonas indica</i>	Krishnamurthy and Sultana (1976)
	<i>Monocercomonoides krishnamurthii</i>	Sultana (1976)
	<i>Monocercomonoides khultabadae</i>	Mali and Mali (2004)
Order HEMIPTERA		
<i>Laccotrephes maculatus</i>	<i>Leptomonas</i> sp.	Krishnamurthy and Sultana (1972)
<i>Nepa</i> sp.	<i>Leptomonas</i> sp.	Krishnamurthy and Sultana (1972)
<i>Ranatra filiformes</i>	<i>Leptomonas</i> sp.	Krishnamurthy and Sultana (1972)
<i>Ranatra</i> sp.	<i>Leptomonas</i> sp.	Krishnamurthy and Sultana (1972)
Order COLEOPTERA		
<i>Oryctes rhinoceros</i>	<i>Monocercomonas</i> sp.	Krishnamurthy and Sultana (1972)
	<i>Monocercomonoides adarshii</i>	Mali <i>et al.</i> (2001)
	<i>Monocercomonoides</i> sp.	Krishnamurthy and Sultana (1972)
	<i>Monocercomonoides qadrii</i>	Krishna and Sultana (1972)
	<i>Monocercomonoides omergae</i>	Mali <i>et al.</i> (2001)
	<i>Monocercomonoides oryctesae</i>	Krishnamurthy and Sultana (1977)
	<i>Polymastix krishnamurthyi</i>	Sultana and Hulsurkar (1995)
	<i>Polymastix oryctesae</i>	Sultana and Hulsurkar (1995)
	<i>Retortamonas</i> sp.	Krishnamurthy and Sultana (1972)
	<i>Tubulimonoides aurangabadae</i>	Mali, Kulkarni and Mali (2003)
	<i>Tubulimonoides shivamurthii</i>	Mali and Sultana (1993)
<i>Rhytinota</i> sp.	<i>Gregarina biddari</i>	Nikam (2001)
	<i>Gregarina havanuri</i>	Gulbhile and Nikam (2005)
	<i>Xiphoccephalus africanus</i>	Gulbhile and Nikam (2005)
Scarabaeid larvae	<i>Polymastix ganapatii</i>	Sultana (1976)
Order DIPTERA		
<i>Aedes aegypti</i>	<i>Lankesteria</i> sp.	Dhanda and Mourya (1981)
<i>Aedes albopictus</i>	<i>Lankesteria</i> sp.	Mourya and Dhanda (1981)
<i>Armigeres subalbatus</i>	<i>Lankesteria</i> sp.	Dhanda and Mourya (1981)
<i>Calliphora</i> sp.	<i>Herpetomonas</i> sp.	Krishnamurthy and Sultana (1972)
<i>Lucila</i> sp.	<i>Leptomonas</i> sp.	Krishnamurthy and Sultana (1972)
	<i>Herpetomonas</i> sp.	Krishnamurthy and Sultana (1972)
<i>Musca domestica</i>	<i>Herpetomonas</i> sp.	Krishnamurthy and Sultana (1972)
Class ARACHNIDA		
Order ACARINA		
<i>Hyalomma a. anatolicum</i>	<i>Blastocrithidia</i> sp.	Krishnamurthy and Sultana (1979)

HOST	PARASITE	REFERENCE
	Class MYRIAPODA Order DIPLOPODA	
<i>Chondromorpha kelaarti</i>	<i>Monoductus lunatus</i> <i>Stenoducctus</i> sp. <i>Stenophora mruthanjayi</i>	Gulbhile and Nikam (2005) Gulbhile and Nikam (2005) Gulbhile and Nikam (2005)
<i>Chondromorpha reverini</i>	<i>Stenophora mahabaleshwari</i> <i>Stenophora nematoides</i> <i>Stenophora ozakii</i>	Nikam (2001) Gulbhile and Nikam (2005) Gulbhile and Nikam (2005)
<i>Spirotreptus</i> sp.	<i>Monocercomonoides spirotreptae</i> <i>Monocercomonoides</i> sp. <i>Retortamonas</i> sp.	Krishnamurthy and Sultana (1980) Krishnamurthy and Sultana (1972) Krishnamurthy and Sultana (1972)
<i>Thyropagus nigrolabiatus</i>	<i>Metastephanonympha karnataki</i>	Karandikar and Rodgi (1956)
	Phylum CHORDATA Class CHONDRICHTHYES Order LAMNIFORMES	
<i>Carcharinus bleekeri</i>	<i>Ceratomyxa</i> sp. <i>Chloromyxum</i> sp.	Setna (1942) Setna (1942)
<i>C. limbatus</i>	<i>Ceratomyxa</i> sp. <i>Chloromyxum</i> sp.	Setna (1942) Setna (1942)
<i>C. melanopterus</i>	<i>Ceratomyxa</i> sp. <i>Chloromyxum</i> sp.	Setna (1942) Setna (1942)
<i>C. menisorrah</i>	<i>Ceratomyxa</i> sp.	Setna (1942)
<i>C. pleurotaenia</i>	<i>Ceratomyxa</i> sp.	Setna (1942)
<i>Cestraction blochii</i>	<i>Ceratomyxa</i> sp. <i>Chloromyxum</i> sp.	Setna (1942) Setna (1942)
<i>C. zygaena</i>	<i>Ceratomyxa</i> sp. <i>Chloromyxum</i> sp.	Setna (1942) Setna (1942)
<i>Chiloscyllium griseum</i>	<i>Chloromyxum</i> sp.	Setna (1942)
<i>Hemigaleus balfouri</i>	<i>Ceratomyxa</i> sp. <i>Chloromyxum</i> sp.	Setna (1942) Setna (1942)
<i>Hypoprion macloiti</i>	<i>Ceratomyxa</i> sp.	Setna (1942)
<i>Scoliodon palasorrah</i>	<i>Ceratomyxa</i> sp. <i>Chloromyxum</i> sp.	Setna (1942) Setna (1942)
<i>S. sorrakowah</i>	<i>Ceratomyxa</i> sp. <i>Chloromyxum</i> sp.	Setna (1942) Setna (1942)
<i>S. walbeehmi</i>	<i>Ceratomyxa</i> sp. <i>Chloromyxum</i> sp.	Setna (1942). Setna (1942)
<i>S. sp.</i>	<i>Ceratomyxa</i> sp. <i>Chloromyxum</i> sp.	Setna (1942) Setna (1942)
<i>Trygon bleekeri</i>	<i>Chloromyxum</i> sp.	Setna (1942)
	Order RAJIFORMES	
<i>Pristis cuspidatus</i>	<i>Ceratomyxa</i> sp. <i>Chloromyxum</i> sp.	Setna (1942) Setna (1942)

HOST	PARASITE	REFERENCE
<i>Aetobatis narinari</i>	<i>Eimeria southwelli</i>	Setna (1942)
<i>Rhynchobatus djeddensis</i>	<i>Ceratomyxa</i> sp.	Setna (1942)
	<i>Chloromyxum</i> sp.	Setna (1942)
<i>Rhynoptera javanica</i>	<i>Chloromyxum</i> sp.	Setna (1942)
Class OSTEICHTHYES Order CLUPEIFORMES		
<i>Coilia dussumieri</i>	<i>Eimeria</i> sp.	Setna and Bana (1935)
<i>Engraulus mystax</i>	<i>Eimeria</i> sp.	Setna and Bana (1935)
<i>Notopterus notopterus</i>	<i>Trypanosoma</i> sp.	Wahul (1985)
Order MYCTOPHIFORMES		
<i>Harpodon nehereus</i>	<i>Eimeria harpodonii</i>	Setna and Bana (1935)
Order CYPRINIFORMES		
<i>Cirrhinia mrigala</i>	<i>Myxobolus cerebralis</i>	Maheswari (1986)
<i>Labeo calbasu</i>	<i>Cryptobia (Trypanoplasma) qadrii</i>	Krishnamurthy and Wahul '86)
<i>Labeo dyochelius</i>	<i>Cryptobia (Trypanoplasma) qadrii</i>	Krishnamurthy and Wahul (1986)
<i>Puntius hexastichus</i>	<i>Cryptobia (Trypanoplasma) lomi</i>	Wahul (1986)
	<i>Trypanosoma marathwadensis</i>	Wahul (1986)
<i>Puntius jerdoni</i>	<i>Cryptobia (Trypanoplasma) solapurensis</i>	Wahul (1986)
<i>Puntius kolus</i>	<i>Cryptobia (Trypanoplasma) sp.</i>	Wahul (1986)
	<i>Trypanosoma puntii</i>	Wahul (1986)
<i>Puntius sarana</i>	<i>Cryptobia (Trypanoplasma) saranae</i>	Wahul (1986)
	<i>Trypanosoma rayi</i>	Wahul (1986)
Order SILURIFORMES		
<i>Mystus cavacius</i>	<i>Cryptobia (Trypanoplasma) cavacii</i>	Wahul (1985)
	<i>Cryptobia (Trypanoplasma) krishnamurthyi</i>	Wahul (1985)
	<i>Trypanosoma joshii</i>	Wahul (1986)
<i>Mystus seenghala</i>	<i>Cryptobia (Trypanoplasma) seenghali</i>	Wahul (1985)
	<i>Cryptobia (Trypanoplasma) vidyai</i>	Wahul (1986)
	<i>Trypanosoma mandali</i>	Wahul (198)
	<i>Trypanosoma purensis</i>	Wahul (1986)
<i>Plotossus canis</i>	<i>Eimeria</i> sp.	
<i>Wallago attu</i>	<i>Cryptobia (Trypanoplasma) attui</i>	Wahul (1986)
	<i>Cryptobia (Trypanoplasma) wallagoi</i>	Wahul (1986)
Order CHANNIFORMES		
<i>Channa gachua</i>	<i>Trypanosoma misrai</i>	Wahul (1982)
	<i>Trypanosoma punctati</i>	Wahul (1985)
	<i>Trypanosoma</i> sp.	Wahul (1985)
<i>Channa punctatus</i>	<i>Trypanosoma</i> sp.	Wahul (1986)

HOST	PARASITE	REFERENCE
Order PERCIFORMES		
<i>Glossogobius giuris</i>	<i>Trypanosoma</i> sp.	Wahul (1985)
Order PERCIFORMES		
<i>Epinephalus tauvina</i>	<i>Eimeria</i> sp.	Bhosale (1977)
<i>Epinephalus diacanthus</i>	<i>Eimeria</i> sp.	Bhosale (1977)
<i>Trichiurus savala</i>	<i>Eimeria</i> sp.	Bhosale (1977)
<i>Otolithes ruber</i>	<i>Eimeria</i> sp.	Bhosale (1977)
<i>Silago sihama</i>	<i>Eimeria</i> sp.	Bhosale (1977)
Order MASTACEMBELIFORMES		
<i>Mastacembelus armatus</i>	<i>Trypanosoma aurngabadensis</i>	Wahul (1987)
	<i>Trypanosoma mastacembeli</i>	Wahul (1987)
	<i>Trypanosoma murtii</i>	Wahul (1987)
Order BATRACHOIDIFORMES		
<i>Batrachus grunniens</i>	<i>Eimeria</i> sp.	Nikam (1983)
Class AMPHIBIA Order ANURA		
<i>Bufo melanostictus</i>	<i>Chilomastix</i> sp.	Krishnamurthy and Madre (1975)
	<i>Hexamitus melanosticti</i>	Krishnamurthy and Shete (1981)
	<i>Hexamitus</i> sp.	Krishnamurthy and Madre (1975)
	<i>Monocercomonas aurangabadensis</i>	Krishnamurthy and Madre (1979)
	<i>Monocercomonas melanosticti</i>	Krishnamurthy and Madre (1979)
	<i>Monocercomonas</i> spp. (2)	Krishnamurthy and Madre (1975)
	<i>Monocercomonides dobelli</i>	Krishnamurthy and Madre (1979)
	<i>Monocercomonides</i> sp.	Krishnamurthy and Madre (1975)
	<i>Nyctotheroides (Nyctotheroides) indicum</i>	Shete (1982)
	<i>Nyctotheroides (Aduncuperistomatus) aurangabadensis</i>	Shete (1982)
	<i>Nyctotheroides (Aduncuperistomatus) melanosticti</i>	Shete (1982)
	<i>Trichomitus batrachorum</i>	Krishnamurthy and Madre (1975)
	<i>Tritrichomonas augusta</i>	Krishnamurthy and Madre (1975)
<i>Microhyla ornata</i>	<i>Protopalina caudata microhyla</i>	Nie (1935); Metcalf (1940)
<i>Rana cyanophlyctis</i>	<i>Balantidium corlissi</i>	Shete and Krishnamurthy (1984)
	<i>Balantidium cyanophylcti</i>	Shete and Krishnamurthy (1984)
	<i>Balantidium ganapati</i>	Shete and Krishnamurthy (1984)
	<i>Balantidium megastomae</i>	Shete and Krishnamurthy (1984)
	<i>Balantidium mininucleatum</i>	Shete and Krishnamurthy (1984)
	<i>Balantidium</i> sp.	Adavant <i>et al.</i> (1981)
	<i>Chilomastix qadrii</i>	Krishnamurthy and Madre (1975)
	<i>Giardia</i> sp.	Krishnamurthy and Madre (1975)
	<i>Hexamitus cyanophlycti</i>	Krishnamurthy and Shete (1975)

HOST	PARASITE	REFERENCE
	<i>Hexamitus</i> sp.	Krishnamurthy and Madre (1975)
	<i>Monocercomonas cyanophlycti</i>	Krishnamurthy and Madre (1979)
	<i>Monocercomonas maharashtra</i>	Krishnamurthy and Shete (1981)
	<i>Monocercomonas</i> sp.	Krishnamurthy and Madre (1975)
	<i>Nyctotheroides</i> (<i>Nyctotheroides</i>) <i>ameroi</i>	Shete (1982)
	<i>Nyctotheroides</i> (<i>Nyctotheroides</i>) <i>cyanophlyctis</i>	Shete (1982)
	<i>Nyctotheroides</i> (<i>Nyctotheroides</i>) <i>ratnagiriensis</i>	Shete (1982)
	<i>Nyctotheroides</i> (<i>Aduncuperistomatus</i>) <i>cyanophlyctis</i>	Shete (1982)
	<i>Trichomitus batrachorum</i>	Shete (1982)
	<i>Trichomitus granulae</i>	Krishnamurthy and Madre (1975)
	<i>Trichomitus</i> sp.	Krishnamurthy and Madre (1975)
<i>Rana tigrina</i>	<i>Balantidium aurangabadensis</i>	Shete and Krishnamurthy (1984)
	<i>Balantidium ranae</i>	Shete and Krishnamurthy (1984)
	<i>Balantidium tigrinae</i>	Shete and Krishnamurthy (1984)
	<i>Haemogregarina berestneffi</i>	Vide Bhatia (1938)
	<i>Haemogregarina magna</i>	Vide Bhatia (1938)
	<i>Hexamitus</i> sp.	Krishnamurthy and Madre (1975)
	<i>Lankesterella minima</i>	Berestneff (1903)
	<i>Monocercomonas sultanae</i>	Krishnamurthy and Shete (1981)
	<i>Nyctotheroides</i> (<i>Aduncuperistomatus</i>) <i>marathwadensis</i>	Krishnamurthy and Madre (1975)
	<i>Rhizomastix ranae</i>	Krishnamurthy (1969)
	<i>Rhizomastix</i> sp.	Krishnamurthy and Madre (1975)
	<i>Sicuophora macropharyngea</i>	Bezenberger (1904)
	<i>Tritrichomonas augusta</i>	Krishnamurthy and Madre (1975)
	<i>Trichomitus aurangabadensis</i>	Krishnamurthy and Shete (1981)
	<i>Trichomitus batrachorum</i>	Krishnamurthy and Madre (1975)
Class REPTILIA		
Order CHELONIA		
<i>Testudo elegans</i>	<i>Hexamastix dobelli</i>	Krishnamurthy (1968)
<i>Trionyx gangeticus</i>	<i>Myxidium mackie</i>	Bosanquet (1910)
Order LACERTILIA		
<i>Calotes versicolor</i>	<i>Chilomastix</i> sp.	Krishnamurthy and Madre (1975)
	<i>Hexamitus</i> sp.	Krishnamurthy and Madre (1975)
	<i>Isospora calotesi</i>	Bhatia (1938)
	<i>Monocercomonas calotesi</i>	Mali (1978)
	<i>Monocercomonas longiflagellata</i>	Krishnamurthy (1968)
	<i>Monocercomonas</i> spp. (2)	Krishnamurthy and Madre (1975)
	<i>Proteromonas</i> sp.	Krishnamurthy and Madre (1975)
<i>Calotes versicolor major</i>	<i>Monocercomonides</i> sp.	Krishnamurthy and Madre (1975)

HOST	PARASITE	REFERENCE
<i>Calotes</i> sp.	<i>Monocercomonides mehdii</i> <i>Proteromonas</i> sp.	Krishnamurthy (1967) Krishnamurthy and Madre (1975)
<i>Chameleon zeylanicus</i>	<i>Monocercomonas</i> sp. <i>Proteromonas chameleoni</i> <i>Proteromonas</i> sp.	Krishnamurthy and Madre (1975) Krishnamurthy (1968) Krishnamurthy and Madre (1975)
<i>Eublepharus</i> sp.	<i>Monocercomonas desh mukhii</i> <i>Proteromonas</i> sp.	Krishnamurthy and Deshmukh (1971) Krishnamurthy and Madre (1975)
<i>Hemidactylus brooki</i>	<i>Monocercomonas shortii</i> <i>Monocercomonas</i> sp. <i>Proteromonas</i> sp. <i>Trichomitus batrachorum</i>	Krishnamurthy (1968) Krishnamurthy and Madre (1975) Krishnamurthy and Deshmukh (1971) Krishnamurthy and Madre (1975)
<i>Hemidactylus cactaei</i>	<i>Monocercomonas</i> sp. <i>Proteromonas</i> sp.	Krishnamurthy and Madre (1975) Krishnamurthy and Madre (1975)
<i>Hemidactylus faviviridis</i>	<i>Eimeria flaviviridis</i> <i>Eimeria hemidactyli</i> <i>Eimeria knowlesi</i>	Setna and Bana (1935) Present report Present report
<i>Hemidactylus giganteus</i>	<i>Chilomastix</i> sp. <i>Chilomastix hemidactyli</i> <i>Monocercomonas marthwadensis</i> <i>Monocercomonas</i> (Alimonas) <i>hemidactyli</i> <i>Monocercomonas</i> sp. <i>Proteromonas</i> sp. <i>Trichomitus batrachorum</i>	Krishnamurthy and Madre (1975) Madre (1979) Mali (1978) Madre (1979) Krishnamurthy and Madre (1975) Krishnamurthy and Madre (1975) Krishnamurthy and Madre (1975)
<i>Uromastix hardwickii</i>	<i>Hexamastix laceratae</i> <i>Nyctotherus hardwickii</i> <i>Proteromonas uromastixi</i>	Krishnamurthy (1968) Janakidevi (1961) Janakidevi (1961)
<i>Varanus indica</i>	<i>Chilomastix</i> sp. <i>Monocercomonas</i> sp. <i>Trichomitus</i> sp.	Krishnamurthy and Madre (1975) Krishnamurthy and Madre (1975) Krishnamurthy and Madre (1975)
<i>Varanus</i> sp.	<i>Monocercomonas</i> sp.	Krishnamurthy and Madre (1975)
Order OPHIDIA		
<i>Elapha helena</i>	<i>Monocercomonas elaphae</i>	Krishnamurthy (1968)
<i>Naja naja</i>	<i>Monocercomonas breviflagellata</i> <i>Monocercomonas najae</i> <i>Monocercomonas</i> sp.	Mali (1978) Krishnamurthy (1968) Krishnamurthy and Madre (1975)
<i>Lycodon aulicus</i>	<i>Monocercomonas garnhami</i>	Krishnamurthy (1968)
<i>Ptyas karolimi</i>	<i>Haemogregarina</i> sp.	Ball (1958)
<i>Ptyas mucosus</i>	<i>Haemogregarina</i> sp.	Present report
<i>Vipera russeli</i>	<i>Monocercomonas garnhami</i> <i>Monocercomonas</i> sp. <i>Monocercomonides viperae</i> <i>Retortamonas viperae</i>	Krishnamurthy (1968) Krishnamurthy and Madre (1975) Madre and Krishnamurthy (1976) Krishnamurthy and Madre (1976)

HOST	PARASITE	REFERENCE
<i>Xenochrophis piscator</i>	<i>Haemogregarina mirabilis</i>	Ball (1958)
	Class AVES	
	Order CICONIFORMES	
<i>Pseudibis p. papillosa</i>	<i>Haemoproteus plataleae</i>	Nandi (1976)
	Order FALCONIFORMES	
<i>Accipiter badius</i>	<i>Haemoproteus</i> sp.	McClure et al. (1978)
	<i>Leucocytozoon</i> sp.	McClure et al. (1978)
<i>Buteo vulpinus</i>	<i>Trypanosoma</i> sp.	McClure et al. (1978)
<i>Falco tinnunculus</i>	<i>Haemoproteus tinnunculi</i>	Nandi (1976)
	Order GALIFORMES	
<i>Coturnix coturnix coturnix</i>	<i>Eimeria</i> sp.	Bhosale (1977)
<i>Fracolinus francolinus</i>	<i>Eimeria</i> sp.	Bhosale (1977)
<i>Fracolinus pictus</i>	<i>Leucocytozoon</i> sp.	McClure et al. (1978)
<i>Fracolinus pondicerianus</i>	<i>Leucocytozoon</i> sp.	McClure et al. (1978)
<i>Galloperdix spadicea</i>	<i>Haemoproteus</i> sp.	McClure et al. (1978)
<i>Gallus domesticus</i>	<i>Eimeria hagini</i>	Gill (1954)
	<i>Eimeria tenella</i>	Gill and Ray (1957)
<i>Gallus gallus</i>	<i>Eimeria acervulina</i>	Gill (1954)
	<i>Eimeria maxima</i>	Gill (1954)
	<i>Eimeria mitis</i>	Gill (1954)
	<i>Eimeria praecox</i>	Gill (1954)
<i>Perdicula argoondah</i>	<i>Leucocytozoon</i> sp.	McClure et al. (1978)
<i>Perdicula asiatica</i>	<i>Eimeria</i> sp.	Bhosale (1977)
	Order COLUMBIFORMES	
<i>Columbia livia intermedia</i>	<i>Eimeria columbae</i>	Present report
	<i>Eimeria necatrix</i>	Gill (1961)
	<i>Eimeria</i> sp.	Bhosale (1977)
	<i>Haemoproteus columbae</i>	Nandi (1976)
<i>Streptopelia chinensis</i>	<i>Trypanosoma</i> sp.	McClure et al. (1978)
<i>Streptopelia decaocto</i>	<i>Haemoproteus</i> sp.	McClure et al. (1978)
	<i>Leucocytozoon</i> sp.	McClure et al. (1978)
<i>Streptopelia orientalis</i>	<i>Haemoproteus</i> sp.	McClure et al. (1978)
	<i>Leucocytozoon</i> sp.	McClure et al. (1978)
<i>Streptopelia senegalensis</i>	<i>Haemoproteus</i> sp.	McClure et al. (1978)
	<i>Leucocytozoon</i> sp.	McClure et al. (1978)
	Order CUCULIFORMES	McClure et al. (1978)
<i>Centropus sinensis</i>	<i>Haemoproteus</i> sp.	McClure et al. (1978)
	<i>Leucocytozoon</i> sp.	McClure et al. (1978)
<i>Centropus sinensis parroti</i>	<i>Haemoproteus centropi</i>	McClure et al. (1978)
<i>Clamator jacobinus</i>	<i>Haemoproteus</i> sp.	McClure et al. (1978)
	<i>Leucocytozoon</i> sp.	McClure et al. (1978)

HOST	PARASITE	REFERENCE
Order CORACIIFORMES		
<i>Coracias b. benghalensis</i>	<i>Haemoproteus coraciae</i>	Nandi (1976)
<i>Halcyon smyrnensis</i>	<i>Haemoproteus</i> sp.	McClure <i>et al.</i> (1978)
<i>Merops orientallis</i>	<i>Haemoproteus manwelli</i> <i>Haemoproteus</i> sp.	Bennett (1978) McClure <i>et al.</i> (1978)
<i>Merops o. orientalis</i>	<i>Haemoproteus meropi</i>	Zargar (1945)
<i>Tockus griseus griseus</i>	<i>Trypanosoma</i> sp.	McClure <i>et al.</i> (1978)
Order PICIFORMES		
<i>Megalaima viridis</i>	<i>Haemoproteus cornuata</i> <i>Haemoproteus xantholaemae</i> <i>Haemoproteus</i> sp. <i>Leucocytozoon capitonis</i> <i>Leucocytozoon</i> sp.	Bennett and Nandi (1981) Zargar (1945) McClure <i>et al.</i> (1978) Bennett <i>et al.</i> (1993) McClure <i>et al.</i> (1978)
<i>Megalaima haemacephala</i>	<i>Haemoproteus</i> sp. <i>Haemoproteus xantholaemae</i>	McClure <i>et al.</i> (1978) Bennett and Nandi (1981)
<i>Megalaima zeylanica</i>	<i>Haemoproteus thereicercys</i> <i>Haemoproteus</i> sp.	Bennett and Nandi (1981) McClure <i>et al.</i> (1978)
<i>Picoides m. mahrattensis</i>	<i>Haemoproteus borgesii</i> <i>Haemoproteus velans</i> <i>Plasmodium relictum</i>	Nandi (1976) Nandi (1976) Nandi (1976)
Order PASSERIFORMES		
<i>Acridotheres tristis tristis</i>	<i>Haemoproteus pastoris</i> <i>Haemoproteus</i> sp. <i>Plasmodium vauhani</i>	Nandi (1976) McClure <i>et al.</i> (1978) Nandi (1976)
<i>Aegithina tiphia</i>	<i>Haemoproteus aegithinae</i> <i>Haemoproteus</i> sp.	Bennett and Peirce (1990) McClure <i>et al.</i> (1978)
<i>Alauda gulgula</i>	<i>Eimeria</i> sp. 1 <i>Eimeria</i> sp. 2 <i>Isospora</i> sp.	Bhosale (1977) Bhosale (1977) Bhosale (1977)
<i>Amandava amandava</i> ?	<i>Isospora</i> sp.	Bhosale (1977)
<i>Anthus hodgsoni</i>	<i>Haemoproteus</i> sp. <i>Haemoproteus anthi</i>	McClure <i>et al.</i> (1978) Bennett and Peirce (1990)
<i>Carpodacus erythrinus</i>	<i>Haemoproteus</i> sp.	McClure <i>et al.</i> (1978)
<i>Copsychus saularis saularis</i>	<i>Trypanosoma</i> sp.	McClure <i>et al.</i> (1978)
<i>Corvus macrorhynchus</i>	<i>Haemoproteus</i> sp.	McClure <i>et al.</i> (1978)
<i>Dendrocitta vagabunda</i>	<i>Haemoproteus</i> sp.	McClure <i>et al.</i> (1978)
<i>Dicaeum erythronotus</i>	<i>Haemoproteus</i> sp.	McClure <i>et al.</i> (1978)
<i>Dicrurus caeruleus</i>	<i>Haemoproteus</i> sp.	McClure <i>et al.</i> (1978)
<i>Dicrurus paradiseus</i>	<i>Haemoproteus</i> sp.	McClure <i>et al.</i> (1978)

HOST	PARASITE	REFERENCE
<i>Hypsipetes madagascariensis</i>	<i>Haemoproteus philippinensis</i> <i>Haemoproteus</i> sp. <i>Plasmodium</i> sp.	Rahal <i>et al.</i> (1987) McClure <i>et al.</i> (1978) McClure <i>et al.</i> (1978)
<i>Lanius schach</i>	<i>Haemoproteus</i> sp. <i>Plasmodium</i> sp.	McClure <i>et al.</i> (1978) McClure <i>et al.</i> (1978)
<i>Lanius tigrinus</i>	<i>Haemoproteus lanii</i>	Nandi (1976)
<i>Lanius vittatus</i>	<i>Haemoproteus</i> sp.	McClure <i>et al.</i> (1978)
<i>Lonchura malabarica</i>	<i>Haemoproteus</i> sp.	McClure <i>et al.</i> (1978)
<i>Lonchura punctulata</i>	<i>Haemoproteus</i> sp.	McClure <i>et al.</i> (1978)
<i>Melophus lathami</i>	<i>Haemoproteus</i> sp. <i>Leucocytozoon</i> sp.	McClure <i>et al.</i> (1978) McClure <i>et al.</i> (1978)
<i>Micropus affinis</i>	<i>Isospora</i> sp.	Bhosale (1977)
<i>Motacilla alba</i>	<i>Haemoproteus</i> sp.	McClure <i>et al.</i> (1978)
<i>Monticola cinclorhynchus</i>	<i>Haemoproteus</i> sp.	McClure <i>et al.</i> (1978)
<i>Muscicapa tickelliae</i>	<i>Haemoproteus</i> sp. <i>Leucocytozoon</i> sp.	McClure <i>et al.</i> (1978) McClure <i>et al.</i> (1978)
<i>Nectarina asiatica</i>	<i>Haemoproteus</i> sp. <i>Plasmodium</i> sp.	McClure <i>et al.</i> (1978) McClure <i>et al.</i> (1978)
<i>Nectarina lotenia</i>	<i>Haemoproteus</i> sp.	McClure <i>et al.</i> (1978)
<i>Nectarina zeylanica</i>	<i>Haemoproteus</i> sp.	McClure <i>et al.</i> (1978)
<i>Orthotomus sutorius</i>	<i>Haemoproteus</i> sp.	McClure <i>et al.</i> (1978)
<i>Parus major</i>	<i>Leucocytozoon</i> sp.	McClure <i>et al.</i> (1978)
<i>Passer domesticus</i>	<i>Haemoproteus</i> sp. <i>Isospora lackzei</i>	McClure <i>et al.</i> (1978) McClure <i>et al.</i> (1978)
<i>Petronia xanthocollis</i>	<i>Haemoproteus</i> sp.	McClure <i>et al.</i> (1978)
<i>Pitta brachyuran</i>	<i>Plasmodium</i> sp.	McClure <i>et al.</i> (1978)
<i>Ploceus philippinus</i>	<i>Haemoproteus</i> sp. <i>Plasmodium</i> sp.	McClure <i>et al.</i> (1978) McClure <i>et al.</i> (1978)
<i>Prinia hodgsoni</i>	<i>Haemoproteus</i> sp.	McClure <i>et al.</i> (1978) McClure <i>et al.</i> (1978)
<i>Prinia socialis</i>	<i>Haemoproteus</i> sp. <i>Plasmodium</i> sp.	McClure <i>et al.</i> (1978) McClure <i>et al.</i> (1978)
<i>Prinia sylvatica</i>	<i>Haemoproteus</i> sp.	McClure <i>et al.</i> (1978)
<i>Pycnonotus cafer</i>	<i>Haemoproteus</i> sp. <i>Isospora</i> sp. 1 <i>Isospora</i> sp. 2 <i>Leucocytozoon</i> sp. <i>Plasmodium</i> sp.	McClure <i>et al.</i> (1978) Bhosale (1977) Bhosale (1977) McClure <i>et al.</i> (1978) McClure <i>et al.</i> (1978)
<i>Pycnonotus jocosus</i>	<i>Haemoproteus</i> sp. <i>Leucocytozoon</i> sp. <i>Trypanosoma</i> sp.	McClure <i>et al.</i> (1978) McClure <i>et al.</i> (1978) McClure <i>et al.</i> (1978)

HOST	PARASITE	REFERENCE
<i>Rhipidura albogulari</i>	<i>Haemoproteus</i> sp. <i>Plasmodium</i> sp.	McClure <i>et al.</i> (1978) McClure <i>et al.</i> (1978)
<i>Saxicoloides fulicata</i>	<i>Haemoproteus</i> sp.	McClure <i>et al.</i> (1978)
<i>Sturnus pagodarum</i> (<i>Temenuchus pagodarum</i>)	<i>Haemoproteus pastoris</i> <i>Haemoproteus</i> sp. <i>Isospora</i> sp.	Nandi (1976) McClure <i>et al.</i> (1978) Bhosale (1977)
<i>Sylvia curruca</i>	<i>Isospora</i> sp.	Bhosale (1977)
<i>Tephrodornis pondiceriana</i>	<i>Haemoproteus</i> sp. <i>Leucocytozoon</i> sp.	McClure <i>et al.</i> (1978) McClure <i>et al.</i> (1978)
<i>Turdoides somervillei</i>	<i>Isospora</i> sp.	Bhosale (1977)
<i>Turdoides striatus</i>	<i>Leucocytozoon</i> sp.	McClure <i>et al.</i> (1978)
<i>Turdus merula</i>	<i>Haemoproteus</i> sp. <i>Leucocytozoon</i> sp.	McClure <i>et al.</i> (1978) McClure <i>et al.</i> (1978)
<i>Turdus striatus</i>	<i>Haemoproteus</i> sp.	McClure <i>et al.</i> (1978)
<i>Zoothera citrina</i>	<i>Leucocytozoon</i> sp.	McClure <i>et al.</i> (1978)
<i>Zosterops palpebrosa</i>	<i>Haemoproteus zosteropis</i> <i>Haemoproteus</i> sp.	Bennett and Peirce (1981) McClure <i>et al.</i> (1978)
Class MAMMALIA Order RODENTIA		
<i>Rattus rattus</i>	<i>Trypanosoma</i> sp.	Mourya <i>et al.</i> (1996)
<i>Rattus rattus rattus</i>	<i>Eimeria levinei</i> <i>Eimeria nagpurensis</i> <i>Eimeria tuberculata</i> <i>Isospora aurangabadensis</i> <i>Isospora krishnamurthyi</i>	Krishnamurthy and Kshirsagar (1980) Gill and Ray (1961) Krishnamurthy and Kshirsagar (1980) Kshirsagar (1980) Kshirsagar (1980)
<i>Ratufa indica</i>	<i>Plasmodium ratufoe</i>	Donovan (1920)
<i>Funambulus palmarum</i>	<i>Eimeria</i> sp.	Bhosale (1977)
<i>Funambulus pennati</i>	<i>Hepatozoon funnambuli</i>	Bhatia (1938)
Order LAGOMORPHA		
<i>Oryctolagus cuniculus</i>	<i>Eimeria intestinalis</i> <i>Eimeria irresidua</i> <i>Eimeria perforans</i> <i>Eimeria</i> sp.	Nikam (1983) Nikam (2002) Nikam (1983) Nikam (1983)
Order CARNIVORA		
<i>Canis familiaris</i>	<i>Giardia canis</i> <i>Hepatozoon canis</i> <i>Isospora begemina</i> <i>Pentatrichomonas</i> sp. <i>Sarcocystis</i> sp <i>Trypanosoma evansi</i>	Deshpande <i>et al.</i> (1981) Pawar and Gatne (2005) Rao (1968) Deshpande <i>et al.</i> (1981) Shastri (1990) Shastri <i>et al.</i> (1981)
<i>Canis</i> sp.	<i>Isospora felis</i>	Rao and Hiregauder (1952)

HOST	PARASITE	REFERENCE
<i>Felis catus</i>	<i>Isospora rivolta</i>	Rao and Hiregauder (1952)
	<i>Toxoplasma gondii</i>	Shastri and Ratnaparkhi (1992)
	<i>Toxoplasma hammondi</i>	Shastri and Ratnaparkhi (1992)
<i>Felis domestica</i>	<i>Eimeria canis</i>	Rao and Hiregauder (1952)
	<i>Toxoplasma</i> sp.	Ali <i>et al.</i> (1981)
Order ARTIODACTYLA		
<i>Bos indicus</i>	<i>Anaplasma marginale</i>	Shastri <i>et al.</i> (1981)
	<i>Eimeria brasiliensis</i>	Rao and Bhatawadekar (1959)
	<i>Eimeria pellita</i>	Rao and Hiregauder (1954)
	<i>Eimeria zuernii</i>	Present report
	<i>Theileria annulata</i>	Shastri <i>et al.</i> (1981)
	<i>Theileria mutans</i>	Shastri <i>et al.</i> (1988)
	<i>Theileria orientalis</i>	Shastri <i>et al.</i> (1988)
	<i>Theileria</i> sp.	Shastri <i>et al.</i> (1981)
	<i>Trypanosoma theileri</i>	Shastri <i>et al.</i> (1981)
<i>Bubalus bubalus</i>	<i>Trypanosoma</i> sp.	Shastri and Tekerkhede (1979)
	<i>Babesia bigemina</i>	Shastri <i>et al.</i> (1981)
	<i>Babesia bovis</i>	Shastri <i>et al.</i> (1981)
	<i>Eimeria alabamensis</i>	Jadhav and Nikam (2002)
	<i>Eimeria auburensis</i>	Jadhav and Nikam (2002)
	<i>Eimeria bareillyi</i>	Shastri <i>et al.</i> (1973, 1974)
	<i>Eimeria bovis</i>	Rao and Hiregauder (1954)
	<i>Eimeria bukidnonensis</i>	Jadhav and Nikam (2002)
	<i>Eimeria canadensis</i>	Rao and Hiregauder (1954)
	<i>Eimeria coecicola</i>	Nikam (1983)
	<i>Eimeria cylindrica</i>	Jadhav and Nikam (2002)
	<i>Eimeria ellipsoidalis</i>	Jadhav and Nikam (2002)
	<i>Eimeria subspherica</i>	Jadhav and Nikam (2002)
	<i>Plasmodium bubalis</i>	Shastri <i>et al.</i> (1981)
	<i>Trypanosoma evansi</i>	Shastri <i>et al.</i> (1981)
<i>Capra hircus</i>	<i>Anaplasma ovis</i>	Nikam (1983)
	<i>Eimeria ahsata</i>	Krishnamurthy <i>et al.</i> (1974-1981)
	<i>Eimeria arloingi</i>	Nikam (1983)
	<i>Eimeria christenseni</i>	Jadhav <i>et al.</i> (2001)
	<i>Eimeria faurei</i>	Krishnamurthy and Kshirsagar (1980)
	<i>Eimeria granulosa</i>	Krishnamurthy and Kshirsagar (1980)
	<i>Eimeria intricata</i>	Jadhav <i>et al.</i> (2001)
	<i>Eimeria ninkohlyakimovae</i>	Rao and Hiregauder (1954)
	<i>Eimeria parbhaniensis</i>	Kshirsagar (1976)
	<i>Eimeria parva</i>	Rao and Hiregauder (1954)
	<i>Eimeria</i> sp.	Krishnamurthy and Kshirsagar (1976)
	<i>Sarcocystis capraecanis</i>	Shastri (1990)
	<i>Sarcocystis</i> sp.	Shastri (1990)

HOST	PARASITE	REFERENCE
	<i>Theileria ovis</i>	Shastri and Deshpande (1987)
	<i>Theileria</i> sp.	Shastri <i>et al.</i> (1981)
	<i>Trypanosoma evansi</i>	Shastri <i>et al.</i> (1981)
<i>Ovis aries</i>	<i>Anaplasma ovis</i>	Shastri and Deshpande (1987)
	<i>Eimeria crandalis</i>	Jadhav <i>et al.</i> (2001)
	<i>Eimeria faurei</i>	Krishnamurthy and Kshirsagar (1976)
	<i>Eimeria granulosa</i>	Krishnamurthy and Kshirsagar (1976)
	<i>Eimeria intricata</i>	Rao and Hiregauder (1954)
	<i>Eimeria ninkohlyakimovae</i>	Rao and Hiregauder (1954)
	<i>Eimeria ovina</i>	Krishnamurthy and Bawazir (1981)
	<i>Eimeria parva</i>	Rao and Hiregauder (1954)
	<i>Eimeria punctata</i>	Nikam <i>et al.</i> (1999-2001)
	<i>Eimeria weybridgensis</i>	Nikam <i>et al.</i> (1999-2001)
	<i>Theileria hirci</i>	Shastri <i>et al.</i> (1981)
	<i>Theileria ovis</i>	Shastri and Deshpande (1981)
	<i>Theileria</i> sp.	Shastri <i>et al.</i> (1981)
	<i>Trypanosoma evansi</i>	Shastri <i>et al.</i> (1981)
<i>Sus scrofa</i>	<i>Eimeria debleicki</i>	Present report
Order PERISSODACTYLA		
<i>Equus caballus</i>	<i>Eimeria leuckarti</i>	Hiregauder (1956)
Order PRIMATE		
<i>Homo sapiens</i>	<i>Entamoeba coli</i>	Kalyankar <i>et al.</i> (1981)
	<i>Entamoeba histolytica</i>	Kalyankar <i>et al.</i> (1981)
	<i>Giardia intestinalis</i>	Kalyankar <i>et al.</i> (1981)
	<i>Isospora belli</i>	Cragg (1917)
	<i>Plasmodium falciparum</i>	Bhatia (1938)
	<i>Plasmodium malariae</i>	Bhatia (1938)
	<i>Plasmodium vivax</i>	Bhatia (138)
	<i>Toxoplasma</i> sp.	Ali <i>et al.</i> (1981)
	<i>Trypanosoma evansi.</i>	Shastri <i>et al.</i> (1981)

- Note : 1. In most cases original references are cited, while in some others these are cited from review works, consolidated document and Fauna of British India (Bhatia, 1938) as well as Fauna of India (Mandal, 1987)
2. Present report indicates parasites recorded during present study.
3. References relating to some gregarines and several coccidian parasites are from Ph.D. works of Marathwada University communicated herein by one of us (S. R. Nikam).
4. The first references from this state for the parasites are cited, while there may be other works from Maharashtra cited in the text.
5. Both named and unnamed species from the same host are cited, which indicate the occurrences of different parasites or dearth of information relating to recognition of the parasites.

SYSTEMATIC ACCOUNT

Kingdom PROTISTA
 Subkingdom PROTOZOA
 Phylum SARCOMASTIGOPHORA
 Subphylum MASTIGOPHORA
 Class ZOOMASTIGOPHOREA
 Order KINETOPLASTIDA
 Suborder BODONINA
 Family CRYPTOBIDAE

Diagnosis : Flagellates with 2 heterodynamic flagella arising from a broad flagellar pocket; kinetoplast relatively large or diffuse; recurrent flagellum attached to body surface.

Genus *Cryptobia* Leidy, 1846

Diagnosis : Recurrent flagellum attached to body surface; kinetoplast prominent, oval or rod-like or fragmented.

Subgenus *Trypanoplasma* Laveran
 and Mesnil, 1901

Diagnosis : Body leaf-like, blepharoplast elongated rod-like; parasitic in the blood of fishes.

Key to species

1. Cell body short
 - 1.(1). Cell body short, broad slightly curved; nucleus spherical, oval or elongated; kinetoplast diffused, short; 2 kinetosomes located in front of the kinetoplast *C (T) attui*
 - 1.(2) Cell body short, broad often irregular; nucleus oval, located dorsally in the anterior half of the body; kinetoplast absent; posterior flagellum forming 'S' configuration over the body *C. (T.) krishnamurthyi*
 - 1.(3) Cell body typically short, broad and stumpy; nucleus extremely variable; kinetoplast distinctly short located opposite to the nucleus on the ventral side; no distinct undulating membrane *C. (T) lomi*
 - 1.(4) Cell body short, broad and stumpy; kinetoplast relatively short, triangular or fusiform; posterior free flagellum recurved and ending in a loop *C (T) vidyai*
2. Cell body slender and elongated
 - 2.(1) Cell body dimorphic; slender form elongated, uniformly broad with long kinetoplast, stumpy forms short and blunt, kinetoplast short and curved *C (T) qadri*
 - 2.(2) Cell body elongated curved, broad in the middle; kinetoplast distinctly elongated; no distinct undulating membrane *C (T) saranae*
 - 2.(3) Cell body elongated; 'C' or 'U' shaped; kinetoplast elongated, straight, rod-like *C (T) seenghali*
 - 2.(4) Cell body distinctly elongated and curved; dorsal surface markedly undulated; kinetoplast elongated; cytoplasm with chromophilic granules *C (T). solapurensis*
3. Cell body variable.
 - 3.(1) Cell body variable; nucleus oval to elongated; kinetoplast relatively short, triangular or fusiform; posterior flagellum thrown into 2-3 folds *C (T) cavacii*
 - 3.(2) Cell body variable. 18.74 μm $\times$ 9.76 μm in size; kinetoplast diffuse; cytoplasm highly vacuolated containing several chromophilic granules *C (T) wallagoi*

1. *Cryptobia (Trypanoplasma) attui*
 Wahul, 1986a
 (Fig. 1a-d)

1986. *Cryptobia (Trypanoplasma) attui* Wahul, Arch. Protistenk, 131 : 309-318.

Diagnosis : Cell body short, broad slightly curved, measuring 13.18-25.89(18.74) μm $\times$ 5.64-15.06 (9.76) μm ; nucleus spherical, oval or elongated, 3.76-9.41(6.15) μm $\times$ 1.41-4.23(2.61) μm , located dorsally in the anterior half of the body; kinetoplast diffused, short, 2.35-5.64(3.92) μm $\times$ 0.47-1.17(0.97) μm , located opposite to the nucleus on the ventral side; 2 kinetosomes located in front of the kinetoplast and 2 flagella arising

from them; anterior flagellum short, 14.12-26.83(21.63) μm in length; posterior flagellum running along the side of the body, thrown into 3-4 folds and emerging out as free flagellum measuring 6.12-15.06(10.16) μm ; cytoplasm granular and vacuolated.

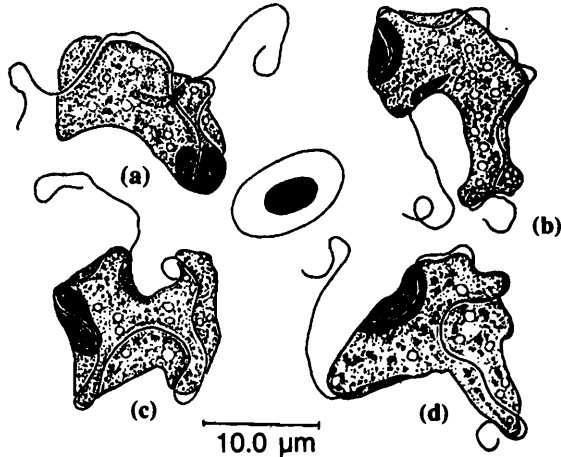


Fig. 1a-d. *Cryptobia (Trypanoplasma) attui*

Host : *Wallago attu*; site of infection : blood.

Distribution : India : Maharashtra (Purna, Aurangabad district).

Remarks : Wahul (1986) reported this species from Maharashtra state.

2. *Cryptobia (Trypanoplasma) cavacii*

Wahul, 1985

(Fig. 2a-d)

1985. *Cryptobia (Trypanoplasma) cavacii* Wahul, *Proc. Ind. Acad. Sci.*, 94(1) : 25-35.

Diagnosis : Cell body variable in shape, measuring 15.06-20.24(17.63) μm $\times$ 6.59-14.59 (9.58) μm ; nucleus oval to elongated, 4.23-8.47(6.25) μm $\times$ 1.41-4.23(2.65) μm , located close to the anterior end; kinetoplast relatively short, triangular or fusiform, 2.11-6.12(4.33) μm $\times$ 0.47-3.29(1.43) μm , located on the ventral side; 2 kinetosomes located in front of the kinetoplast and 2 flagella arising from them; anterior flagellum short, 13.65-23.06(20.41) μm in length; posterior flagellum running along the side of the body, thrown into 2-3 folds, emerging out as free flagellum, measuring 12.17-21.18 (16.94) μm ; cytoplasm granular and vacuolated.

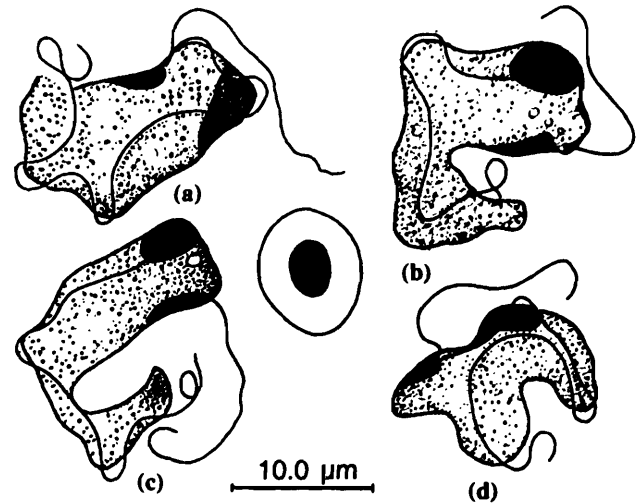


Fig. 2a-d. *Cryptobia (Trypanoplasma) cavacii*

Host : *Mystus cavacius*; site of infection : blood.

Distribution : India : Maharashtra (Purna, Aurangabad district).

Remarks : Wahul (1986) reported this species from Maharashtra state.

3. *Cryptobia (Trypanoplasma) krishnamurthyi*

Wahul, 1985

(Fig. 3a-c)

1985. *Cryptobia (Trypanoplasma) krishnamurthyi* Wahul, *Proc. Ind. Acad. Sci.*, 94(1) : 25-35.

Diagnosis : Cell body short, broad often irregular, measuring 15.53-28.24(19.89) μm $\times$ 5.17-16.0(10.13) μm ; nucleus oval, 3.29-11.29(6.91) μm $\times$ 1.41-6.12(3.08) μm , located dorsally in the

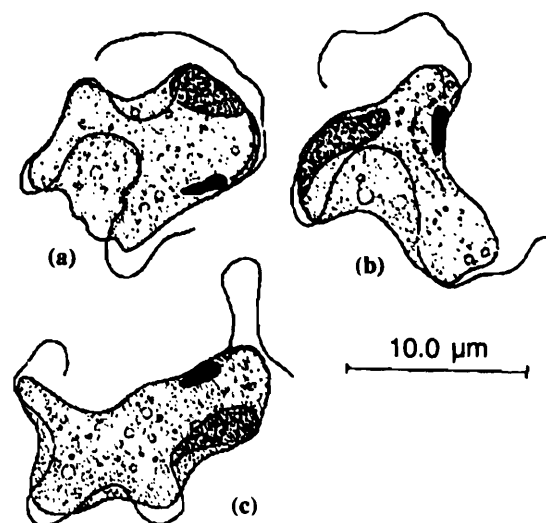


Fig. 3a-c. *Cryptobia (Trypanoplasma) krishnamurthyi*

anterior half of the body; kinetoplast absent; 2 kinetosomes located in front of the kinetoplast with 2 flagella arising from them; anterior flagellum short, 10.35-30.13(22.52) μm in length; posterior flagellum forming 'S' configuration, running over the body and emerging out as free flagellum measuring 11.29-27.3 (18.38) μm ; cytoplasm granular and vacuolated.

Host : *Mystus cavacius*; site of infection : blood.

Distribution : India : Maharashtra (Purna, Aurangabad district).

Remarks : Wahul (1985) reported this species from Maharashtra state.

4. *Cryptobia (Trypanoplasma) lomi*

Wahul, 1986a

(Fig. 4a-c)

1986. *Trypanoplasma lomi* Wahul, Arch. Protistenk., 131 : 309-318.

Diagnosis : Cell body typically short, broad and stumpy, measuring 11.77-19.30(14.67) μm $\times$ 5.17-12.24 (8.11) μm ; both ends bluntly rounded; nucleus extremely variable, 3.29-8.0(5.64) μm $\times$ 1.41-4.23(2.19) μm , located near the dorsal border; kinetoplast distinctly short, 1.64-4.7(2.75) μm $\times$ 0.47-1.17(0.79) μm , located opposite to the nucleus on the ventral side; 2 kinetosomes located in front of the kinetoplast with 2 flagella arising from them; anterior flagellum short, 13.18-20.24 (17.36) μm in length; posterior flagellum running

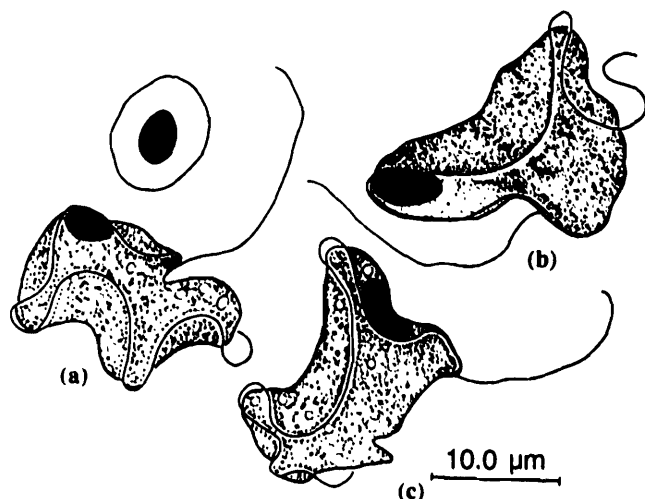


Fig. 4a-c. *Cryptobia (Trypanoplasma) lomi*

along the side of the body emerging out as free flagellum measuring 6.12-12.24(8.97) μm ; no distinct undulating membrane; cytoplasm homogenous and vacuolated; no distinct chromophilic granules.

Host : *Puntius hexastichus*; site of infection : blood.

Distribution : India : Maharashtra (Purna, Aurangabad district).

Remarks : Wahul (1986) reported this species from Maharashtra state.

5. *Cryptobia (Trypanoplasma) qadri* Wahul,

1986a

(Fig. 5a-c)

1986a. *Cryptobia (Trypanoplasma) qadrii* Wahul, Arch. Protistenk., 131 : 309-318.

Diagnosis : Typically dimorphic; slender form elongated, straight or slightly curved, uniformly broad, bluntly conical ends, 14.12-24.48(19.11) μm $\times$ 2.82-11.17 (6.19) μm in size; stumpy forms short and blunt, broader just below the kinetoplast, 11.77-23.54(17.6) μm $\times$ 4.7-12.7 (8.17) μm in size; nucleus variable in shape, 4.0-7.53(5.2) μm $\times$ 0.47-

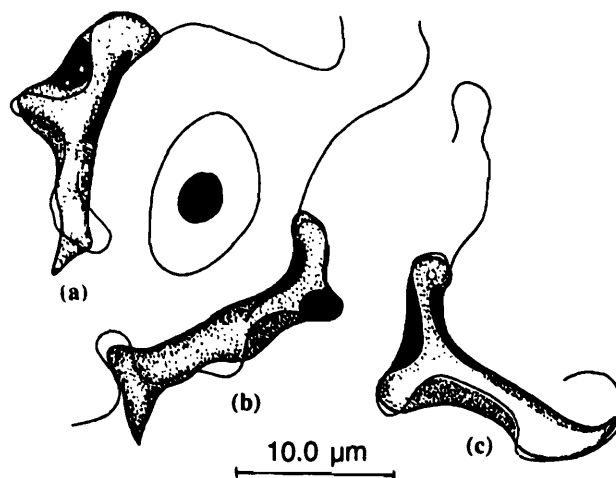


Fig. 5a-c. *Cryptobia (Trypanoplasma) qadri*

2.82(1.81) μm , located dorsally in the anterior one third; kinetoplast in slender forms long, 5.17-8.94 (6.61) μm $\times$ 0.47-1.17(0.72) μm located on the ventral side; kinetoplast short and curved in stumpy forms 2.82-4.7(3.94) μm $\times$ 0.47-0.94(0.69) μm , with 2 kinetosomes located in front of the

kinetoplast and 2 flagella arising from them; anterior flagellum as long as the body, 8.94-19.30(15.17) μm in slender forms and 13.18-18.83(15.55) μm in stumpy forms; posterior flagellum running along the dorsal surface of the body, thrown into 3-4 undulations emerging out as free flagellum measuring 2.82-16.47(8.43) μm ; no distinct undulating membrane seen; cytoplasm with distinct chromophilic granules in slender forms

Host : *Labeo calbasu*, *L. dyochelius*; site of infection : blood.

Distribution : India : Maharashtra (Purna, Aurangabad district); Andhra Pradesh.

Remarks : Wahul (1986) reported this species from Maharashtra state.

6. *Cryptobia (Trypanoplasma) saranae*

Wahul, 1986a

(Fig. 6a-c)

1986. *Cryptobia (Trypanoplasma) saranae* Wahul, *Arch. Protistenk.*, 131 : 309-318.

Diagnosis : Cell body typically elongated, often curved measuring 13.88-29.18(18.8) $\mu\text{m} \times$ 4.7-14.12 (9.0) μm ; broad in the middle part, bluntly conical anteriorly and tapering posteriorly; nucleus elongated, 3.2-10.35(6.35) $\mu\text{m} \times$ 1.17-5.17(2.67) μm , located in the widest part of the body; kinetoplast distinctly elongated, 1.88-8.0(4.84) $\mu\text{m} \times$ 0.47-2.11(0.93) μm , located opposite to the nucleus on the ventral side; 2 kinetosomes located in front of the kinetoplast and 2 flagella arising

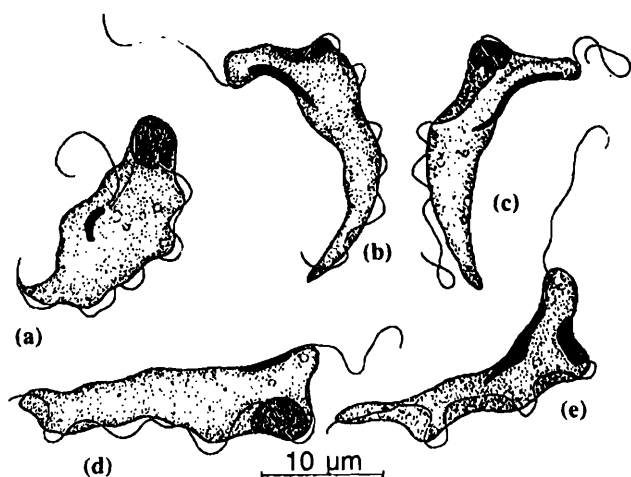


Fig. 6a-c. *Cryptobia (Trypanoplasma) saranae*

from them; anterior flagellum short, 13.65-22.59 μm in length; posterior flagellum running along the side of the body and emerging out as free flagellum measuring 6.59-13.65 μm ; no distinct undulating membrane; cytoplasm granular and vacuolated.

Host : *Puntius sarana*; site of infection : blood.

Distribution : India : Maharashtra (Aurangabad district).

Remarks : Wahul (1986) reported this species from Maharashtra state.

7. *Cryptobia (Trypanoplasma) seenghali*

Wahul, 1985

(Fig. 7a-d)

1985. *Cryptobia (Trypanoplasma) seenghali* Wahul, *Proc. Ind. Acad. Sci.*, 94(1) : pp. 25-35.

Diagnosis : Cell body elongated; 'C' or 'U' shaped; anterior end broad and bluntly conical; 15.53-32.95(25.27) $\mu\text{m} \times$ 5.17-10.82 (8.0) μm ; nucleus oval to elongated, 3.76-9.8 (6.93) $\mu\text{m} \times$

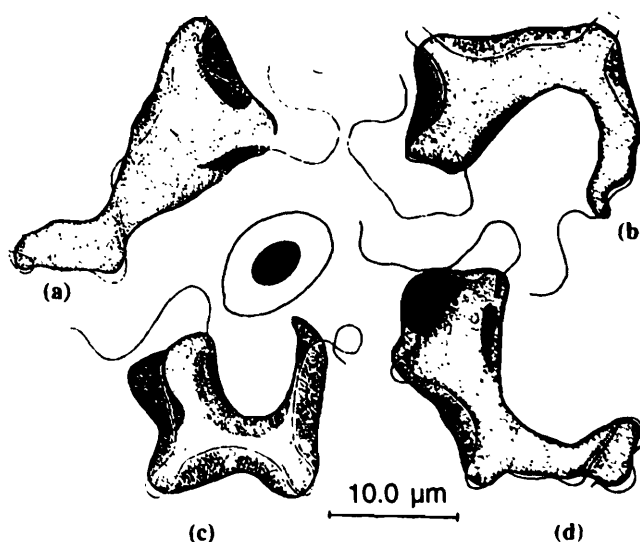


Fig. 7a-d. *Cryptobia (Trypanoplasma) seenghali*

1.41-4.23 (2.8) μm , located at dorsal margin in the anterior one third; kinetoplast elongated, straight, rod-like, 3.76-8.0(5.7) $\mu\text{m} \times$ 0.47-1.88(0.98) μm , located on the ventral side; 2 kinetosomes located in front of the kinetoplast and 2 flagella arising from them; anterior flagellum short, 20.7-37.3(23.69) μm in length; posterior

flagellum running along the dorsal surface, thrown into 2 folds emerging out as free flagellum, 12.24-25.4 (17.84) μm ; cytoplasm highly vacuolated and homogenous.

Host : *Mystus seenghala* : site of infection : blood.

Distribution : India : Maharashtra (Purna, Aurangabad District).

Remarks : Wahul (1985) reported this species from Maharashtra state.

8. *Cryptobia (Trypanoplasma) solapurensis*

Wahul, 1986a

(Fig. 8a-d)

1986. *Trypanoplasma solapurensis* Wahul, *Arch. Protistenk.*, 131 : 309-318.

Diagnosis : Cell body distinctly elongated and curved, 16.94-28.24(23.42) μm $\times$ 2.82-8.0 (5.64) μm , with smooth and concave ventral surface; dorsal surface markedly undulated; anterior half broad, posterior tapering; nucleus elongated, 3.76-10.35(6.66) μm $\times$ 0.94-3.29(1.81) μm , located

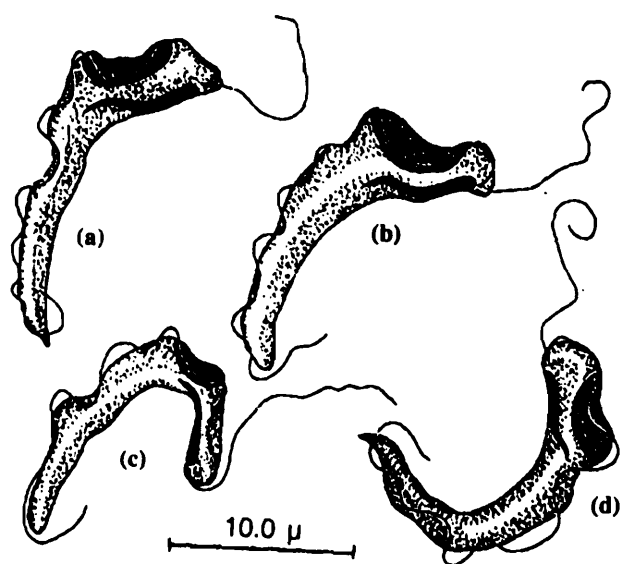


Fig. 8a-d. *Cryptobia (Trypanoplasma)*

dorsally in the anterior 1/4 of the body; kinetoplast distinctly elongated, 4.00-10.12(6.66) μm $\times$ 0.23-1.17(0.68) μm ; 2 flagella arising from 2 kinetosomes located in front of the kinetoplast; anterior flagellum short, 9.41-23.06(16.53) μm in length; posterior flagellum running along the side

of the body and emerging out as free flagellum measuring 4.23-13.65 (8.47) μm ; undulating membrane forming 4-5 folds in the posterior part of the body and not apparent in the anterior 1/4 of the body; cytoplasm with chromophilic granules and 1 or 2 vacuoles in the anterior region.

Host : *Puntius hexastichus*; site of infection : blood.

Distribution : India : Maharashtra (Solapur district).

Remarks : Wahul (1986) reported this species from Maharashtra state.

9. *Cryptobia (Trypanoplasma) vidyai*

Wahul, 1985

(Fig. 9a-d)

1985. *Cryptobia (Trypanoplasma) vidyai* Wahul, *Proc. Ind. Acad. Sci.*, 94(1) : 25-35.

Diagnosis : Cell body short, broad and stumpy; dorsal margin convex; ventral straight or concave; 15.53-30.13(19.16) μm $\times$ 7.53-15.53 (11.84) μm in size; nucleus spherical to oval, 4.7-9.41(6.76) μm $\times$ 1.88-5.64(3.15) μm , located at the dorsal margin in the anterior one third; kinetoplast relatively short, triangular or fusiform, measuring 2.82-6.82(4.78) μm $\times$ 0.7-3.29(1.43) μm , located on the ventral side; 2 kinetosomes located in front of the kinetoplast and 2 flagella arising from them; anterior flagellum short, 20.24-30.6(25.05) μm in

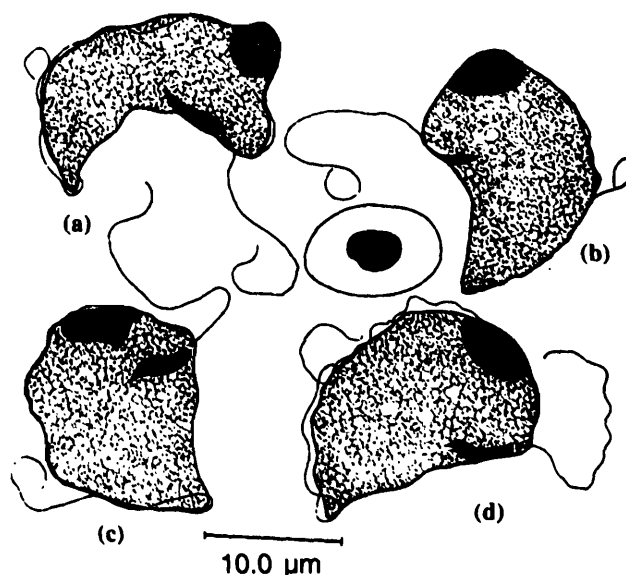


Fig. 9a-d. *Cryptobia (Trypanoplasma) vidyai*

length; posterior flagellum running along the dorsal surface emerging out as free flagellum, recurving and ending in a loop, measuring 11.7-26.3 (18.06) μm ; cytoplasm highly vacuolated.

Host : *Mystus seenghala* : site of infection : blood.

Distribution : India : Maharashtra (Purna, Aurangabad district).

Remarks : Wahul (1985) reported this species from Maharashtra state.

10. *Cryptobia (Trypanoplasma) wallagoi*

Wahul, 1986c

(Fig. 10a-d)

Diagnosis : Cell body short and broad, with a slight curvature, often looking irregular in shape, measuring 18.74 μm $\times$ 9.76 μm on average and characterized by a diffuse kinetoplast and highly vacuolated cytoplasm containing several chromophilic granules; nucleus spherical or elongated, 6.15 μm $\times$ 2.61 μm , located dorsally in the anterior half of the body; kinetoplast relatively short, 3.92 μm $\times$ 0.97 μm , somewhat fusiform, either straight or curved, with blunt anterior and tapering posterior end; anterior flagellum free and slightly longer than the body, averaging 21.63 μm in length, posterior flagellum, averaging 10.16 μm in length, running along the entire body, showing

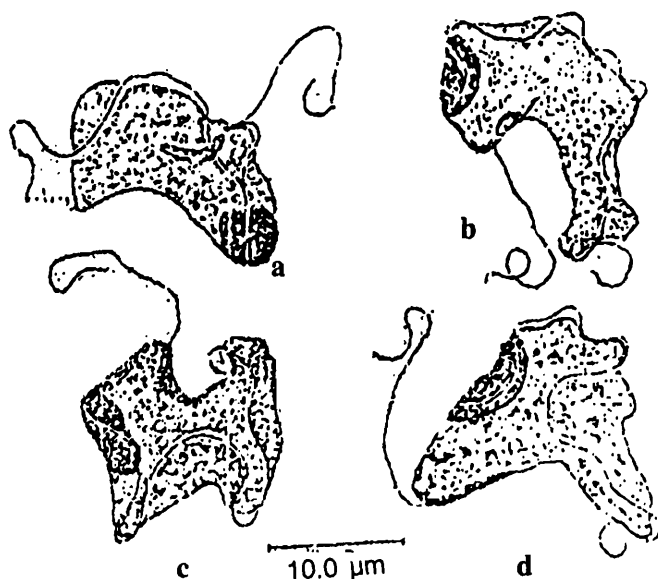


Fig. 10a-d. *Cryptobia (Trypanoplasma) wallagoi*

3-4 folds, partially attached to the body at 3-4 points and becoming free posteriorly, measuring more than half the length of the body; undulating membrane not clearly evident.

Host : *Wallago attu* : site of infection : blood.

Distribution : India : Maharashtra (Purna, Aurangabad district).

Remarks : Wahul (1986) reported this species from Maharashtra state.

11. *Cryptobia (Trypanoplasma)* sp.

Host : *Puntius kolus*; site of infection : blood.

Distribution : India : Maharashtra (Purna district).

Remarks : Wahul (1986) recorded this unnamed species from this state along with *Trypanosoma puntii*.

Genus *Blastocrithidia* Laird, 1959

1959. *Blastocrithidia* Laird, *Canad. J. Zool.*, **37** : p. 749.

Diagnosis : Monogenetic trypanosomatids with characteristic epimastigote forms; amastigotes in some species produced as flagellate cysts.

12. *Blastocrithidia* sp.

1979. *Blastocrithidia* sp. Shastri, Krishnamurthy and Sultana, *Proc. II Nat. Cong. of Parasitology.* : p. 59.

Diagnosis : Flagellates measuring 17.0-31.0 (22.5 $\pm$ 0.42) μm in length; posterior end tapering and pointed; nucleus elliptical located slightly above the central part of the body; kinetoplast juxtanuclear; flagellum arising from the kinetoplast passing along the outer border of the undulating membrane and free anteriorly; free flagellum 8.0-19.0 (12.5 $\pm$ 0.31) μm long.

Host : *Hyalomma anatolicum anatolicum*; site of infection : blood.

Distribution : India : Maharashtra (Aurangabad district).

Remarks : Shastri, Krishnamurthy and Sultana (1979) reported this unnamed species from Maharashtra state.

13. *Blastocrithidia* sp.

Host : *Ranatra filiformis*; site of infection : intestine.

Distribution : India : Maharashtra (Marathwada district).

Remarks : Sultana, Krishnamurthy and Kulkarni (1981) reported this unnamed species from this state.

14. *Blastocrithidia* sp.

Host : *Laccotrephes maculatus*; site of infection : intestine.

Distribution : India : Maharashtra (Marathwada district).

Remarks : Sultana, Krishnamurthy and Kulkarni (1981) reported this unnamed species from this state.

15. *Blastocrithidia* sp.

Host : *Dysdercus cingulatus*; site of infection : intestine.

Distribution : India : Maharashtra (Marathwada district).

Remarks : Sultana, Krishnamurthy and Kulkarni (1981) reported this unnamed species from this state.

Suborder TRYPANOSOMATINA

Family TRYPANOSOMATIDAE

Genus *Trypanosoma* Gruby, 1843

Diagnosis : Body leaf-like with a single nucleus, a blepharoplast, a flagellum and an undulating membrane; excursively parasitic.

1843. *Trypanosoma* Gruby, C. R. Acad. Sci., 17 : 1134.

Diagnosis : Body highly flattened, pointed at flagellate end and bluntly rounded or pointed at the other; usually pleomorphic; nucleus central; a blepharoplast near a flagellate end.

Key to the species

A. *Trypanosoma* of fishes

1. Trypomastigotes monomorphic

1.(1) Cell body small, elongated, slender; nucleus elongated / sausage-shaped, kinetoplast sub-terminal, asymmetrically placed, undulating membrane thrown into 4-6 folds *T. aurangabadensis*

1.(2) Cell body small, broad in the middle, tapering at both ends; nucleus elongate to oval, kinetoplast terminal, undulating membrane well developed *T. joshii*

1.(3) Cell body medium, slender, with 'C'/'S' configuration; kinetoplast conspicuous, subterminal; undulating membrane poor or moderately developed *T. mandali*

1.(4) Cell body medium, spindle or 'S' shaped, nucleus elongated / kidney-shaped, kinetoplast sub-terminal; undulating membrane thrown into 5-6 folds *T. marthwadensis*

1.(5) Cell body large, with 'S' configuration; nucleus large, ovoid or kidney-shaped; kinetoplast subterminal; undulating membrane hyaline, thrown into numerous small, shallow folds *T. misrai*

1.(6) Cell body small with 'S' configuration; kinetoplast prominent, distinctly conical, terminal; undulating membrane moderately developed *T. punctati*

1.(7) Cell body medium spindle-shaped; kinetoplast oval or elongated, terminal, undulating membrane moderately developed *T. purensis*

1.(8) Cell body medium, uniformly broad, posterior end beak-like or bifid; kinetoplast subterminal; undulating membrane well developed and hyaline; cytoplasm vacuolated consistently with 4 vacuoles *T. rayii*

2. Trypomastigotes dimorphic

2.(1) Cell body medium; kinetoplast small, subterminal; undulating membrane well developed and hyaline *T. puntii*

3. Trypomastigotes polymorphic

3.(1) Cell body medium, spindle-shaped; nucleus with a clear zone around; kinetoplast sub-

terminal; undulating membrane very delicate
..... *T. mastacembli*

- 3.(2) Cell body medium, spindle-shaped;
kinetoplast sub-terminal; undulating
membrane with pronounced folds in small and
medium forms and shallow in others
..... *T. murtii*

16. *Trypanosoma aurangabadensis* Wahul, 1987
(Fig. 11a-d)

1987. *Trypanosoma aurangabadensis* Wahul, Arch.
Protistenk., 133 : 111-124.

Diagnosis : Cell body small, elongated, slender, monomorphic, uniformly wide, acutely tapering posteriorly and gradually tapering anteriorly; nucleus elongated, somewhat sausage-shaped, asymmetrically located close to the pellicle above the middle part of the body; kinetoplast small, spherical to ovoid, sub-terminal, asymmetrically placed, prominently bulging on one side; undulating membrane thrown into 4-6 folds, one or two deep and rest shallow folds; body dimensions : length 12.71-30.60 (21.00) μm , width 0.94-2.11 (1.37) μm ; nucleus length 1.71-3.76 (2.22) μm , width 0.70-1.88 (0.96) μm ; kinetoplast length 0.47-0.94 (0.67) μm , width 0.47-0.70 (0.49) μm ; length of free flagellum 7.53-16.47 (13.13) μm ; distance from posterior end to kinetoplast 0.94-2.11 (1.43) μm ; distance from the center of the kinetoplast to center of nucleus 5.41-14.59

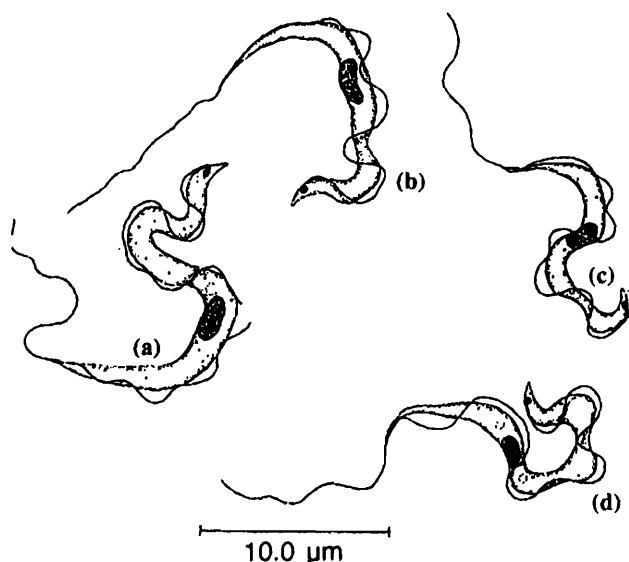


Fig. 11a-d. *Trypanosoma aurangabadensis*

(10.8) μm ; center of nucleus to anterior end 3.29-14.59 (8.85) μm ; nuclear index 1.15; cytoplasm faint with scattered chromophilic granules.

Host : *Mastacembelus armatus*; site of infection : blood.

Distribution : India : Maharashtra (Waluj, Aurangabad district).

Remarks : Wahul (1987) reported this species from Maharashtra state.

17. *Trypanosoma joshii* Wahul, 1986b
(Fig. 12a-d)

1986. *Trypanosoma joshii* Wahul, Indian J. Parasitol., 10(2) : 217-227.

Diagnosis : Cell body small sized, monomorphic, broad in the middle, tapering at both ends; nucleus elongate to oval, located in the anterior half of the body; kinetoplast conspicuous, spherical to ovoid, terminal, generally not occupying the entire width of the

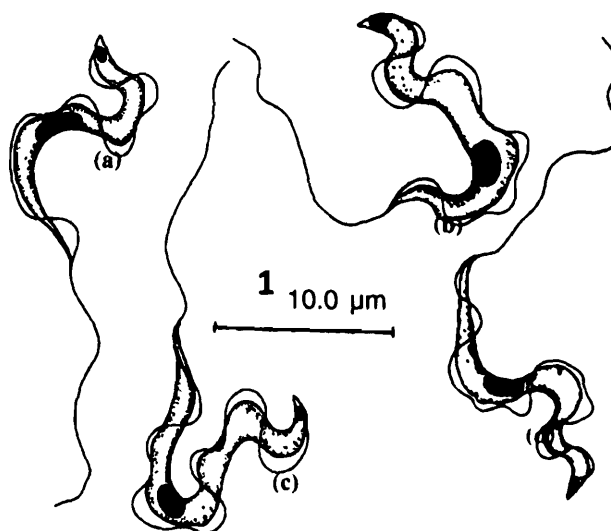


Fig. 12a-d. *Trypanosoma joshii*

body; undulating membrane well developed, thrown into 4-6 conspicuous folds; body dimensions : length 14.12-30.13(22.03) μm , width 1.41-2.58 (1.87) μm ; nucleus length 1.88-4.23(2.82) μm , width 0.47-1.88 (1.08) μm ; kinetoplast length 0.47-1.41(1.06) μm , width 0.47-0.94 (0.71) μm , length of free flagellum 10.35-27.3 (17.41) μm ; distance from posterior end to kinetoplast 0.94-1.88(1.40) μm ; distance from the

center of the kinetoplast to center of nucleus 5.17-15.53 (11.29) μm ; center of nucleus to anterior end 5.64-14.59(9.38) μm ; nuclear index 1.35; cytoplasm clear with very fine granules.

Host : *Mystus cavacius*; site of infection : blood.

Distribution : India : Maharashtra : (Purna, Aurangabad district).

Remarks : Wahul (1986) reported this species from Maharashtra state.

18. *Trypanosoma mandali* Wahul, 1986b
(Fig. 13a-c)

1986c. *Trypanosoma mandali* Wahul, *Indian J. Parasitol.*, 10(2) : 217-227.

Diagnosis : Cell body medium sized, slender, monomorphic, with 'C'/'S' configuration; elongated, tapering at both ends; nucleus elongated, located in the middle of the body; kinetoplast conspicuous, spherical to ovoid, sub-terminal, generally not occupying the entire width of the body; undulating membrane poor or moderately developed, thrown into 4-7 shallow

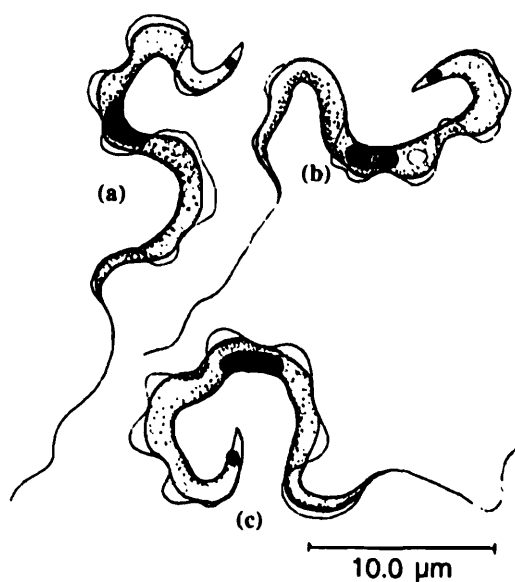


Fig. 13a-c. *Trypanosoma mandali*

fold; body dimensions : length 24.71-34.13(29.95) μm , width 1.17-2.11(1.49) μm ; nucleus length 2.11-4.47(3.25) μm , width 0.7-1.41(0.9) μm ; kinetoplast length 0.47-1.17(0.74) μm , width 0.47-0.70 (0.55) μm ; length of free flagellum 12.71-19.3 (15.69) μm ; distance from posterior end to

kinetoplast 1.17-2.11(1.61) μm ; distance from the center of the kinetoplast to center of nucleus 9.88-19.77(13.75) μm ; center of nucleus to anterior end 7.06-19.30(14.6) μm ; nuclear index 1.05; cytoplasm vacuolated with faintly stained chromophilic granules.

Host : *Mystus seenghala*; site of infection : blood.

Distribution : India : Maharashtra : (Purna, Aurangabad district).

Remarks : Wahul (1986) reported this species from Maharashtra state.

19. *Trypanosoma marthwadensis* Wahul, 1986d
(Fig. 14a-d)

1986. *Trypanosoma marthwadensis* Wahul, *Arch. Protistenk.*, 132 : 101-111.

Diagnosis : Cell body medium sized, elongated spindle-shaped, monomorphic, mostly 'S' shaped in configuration, uniformly broad, both ends tapering; nucleus elongated, somewhat kidney-shaped, located in the middle part of the body; kinetoplast small, elongate, ovoid, sub-terminal, laterally placed, rarely occupying the entire width of the body; undulating membrane thrown into 5-6 broad and shallow folds; body dimensions : length 24.95-35.78 (30.95) μm , width 1.17-2.62

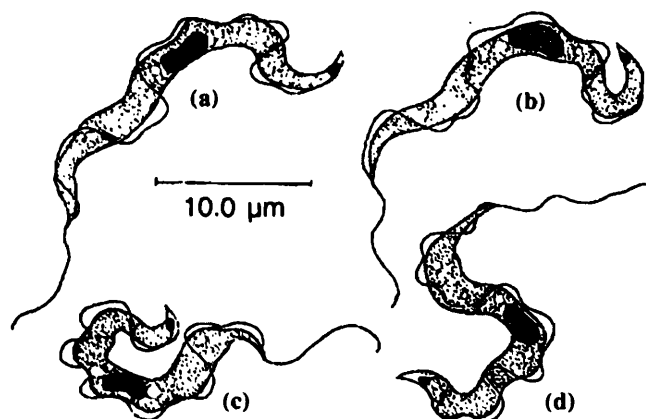


Fig. 14a-d. *Trypanosoma marthwadensis*

(1.95) μm ; nucleus length 1.41-4.7(3.35) μm , width 0.94-2.11 (1.73) μm ; kinetoplast length 0.47-1.17(0.73) μm , width 0.23-0.47 (0.37) μm ; length of free flagellum 5.84-16.47 (11.5) μm ; distance

from posterior end to kinetoplast 0.94-2.11(1.52) μm ; distance from the center of the kinetoplast to center of nucleus 10.59-14.55(12.87) μm ; center of nucleus to anterior end 12.24-21.18(16.46) μm ; nuclear index 0.87; cytoplasm granular and vacuolated; granules uniformly scattered; consistently with 4 vacuoles, one anterior, 2 with one each on either side of the nucleus and one at the posterior end.

Host : *Puntius hexastichus*; site of infection : blood.

Distribution : India : Maharashtra (Aurangabad district).

Remarks : Wahul (1986) reported this species from Maharashtra state.

20. *Trypanosoma mastacembli* Wahul, 1987
(Fig. 15a-d)

1987. *Trypanosoma mastacembli* Wahul, Arch. Protistenk., 133 : 111-124.

Diagnosis : Cell body medium sized, elongated spindle-shaped, polymorphic, broad in the middle region tapering towards ends; nucleus either spherical or ovoid with a clear zone around, located in the middle part of the body; kinetoplast spherical, sub-terminal; undulating membrane very delicate thrown into 4-6 conspicuous folds; body dimensions : **long and slender form** (Fig. 15c-d) : length 32.95-44.02(38.66) μm , width 5.17-6.59(5.57) μm ; nucleus length 3.76-5.17(4.55) μm , width 2.82-4.7(3.31) μm ; kinetoplast length 0.70-1.94(0.86) μm , width 0.70-0.94 (0.78) μm ; length of free flagellum 6.59-9.41(7.96) μm ; distance from posterior end to kinetoplast 1.17-2.35(1.55) μm ; distance from the center of the kinetoplast to center of nucleus 16.94-20.71(19.7) μm ; center of nucleus to anterior end 14.12-22.6(18.05) μm ; nuclear index 1.14; **medium form** (Fig. 15b) : length 30.6-41.9 (34.31) μm , width 3.53-4.7(4.08) μm ; nucleus length 2.82-4.7(3.68) μm , width 1.88-3.53(1.95) μm ; kinetoplast length 0.47-1.41(0.95) μm , width 0.47-0.94(0.79) μm ; length of free flagellum 6.12-12.71(9.3) μm ; distance from posterior end to kinetoplast 1.17-2.58(1.6) μm ; distance from the center of the kinetoplast to center

of nucleus 15.06-21.18(17.5) μm ; center of nucleus to anterior end 12.71-20.24(16.85) μm ; nuclear index 1.13; **small form** (Fig. 15a) : length 24.95-38.84(31.14) μm , width 1.88-3.29 (2.78) μm ; nucleus length 1.88-4.23(3.01) μm , width 1.14-3.29(2.07) μm ; kinetoplast length 0.47-1.41(0.83)

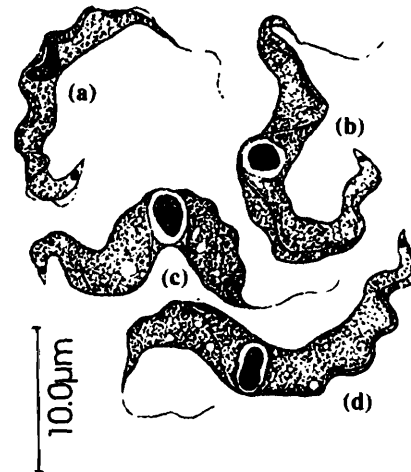


Fig. 15a-d. *Trypanosoma mastacembli*

μm ; width 0.47-0.94(0.77) μm ; length of free flagellum 7.53-11.29(9.16) μm ; distance from posterior end to kinetoplast 1.17-1.64(1.37) μm ; distance from the center of the kinetoplast to center of nucleus 10.35-20.24 (17.5) μm ; center of nucleus to anterior end 9.41-17.41(13.57) μm ; nuclear index 1.29; cytoplasm granular and vacuolated.

Host : *Mastacembelus armatus*; site of infection : blood.

Distribution : India : Maharashtra (Solapur district).

Remarks : Wahul (1987) reported this species from Maharashtra state.

21. *Trypanosoma misrai* Wahul, 1982
(Fig. 16a-c)

1982. *Trypanosoma misrai* Wahul, Ph.D. Thesis, Marathwada University.

Diagnosis : Cell body large, monomorphic, with 'S' configuration; elongated, uniformly broad and tapering at both ends; nucleus large, ovoid or kidney-shaped, located in the middle of the body; kinetoplast small, spherical to ovoid, sub-

terminal, slightly bulging from the body surface; undulating membrane hyaline, thrown into numerous small, shallow folds; body dimensions : length 30.42-52.59(42.16), width 1.95-4.58(3.0) μm ; nucleus length 1.95-5.43(3.62) μm , width

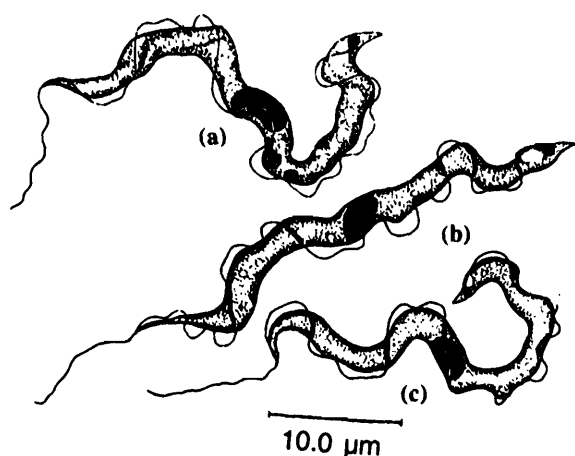


Fig. 16a-c. *Trypanosoma misrai*

1.08-3.04(1.98) μm ; kinetoplast length 0.65-1.52(1.18) μm , width 0.65-1.08 (0.80) μm ; length of free flagellum 5.21-16.08(11.44) μm ; distance from posterior end to kinetoplast 1.08-3.69(2.01) μm ; distance from the center of the kinetoplast to center of nucleus 11.51-23.69(19.07) μm ; center of nucleus to anterior end 16.08-28.25(21.05) μm ; nuclear index 1.0; cytoplasm heavily granulated and vacuolated.

Host : *Channa gachua*; site of infection : blood.

Distribution : India : Maharashtra (Aurangabad district).

Remarks : Wahul (1982) recorded this species from Maharashtra state.

22. *Trypanosoma murtii* Wahul, 1987 (Fig. 17a-d)

1987. *Trypanosoma murtii* Wahul, Arch. Protistenk., 133 : 111-124.

Diagnosis : Cell body medium sized, elongated spindle-shaped, polymorphic, broad in the middle region, tapering towards ends; nucleus oval to elongate in small forms and spherical in others, located in the middle part of the body or slightly shifted into anterior half; kinetoplast spherical, sub-terminal; undulating membrane with

pronounced folds in small and medium forms and shallow in others; body dimensions : **large form** : length 29.66-43.07 (38.8) μm , width 4.23-5.64 (4.62) μm ; nucleus length 3.06-4.23 (3.6) μm , width 1.88-3.29 (2.58) μm ; kinetoplast length 0.70-1.17 (0.98) μm , width 0.70-1.17 (0.94) μm ; length of free flagellum 7.06-11.77 (9.1) μm ; distance from posterior end to kinetoplast 1.17-2.35 (1.92) μm ; distance from the center of the kinetoplast to center of nucleus 15.06-20.71 (18.43) μm ; center of nucleus to anterior end 13.41-20.24 (18.43) μm ; nuclear index 1.10; **medium form** : length 31.48-39.07 (36.18) μm , width 2.82-4.00 (3.49) μm ; nucleus length 2.35-5.64 (3.32) μm , width

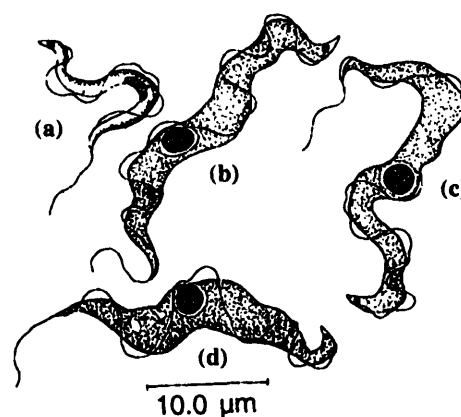


Fig. 17a-d. *Trypanosoma murtii*

1.88-2.58(2.25) μm ; kinetoplast length 0.7-1.94(0.80) μm , width 0.47-0.94(0.70) μm ; length of free flagellum 7.06-12.24(9.28) μm ; distance from posterior end to kinetoplast 1.41-2.58(1.95) μm ; distance from the center of the kinetoplast to center of nucleus 15.06-20.47 (17.89) μm ; center of nucleus to anterior end 13.41-18.93(16.47) μm ; nuclear index 1.2; **small form** : length 20.47-39.78(31.13) μm , width 1.41-2.58 (2.11) μm ; nucleus length 1.88-3.76(2.96) μm , width 0.7-2.11 (1.53) μm ; kinetoplast length 0.47-1.71 (0.94) μm , width 0.47-1.17(0.75) μm ; length of free flagellum 5.64-12.24 (9.1) μm ; distance from posterior end to kinetoplast 1.17-2.58(1.70) μm ; distance from the center of the kinetoplast to center of nucleus 11.29-20.71 (15.86) μm ; center of nucleus to anterior end 7.06-20.24(13.84) μm ; nuclear index 1.26; cytoplasm granular and vacuolated.

Host : *Mastacembelus armatus*; site of infection : blood.

Distribution : India : Maharashtra (Solapur district).

Remarks : Wahul (1987) reported this species from Maharashtra state.

23. *Trypanosoma punctati* Hasan and Qasim, 1986
(Fig. 18a-d)

1962. *Trypanosoma punctati* Hasan and Qasim, *Zeit. fur Parasitenk.*, **22** : 118-122.

Diagnosis : Cell body small sized, monomorphic, with 'S' configuration, elongated, slender, tapering at both ends; nucleus elongated, located above the middle portion of the body; kinetoplast prominent, distinctly conical, terminal, lateral, asymmetrically placed; undulating membrane moderately developed, thrown into 3-4 deep folds; body dimensions : length 17.65-26.12(22.5) μm , width 1.41-2.11(1.68) μm ; nucleus length 1.41-4.0(2.6) μm , width 0.7-1.41(0.94) μm ; kinetoplast length 0.94-1.64(1.2) μm , width 0.47-0.94(0.58) μm ; length of free flagellum 6.12-14.59 (9.53) μm ; distance from posterior end

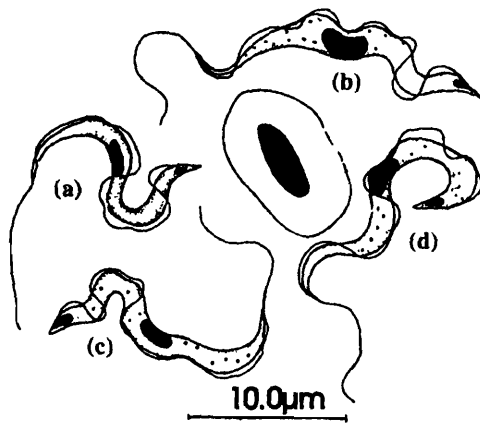


Fig. 18a-d. *Trypanosoma punctati*

to kinetoplast 0.94-2.11(1.51); distance from the center of the kinetoplast to center of nucleus 8.94-12.24 (10.88) μm ; center of nucleus to anterior end 7.06-12.24(10.09) μm ; nuclear index 1.22; cytoplasm uniformly faint with few scattered chromophilic granules.

Host : *Channa gachua*; site of infection : blood.

Distribution : India : Maharashtra (Aurangabad district) and Andhra Pradesh.

Remarks : Hasan and Qasim (1962) reported this species from *Channa punctata* in Andhra Pradesh and Wahul, (1986) recorded this species in 36 of 149 *Channa gachua* examined from Maharashtra state.

24. *Trypanosoma puntii* Wahul, 1986d
(Fig. 19a-c)

1986. *Trypanosoma puntii* Wahul, *Arch. Protistenk.*, **132** : 101-111.

Diagnosis : Cell body medium sized, elongated, dimorphic, uniformly broad acutely tapering anteriorly and less so posteriorly; nucleus elongated, somewhat sausage-shaped in slender forms, spherical to ovoid in short and stumpy forms, located in the middle part of the body; kinetoplast small, sub-terminal occupying the entire width of the body; somewhat elongated in slender forms spherical in broader forms; undulating membrane well developed and hyaline, thrown into 8-10 conspicuous folds; body dimensions : **long and slender form** : length 25.89-37.19 (31.2) μm , width 1.41-2.35 (1.75) μm ; nucleus length 2.11-4.23(3.08) μm , width 0.7-1.88 (1.23) μm ; kinetoplast length 0.47-1.41(0.8) μm ,

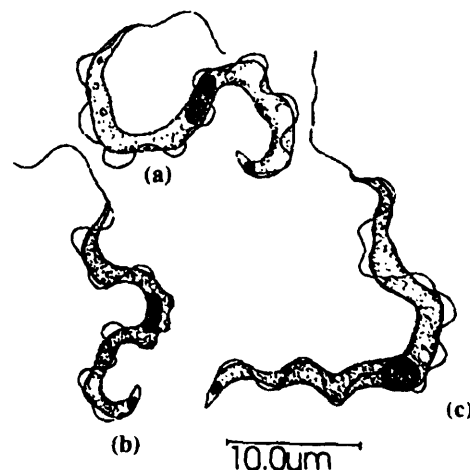


Fig. 19a-c. *Trypanosoma puntii*

width 0.47-0.70 (0.51) μm ; distance from posterior end to kinetoplast 1.17-1.88 (1.34) μm ; length of free flagellum 4.23-15.53 (10.65) μm ; distance from the center of the kinetoplast to center of nucleus 11.29-16.47 (13.96) μm ; center of nucleus to anterior end 10.35-20.47 (15.91) μm ; nuclear

index 0.96; **broad form** : length 28.71-36.72 (32.74) μm , width 1.88-2.82 (2.25) μm ; nucleus length 2.35-3.76 (3.06) μm , width 1.41-2.35 (1.95) μm ; kinetoplast length 0.47-0.94 (0.75) μm , width 0.47-0.70(0.58) μm ; length of free flagellum 9.41-14.12 (11.53) μm ; distance from posterior end to kinetoplast 1.17-1.64 (1.34) μm ; distance from the center of the kinetoplast to center of nucleus 11.77-16.0 (13.39) μm ; center of nucleus to anterior end 14.59-20.47 (7.01) μm ; nuclear index 0.86; cytoplasm granular and vacuolated.

Host : *Puntius kolus*; site of infection : blood.

Distribution : India : Maharashtra (Aurangabad district).

Remarks : Wahul (1986) reported this species from Maharashtra state.

25. *Trypanosoma purensis* Wahul, 1986b
(Fig. 20a-c)

1986. *Trypanosoma purensis* Wahul, *Indian J. Parasitology*, 10(2) : 217-227

Diagnosis : Cell body medium sized, monomorphic; spindle-shaped and distinctly broad tapering at both ends; nucleus large, spherical to ovoid, located in the middle of the body;

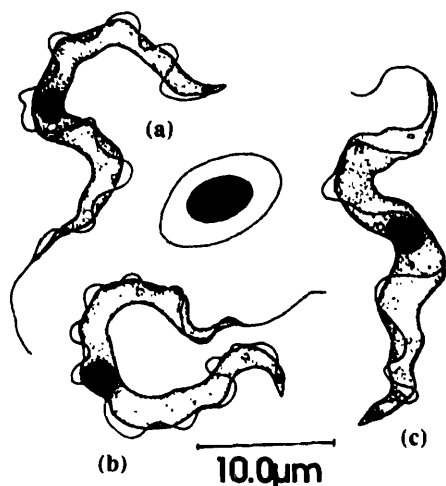


Fig. 20a-c. *Trypanosoma purensis*

kinetoplast oval or elongated, terminal, slightly bulging from the body surface; undulating membrane moderately developed, thrown into 5-7 shallow folds; body dimensions : length 25.89-40.72(34.6) μm , width 1.64-3.76(2.42) μm ; nucleus length 2.35-4.23(3.22) μm , width 1.17-

2.82 (1.86) μm ; kinetoplast length 0.47-1.41 (1.05) μm , width 0.47-0.94 (0.73) μm ; length of free flagellum 6.12-14.59 (9.53) μm ; distance from posterior end to kinetoplast 0.94-2.11(1.4) μm ; distance from the center of the kinetoplast to center of nucleus 9.88-19.30 (15.83) μm ; center of nucleus to anterior end 12.24-21.18 (17.27) μm ; nuclear index 0.99; cytoplasm uniformly granular.

Host : *Mystus seenghala*; site of infection : blood.

Distribution : India : Maharashtra (Aurangabad district).

Remarks : Wahul (1986) reported this species from Maharashtra state.

26. *Trypanosoma rayii* Wahul, 1986d
(Fig. 21a-d)

1986. *Trypanosoma rayii* Wahul, *Arch. Protistenk.*, 132 : 101-111

Diagnosis : Cell body medium sized, monomorphic, uniformly broad, acutely tapering anterior end and posterior end broader and tapering sharply like a beak, sometimes bifid; nucleus elongated ovoid, somewhat kidney-shaped, located in the middle part of the body; kinetoplast small, distinctly spherical to ovoid, sub-terminal, laterally placed, rarely occupying the entire width of the body; undulating membrane well developed and hyaline, thrown into 9-10 conspicuous folds; body dimensions : length 27.3-40.01 (35.93) μm , width

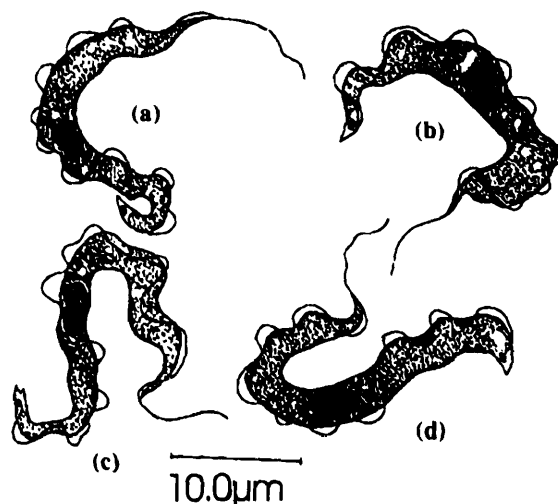


Fig. 21a-d. *Trypanosoma rayii*

1.64-4.94 (2.58) μm ; nucleus length 1.88-4.7 (3.36) μm , width 0.94-2.62 (1.73) μm ; kinetoplast length 0.47-1.71 (0.84) μm ; width 0.47-0.70 (0.58) μm ; length of free flagellum 4.23-15.53 (10.65); distance from posterior end to kinetoplast 0.94-2.58 (1.81) μm ; distance from the center of the kinetoplast to center of nucleus 13.65-20.71 (16.65) μm ; center of nucleus to anterior end 12.74-20.0 (17.45) μm ; nuclear index 1.05; cytoplasm heavily granulated particularly around the middle of the body and vacuolated consistently with 4 vacuoles, one anterolateral to kinetoplast, 2 on either side of the nucleus and one between nucleus and the anterior end.

Host : *Puntius sarana*; site of infection : blood.

Distribution : India : Maharashtra (Aurangabad district).

Remarks : Wahul (1986) reported this species from Maharashtra state.

27. *Trypanosoma* sp.

Host : *Chammua gachua*; site of infection : blood.

Distribution : India : Maharashtra (Aurangabad).

Remarks : Krishnamurthy and Wahul (1981) reported this species from this state.

28. *Trypanosoma* sp.

Host : *Chanmna pnctatus*; site of infection : blood.

Distribution : India : Maharashtra (Solapur, Aurangabad).

Remarks : Wahul (1986), Pokale *et al.* (2002) recorded this unnamed this species from this state.

29. *Trypanosoma* sp.

Host : *Glossogobius giuris*; site of infection : blood.

Distribution : India : Maharashtra (Solapur).

Remarks : Wahul (Pers. Comm.) recorded this unnamed species from this state.

30. *Trypanosoma* sp.

Host : *Notopterus notopterus*; site of infection : blood.

Distribution : India : Maharashtra (Purna).

Remarks : Wahul (Pers. Comm.) recorded this unnamed species from this state.

31. *Trypanosoma* sp.

Host : *Channa striatus*; site of infection : blood.

Distribution : India : Maharashtra (Pune).

Remarks : Lingard (1904) recorded this unnamed species from river at Pune, Maharashtra.

B. *Trypanosoma* of birds

32. *Trypanosoma* sp.

Host : *Buteo vulpinus*; site of infection : blood.

Distribution : India : Maharashtra.

Remarks : McClure *et al.* (1978) reported this unnamed species from this state.

33. *Trypanosoma* sp.

Host : *Copsychus saularis saularis*; site of infection : blood.

Distribution : India : Maharashtra.

Remarks : McClure *et al.* (1978) reported this unnamed species from this state.

34. *Trypanosoma* sp.

Host : *Pycnonotus jocosus*; site of infection : blood.

Distribution : India : Maharashtra.

Remarks : McClure *et al.* (1978) reported this unnamed species from this state.

35. *Trypanosoma* sp.

Host : *Streptopelia chinensis*; site of infection : blood.

Distribution : India : Maharashtra.

Remarks : McClure *et al.* (1978) reported this unnamed species from this state.

36. *Trypanosoma* sp.

Host : *Tockus griseus griseus*; site of infection : blood.

Distribution : India : Maharashtra.

Remarks : McClure *et al.* (1978) reported this unnamed species from this state.

C. *Trypanosoma* from Mammals

37. *Trypanosoma evansi* (Steel, 1885) (Fig. 22)

2005. *Trypanosoma evansi* : Joshi *et al.*, *Am. J. Trop. Med. Hyg.*, **73**(3) : 491-495

2006. *Trypanosoma evansi* : Shegokar *et al.*, *Am. J. Trop. Med. Hyg.*, **75**(5) : 869-870

Diagnosis : Trypanosomes 20-25 μ m in size with the typical trypomastigote morphology; nucleus central, kinetoplast subterminal and a long flagellum with an undulating membrane; usually monomorphic and sometime, plemorphic with slender, intermediate and stumpy forms, measuring 15-33 μ m, 19-21 μ m and 15-19 μ m respectively; stumpy and dyskinetoplastic form rare.

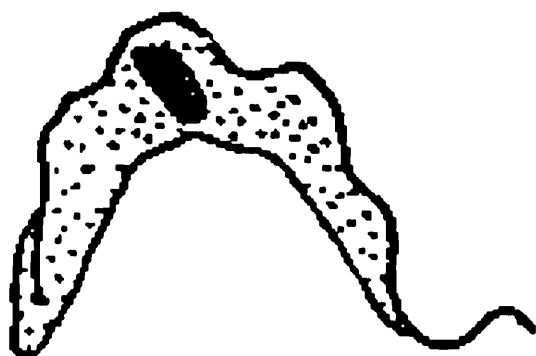


Fig. 22. *Trypanosoma evansi*

Host : *Homo sapiens*, *Bubalus bubalis*, *Ovis aires*, *Capra hircus*, *Canis familiaris*; site of infection : blood, cerebrospinal fluid.

Distribution : India : Maharashtra : (Chandrapur district and Marathwada region).

Remarks : Shasti *et al.* (1981) and Shegokar *et al.* (2006) reported this species in human host from Maharashtra state.

38. *Trypanosoma theileri* Laveran, 1902 (Fig. 23a-b)

1902. *Trypanosoma theileri* Laveran, *C. R. Acad. Sci.*, **134** : 512

1972. *Trypanosoma (Megatryparum) theileri* : Hoare, *The trypanosomes of Mammals : A Zoological Monograph*, p. 125.

Diagnosis : Large trypanosome, usually 31.2-64.9 μ m, sometimes 25-120 μ m including free flagellum measuring 3.6-26.5 μ m in length; cell body usually 34-40 μ m $\times$ 1.4-5.0 μ m; nucleus round, oval or elliptical located near the middle of the body; kinetoplast large, typically round 1.1 μ m in diameter, occupying a marginal position, far from posterior extremity of the body (12-43 μ m); undulating membrane prominent; normally non-pathogenic.

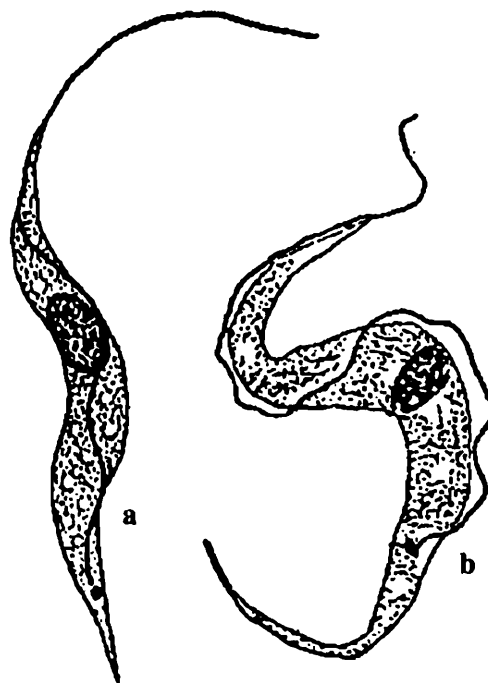


Fig. 23a-b. *Trypanosoma theileri*

Host : *Bos indicus*; site of infection : blood.

Distribution : India : Maharashtra (Marathwada region).

Remarks : Shastri, Deshpande and Deshpande (1981) reported this species from this state.

39. *Trypanosoma* sp.

1979. *Trypanosoma* sp. Sastri and Takerkhede, *Proc. II Nat. Cong. of Parasitology* : 59.

Diagnosis : Trypanosome measured 26.0-35.0 (30 ± 0.23) μm in length and 1.5-2.5 μm in breadth; posterior end tapering and pointed; nucleus elliptical located in the middle of the body; no kinetoplast; undulating membrane well developed; free flagellum 12-21 (16.8 ± 0.32) μm long.

Host : 3 week old red Khandhari cow calf, *Bos indicus*; site of infection : blood.

Distribution : India : Maharashtra (Purna, Parbhani, Aurangabad districts).

Remarks : Sastri and Takerkhede (1979) reported this species from Maharashtra state.

40. *Trypanosoma* sp.

Host : *Rattus rattus*; site of infection : blood.

Distribution : India : Maharashtra (Beed).

Remarks : Mourya *et al.* (1996) reported this unnamed species from this state.

Genus *Leptomonas* Kent, 1880

Diagnosis : Monogenetic trypanosomatids with promastigote stages and cysts only in the life history; parasitic in nematodes and in a wide variety of insects.

41. *Leptomonas* sp.

Host : *Ranatra* sp.; site of infection : gut.

Distribution : India : Maharashtra.

Remarks : Krishnamurthy and Sultana (1972) recorded occurrence of this unnamed species from this state.

42. *Leptomonas* sp.

Host : *Nepa* sp.; site of infection : gut.

Distribution : India : Maharashtra.

Remarks : Krishnamurthy and Sultana (1972) recorded occurrence of this unnamed species from this state.

43. *Leptomonas* sp.

Host : *Dysdercus cingulatus*; site of infection : gut.

Distribution : India : Maharashtra.

Remarks : Sultana *et al.* (1981) recorded occurrence of this unnamed species from this state.

44. *Leptomonas* sp.

Host : *Periplaneta americana*; site of infection : gut.

Distribution : India : Maharashtra.

Remarks : Krishnamurthy and Sultana (1972) recorded occurrence of this unnamed species from this state.

45. *Leptomonas* sp.

Host : *Laccotrephes maculatus*; site of infection : gut.

Distribution : India : Maharashtra.

Remarks : Sultana *et al.* (1981) recorded occurrence of this unnamed species from this state.

46. *Leptomonas* sp.

Host : *Lucila* sp.; site of infection : gut.

Distribution : India : Maharashtra.

Remarks : Sultana *et al.* (1981) recorded occurrence of this unnamed species from this state.

47. *Leptomonas* sp.

Host : *Ranatra filiformis*; site of infection : gut.

Distribution : India : Maharashtra.

Remarks : Sultana *et al.* (1981) recorded occurrence of this unnamed species from this state.

Genus *Herpetomonas* Kent 1880

Diagnosis : Monogenetic trypanosomatids with promastigote and opisthomastigote stages in the life cycle; parasitic in dipterans and other insects.

48. *Herpetomonas* sp.

Host : *Lucila* sp.; site of infection : gut.

Distribution : India : Maharashtra.

Remarks : Krishnamurthy and Sultana (1972) recorded this unnamed species from this state.

49. *Herpetomonas* sp.

Host : *Calliphora* sp.; site of infection : gut.

Distribution : India : Maharashtra.

Remarks : Krishnamurthy and Sultana (1972) recorded this unnamed species from this state.

50. *Herpetomonas* sp.

Host : *Musca domestica*; site of infection : gut.

Distribution : India : Maharashtra.

Remarks : Krishnamurthy and Sultana (1972) recorded this unnamed species from this state.

Class ZOOMASTIGOPHOREA

Order PROTEROMONADIDA

Family PROTEOMONADIDAE

Diagnosis : Uninucleate flagellates with 2 and 4 flagella, single bid mitochondrion, Golgi apparatus, centrosome and rhizoplast present; kinetoplast and flagellar pocket absent; parasitic in the gut of vertebrate.

Genus *Proteromonas* Kunstler, 1883

1883. *Proteromonas* Kunstler, C. R. Acad. Sci., 97 : 755.

Diagnosis : Pyriform, heterodynamic, biflagellates without paraxial rods; bean-shaped mitochondrion curving around the nucleus; a golgi ring apparatus encircling rhizoplast running between the kinetosomes and mitochondrion (Lee *et al.*, 1985).

51. *Proteromonas chameleoni* Krishnamurthy, 1963
(Fig. 24a-b)

1963. *Proteromonas chameleoni* Krishnamurthy, J. biol. Sci., 6(1) : 14-18.

1967. *Proteromonas chameleoni* : Krishnamurthy, J. Bombay Nat. Hist. Soc., 64(3) : 582-583.

Diagnosis : Body elongated fusiform, sometimes rounded or oval, 10.0-15.5 (12.58) μm $\times$ 4.0-10.0 (6.73) μm in size; nucleus spherical or oval, measuring 1.0-3.0(1.99) μm $\times$ 1.5-3.5 (2.4) μm , located slightly above the central part of the body; blepharoplasts 2 in number, closely placed

and dot-like; two unequal flagella 26.5-54.5(42.33) μm and 19.0-36.5 (27.99) μm long; cytoplasm hyaline, no granules.

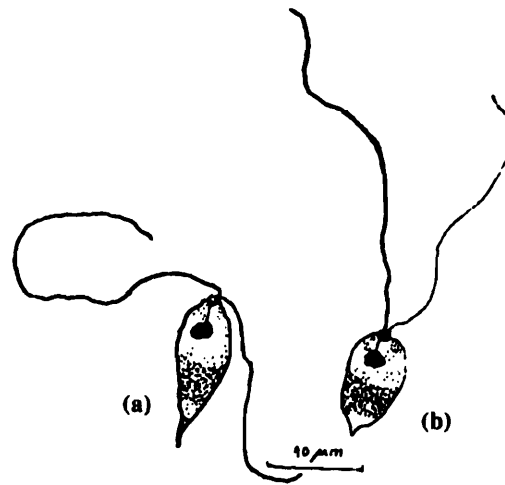


Fig. 24a-b. *Proteromonas chameleoni*

Host : *Chameleon zeylanicus*; site of infection : large intestine.

Distribution : India : Maharashtra (Aurangabad district) and Andhra Pradesh.

Remarks : Krishnamurthy (1963, 1967 and 1968) reported this species from Andhra Pradesh and Maharashtra. Kulda and Nohynkova (1978) treated this species as a synonym of *Proteromonas lacerate-viridis* (Grassi, 1879) even though there are morphological differences. However, this species is retained herein as a valid species as mentioned by Nandi *et al.* (2004).

52. *Proteromonas uromastixi* Janakidevi, 1961

1961. *Proterimonas uromastix*; Janakidevi, Arch. Protistenk., 105 : 450-454.

Diagnosis : Body elongate, fusiform, measuring 12.8-30.0 (23.0) μm $\times$ 1.5-4.0 (3.10) μm ; flagella equal and dissimilar; paranuclear body crescentic or irregular, located behind the nucleus; parabasal body crescentic; subblepharoplast body horizontal; posterior end of the body drawn out into a long tail.

Host : *Uromastix hardwicki*; site of infection : intestine.

Distribution : India : Maharashtra.

Remarks : Janakidevi (1961) described this species from Maharashtra.

53. *Proteromonas* sp.

Host : *Hemidactylus brooki*; site of infection : intestine.

Distribution : India : Maharashtra (Aurangabad and Nanded).

Remarks : Krishnamurthy and Madre (1975) recorded this unnamed species from this state.

54. *Proteromonas* sp.

Host : *Hemidactylus cactaei*; site of infection : intestine.

Distribution : India : Maharashtra.

Remarks : Krishnamurthy and Madre (1975) recorded this unnamed species from this state.

55. *Proteromonas* sp.

Host : *Hemidactylus giganteus*; site of infection : intestine.

Distribution : India : Maharashtra (Aurangabad and Nanded).

Remarks : Krishnamurthy and Madre (1975) recorded this unnamed species from this state.

56. *Proteromonas* sp.

Host : *Chameleon zeylanicus*; site of infection : intestine.

Distribution : India : Maharashtra (Aurangabad and Nanded).

Remarks : Krishnamurthy and Madre (1975) recorded this unnamed species from this state.

57. *Proteromonas* sp.

Host : *Calotes versicolor*; site of infection : intestine.

Distribution : India : Maharashtra (Aurangabad and Nanded).

Remarks : Krishnamurthy and Madre (1975) recorded this unnamed species from this state.

58. *Proteromonas* sp.

Host : *Calotes* sp; site of infection : intestine.

Distribution : India : Maharashtra (Aurangabad and Nanded).

Remarks : Krishnamurthy and Madre (1975) recorded this unnamed species from this state.

59. *Proteromonas* sp.

Host : *Eblephars* sp.; site of infection : intestine.

Distribution : India : Maharashtra.

Remarks : Krishnamurthy and Deshmukh (1971) recorded this unnamed species from this state.

Order RETORTOMANADIDA

Family RETORTOMANADIDAE

Diagnosis : Uninucleate flagellates with a conspicuous cytostomal area; with 2 or 4 flagella, one recurrent and one associated with the cytostome; mitochondria and Golgi apparatus absent; all parasitic.

Key to the genera

- 1(2) Cells pyriform or fusiform, drawn out posteriorly with 2 flagella; one associated with cytostome; four kinetosomes, two possessing flagella and two barren..... *Retortomonas*
- 2(1) Cells pyriform with a large cytostomal cleft at anterior end; with several peripheral plaques; three anteriorly directed flagella; fourth flagellum short recurrent and undulating within the cytostomal cleft; nucleus anterior..... *Chilomastix*

Genus *Retortamonas* Grassi, 1879

1879. *Retortamonas* Grassi, *Gaz. Med. Ital. Lombardi.*, 39 : 445-448.

Diagnosis : As in the key.

Key to the species

- 1(2) Body large averaging about 20 µm or more in length3
- 2(1) Body small averaging less than 15 µm in length4

- 3.1. Body large and bulging; blepharoplastic complex with 3 granules; 2 flagella equal; a characteristic deeply stained large spherical or hemispherical cap-like structure seen at the extreme anterior end of the body
..... *R. aurangabadensis*
- 3.2. Body large, fusiform; blepharoplasts two, nucleus small, ovoid or spherical; cytostome large and conspicuous *R. wenrichi*
- 4.1. Body small, pear-shaped or fusiform, blepharoplast single, flagella unequal, nucleus small, spherical *R. indica*
- 4.2. Body small elongate and spindle-shaped; 2 blepharoplasts; flagella equal; nucleus small, cytostome narrow, sac-like
..... *R. nagabhushani*

60. *Retortomonas aurangabadensis* Sultana, 1976c
(Fig. 25a-c)

1976. *Retortomonas aurangabadensis* Sultana. *Acta Protozool.*, 30(5) : 125-137.

Diagnosis : Body large and bulging with very long and tapering spike posteriorly, cell body proper elongated or ovoid, 15.4-25.7 (20.7) μm $\times$ 8.2-17.0 (12.1) μm in size; anterior end bluntly rounded or conical and projected into a beak-like structure; posterior end tapering into conical and suddenly tapering into a long tail-like spike;

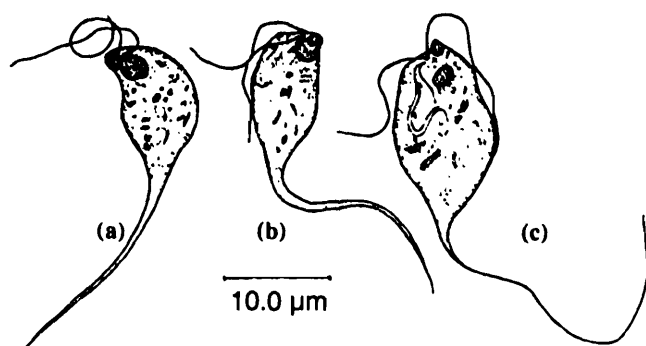


Fig. 25a-c. *Retortomonas aurangabadensis*

cytoplasm with several deeply staining granules; blepharoplast complex comprising of 3 granules located at the anterior end; 2 flagella almost equal 10.3-32.4 (23.3) μm and 11.3-31.4 (23.0) μm in size; nucleus spherical, 1.5-5.7 (3.8) μm $\times$ 2.1-6.2 (4.3) μm in size; a characteristic deeply stained

large spherical or hemispherical cap-like structure seen at the extreme anterior end of the body; cytostome distinct relatively large extending up to the middle of the body and bordered by 3 chromophilic fibrils; two fibrils running close together along the outer border of the cytostome to the posterior end and recurved anteriorly; the third fibril small and fine.

Host : *Gryllotalpa africana*; site of infection : mid-gut.

Distribution : India : Maharashtra (Aurangabad District).

Remarks : Sultana (1976c) reported this species from this state.

61. *Retortomonas indica* Krishnamurthy and Sultana, 1977b
(Fig. 26a-c)

1977. *Retortomonas indica* Krishnamurthy and Sultana, *Geobios*, 4 : 43-44.

Diagnosis : Body pear-shaped or fusiform, 7.2-16.5 (11.1) μm $\times$ 3.1-9.8 (6.3) μm in size with anterior end somewhat rounded, posterior end tapering into tubular spike; cytoplasm with several deeply staining granules; blepharoplast single, giving rise to two short, unequal, flagella, 3.6-11.3 (7.4) μm and 2.1-8.7 (4.4) μm in size; nucleus small, spherical, 1.3 μm in diameter, located close to the anterior end; cytoplasm with several deeply staining granules; a long cytoplasmic projection arising near blepharoplast and extending backwards posterior-laterally as seen in some forms, significance not known.

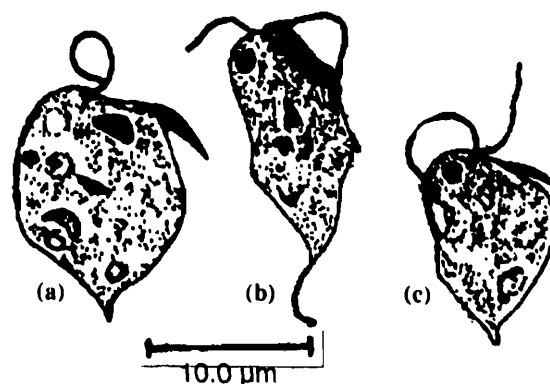


Fig. 26a-c. *Retortomonas indica*

Host : *Polyphaga indica*; site of infection : hind-gut.

Distribution : India : Maharashtra (Aurangabad District).

Remarks : Krishnamurthy and Sultana (1977) reported this species from this state.

62. *Retortamonas masoodi* Mali, 1993
(Fig. 27a-d)

1993. *Retortomonas masoodi*, *Proc. Zool. Soc., Calcutta* 46(1) : 55-59.

Diagnosis : Body somewhat ovoidal or spindle-shaped, 11.31-23.13 (19.91) μm $\times$ 8.22-16.45 (15.11) μm in size; anterior end rounded or conical; posterior end tapering into projection of variable size; cytoplasm with deeply staining granules and bacterial inclusion; two blepharoplasts situated a little behind the anterior end; granules small, upper one giving rise to a single flagellum and the lower one responsible for the origin of the other flagellum as well as the cytostomal fibril; two flagella unequal in length, 8.73-20.56 (14.13) μm and 8.22-19.53 (15.51) μm ; cytostome smaller extending almost one third of the body nucleus located just below the anterior and spherical or ovoidal averaging 3.23 μm $\times$ 2.39 μm .

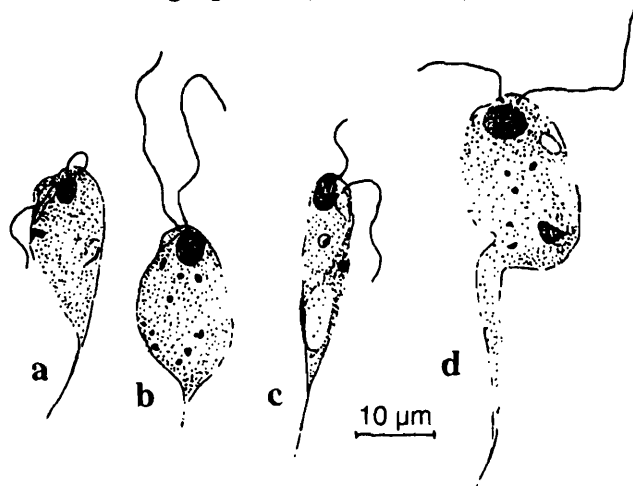


Fig. 27a-d. *Retortamonas masoodi*

Host : *Gryllotalpa africana*; site of infection : mid-gut.

Distribution : India : Maharashtra.

Remarks : Mali (1993) reported this species from Maharashtra.

63. *Retortamonas nagabhushani*
Sultana, 1976c
(Fig. 28a-d)

1976. *Retortomonas nagabhushani* Sultana. *Acta Protozool.*, 30(5) : 125-137.

Diagnosis : Body elongated and spindle-shaped, 9.8-18.0(13.7) μm $\times$ 6.2-9.3(7.6) μm in size; anterior end rounded or conical; posterior end tapering, ending in pointed tip; a pair of blepharoplasts situated at the anterior end by the side of the nucleus; a pair of blepharoplast granules also situated at the anterior end one above the other connected by a delicate rhizoplast; 2 flagella almost equal, 4.1-19.0(11.4) μm and 6.2-15.0(10.2) μm in size; nucleus small, 1.0-3.6 (2.0) μm $\times$ 1.0-4.6 (2.0) μm in size; cytostome narrow, sac-like extending up to the middle of the body; cytostomal fibril extending up to the posterior end and recurved anteriorly around the base of the oral pouch; cytoplasm with several deeply staining granules.

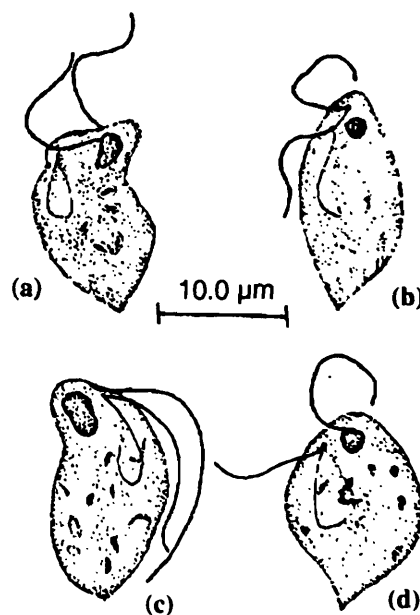


Fig. 28a-d. *Retortomonas nagabhushani*

Host : *Gryllotalpa africana*; site of infection : mid-gut.

Distribution : India : Maharashtra (Aurangabad District).

Remarks : Sultana (1976) reported this species from this state.

64. *Retortamonas viperae* Krishnamurthy and Madre, 1976
(Fig. 29a-d)

1976. *Retortomonas viperae* Krishnamurthy and Madre, *Nat. Sci. J. Marathwada Univ.*, 15(8) : 129-131.

Diagnosis : Body almost spherical or ovoidal, 6.7-16.9 (10.2) μm $\times$ 4.1-13.4 (8.4) μm , with both ends obtuse and no evidence of projections; two blepharoplasts close to the anterior end of the body, one lying above the nucleus and other lying somewhat lateral to the nucleus; two flagella present of same thickness, unequal in length, but shorter than the body; the free flagellum generally longer, measuring 6.1-17.5 μm , cytostomal flagellum shorter, measuring 5.1-14.4 μm ; cytostome inconspicuous; cytoplasm with many vacuoles, bacteria and granules; nucleus almost spherical, 2.4 μm in diameter, placed close to the anterior end.

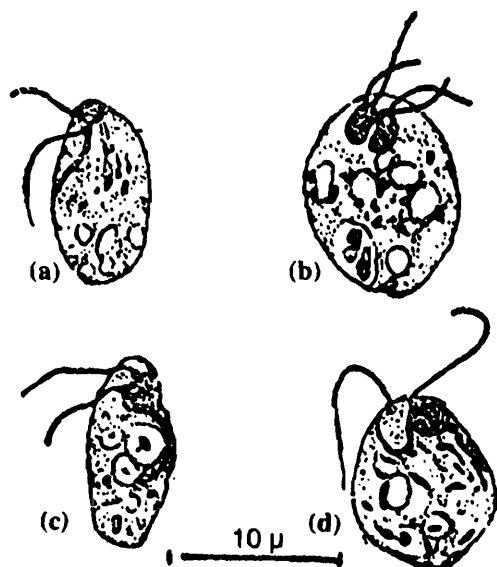


Fig. 29a-d. *Retortomonas viperae*

Host : *Vipera russeli*; site of infection : rectum.

Distribution : India : Maharashtra (Aurangabad).

Remarks : Krishnamurthy and Madre (1976) described species from Aurangabad.

65. *Retortomonas wenrichi* Stabler, 1944
(Fig. 30a-f)

1944. *Retortomonas wenrichi* Stabler, *J. Parasitol.*, 30 : 173-176.

1976c. *Retortomonas wenrichi* Stabler : Sultana, *Acta Protozool.*, 15(2) : 125-137

Diagnosis : Body fusiform, 13.9-24.7(19.2) μm $\times$ 7.7-15.9(11.3) μm in size; anterior end rounded, middle region bulged, posterior end tapering into tail-like projection, measuring 5.1-57.1(20.6) μm ; cytoplasm with several deeply staining granules; blepharoplasts two, giving rise to two flagella, with an average length of 21.3 μm ; nucleus small, ovoidal or spherical, 1.5-5.1(3.5) μm $\times$ 2.6-6.2(3.7) μm in size, located behind the blephroblast; cytostome large and conspicuous extending up to $\frac{1}{3}$ rd the length of the body, 5.7-8.2(7.7) μm $\times$ 3.1-7.2(4.8) μm in size; edge of the cytostome bordered by a cytostomal fibril.

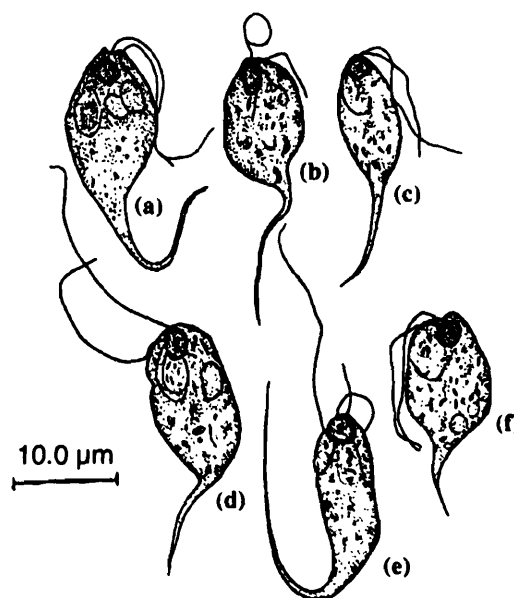


Fig. 30a-f. *Retortomonas wenrichi*

Host : *Gryllotalpa africana*; site of infection : hind-gut.

Distribution : India : Maharashtra (Aurangabad District).

Remarks : Sultana (1976) reported this species from Maharashtra state.

66. *Retortamonas* sp.

Host : *Spirotreptus* sp.; site of infection : gut.

Distribution : India : Maharashtra.

Remarks : Krishnamurthy and Sultana (1972) recorded this unnamed species from this state.

67. *Retortamonas* sp.

Host : *Blatta gemminica*; site of infection : gut.

Distribution : India : Maharashtra.

Remarks : Krishnamurthy and Sultana (1972) recorded this unnamed species from this state.

68. *Retortamonas* sp.

Host : *Gryllotalpa* sp. site of infection : gut.

Distribution : India : Maharashtra.

Remarks : Krishnamurthy and Sultana (1972) recorded this unnamed species from this state.

69. *Retortamonas* sp.

Host : *Periplaneta americana*; site of infection : gut.

Distribution : India : Maharashtra.

Remarks : Krishnamurthy and Sultana (1972) recorded this unnamed species from this state.

70. *Retortamonas* sp.

Host : *Oryctes rhinoceros*; site of infection : gut.

Distribution : India : Maharashtra.

Remarks : Krishnamurthy and Sultana (1972) recorded this unnamed species from this state.

71. *Retortamonas* sp.

Host : *Gryllus domesticus*; site of infection : gut.

Distribution : India : Maharashtra.

Remarks : Krishnamurthy and Sultana (1972) recorded this unnamed species from this state.

Genus *Chilomastix* Alexeiff, 1911

Diagnosis : As in the key.

72. *Chilomastix qadrii* Krishnamurthy, 1970
(Fig. 31a-d)

1970. *Chilomastix qadrii* Krishnamurthy, *Ann. Parasit. Hum. Comp.*, 45(3) : pp. 261-265.

1975. *Chilomastix qadrii* Krishnamurthy, Krishnamurthy and Madre, *Marthwada Univ. J. Sci.*, 14(7) : 219-222.

Diagnosis : Body pear-shaped or ovoid, 7.71-13.37(10.58) μm $\times$ 5.66-10.28(8.63) μm in size; posterior end pointed, spike-like; nucleus round or transversely elongated, located about 2 μm behind the anterior tip of the body with one or two central or eccentric endosomes; blepharoplasts three, located between the nucleus and anterior end; cytostome large, sac-like about $\frac{1}{3}$ – $\frac{1}{2}$ body length and with one cytostomal fibril.

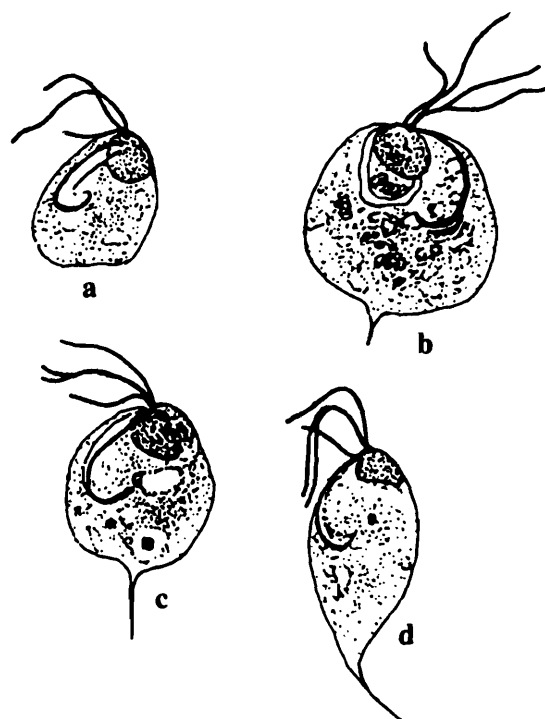


Fig. 31a-d. *Chilomastix qadrii*

Host : *Rana cyanophlyctis*; site of infection : large intestine.

Distribution : India : Maharashtra (Aurangabad and Nanded districts) and Andhra Pradesh.

Remarks : Krishnamurthy (1970) reported this species from *Rana tigrina* collected from Andhra Pradesh. Madre (1979) encountered the same species in *Rana cyanophlyctis* from Maharashtra state.

73. *Chilomastix hemidactyli* Madre, 1979
(Fig. 32a-d)

1976. *Chilomastix hemidactyli* Bhaskar Rao, Bhaskar Rao and Devi, *Acta protozool.*, 15(3) : 289-292.

1979. *Chilomastix hemidactyli* Madre, *Acta Protozool.*, 18(3) : 243-649.

Diagnosis : Body ovoidal or spherical, 7.70-12.85 (10.30) μm $\times$ 5.14-11.31 (7.74) μm ; with a conspicuous posterior spike up to 8.7 μm in length; cytoplasm vacuolated containing bacteria and granules; nucleus rounded or ovoid or irregular, averaging 3.73 μm $\times$ 3.10 μm located at the extreme anterior end of the body or slightly behind; blepharoplastic complex of three granules at the anterior end giving rise from flagella, two flagella by the first granule, third flagellum by the second, a recurrent one and cytostomal fibrils by the third granule; three flagella unequal averaging 5.20 μm , 8.30 μm and 10.60 μm respectively; cytostome conspicuous extending up to the middle; posterior projection 1.03-8.73 (4.74) μm length.

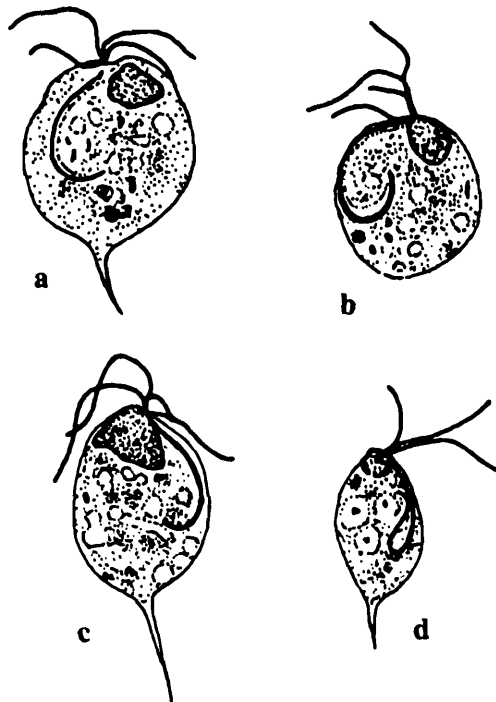


Fig. 32a-d. *Chilomastix hemidactyli*

Host : *Hemidactylus giganteus*; site of infection : rectum.

Distribution : India : Maharashtra (Aurangabad district); Andhra Pradesh.

Remarks : Madre (1979) reported *Chilomastix hemidactyli* as a new species from the rectal contents of *Hemidactylus giganteus* collected from Aurangabad, Maharashtra without realizing that it

is a preoccupied name described earlier by Bhaskar Rao *et al.*, 1976. This species therefore requires reexamination.

74. *Chilomastix* sp.

Host : *Varnus indica*; site of infection : intestine.

Distribution : India : Maharashtra (Aurangabad and Nanded).

Remarks : Krishnamurthy and Madre (1975) recorded this unnamed species from this state.

75. *Chilomastix* sp.

Host : *Hemidactylus giganteus*; site of infection : intestine.

Distribution : India : Maharashtra (Aurangabad and Nanded).

Remarks : Krishnamurthy and Madre (1975) recorded this unnamed species from this state.

76. *Chilomastix* sp.

Host : *Calotes versicolor*; site of infection : intestine.

Distribution : India : Maharashtra (Aurangabad and Nanded).

Remarks : Krishnamurthy and Madre (1975) recorded this unnamed species from this state.

77. *Chilomastix* sp.

Host : *Bufo melanostictus*; site of infection : intestine.

Distribution : India : Maharashtra (Aurangabad and Nanded).

Remarks : Krishnamurthy and Madre (1975) recorded this unnamed species from this state.

Order DIPLOMONADIDA

Family HEXAMITIDAE

Diagnosis : Trophozoites with two cytostomes; one recurrent flagellum bounded by a cell membrane and emerging posteriorly; freeliving, saprozoic and parasitic.

Genus *Hexamitus* Butschli 1884

Diagnosis : Pyriform with two nuclei near anterior end; six anterior and two posterior flagella; two axostyles; cytostome obscure; freeliving or parasitic.

Remarks : The current taxonomic status and validity of this genus is uncertain. Butschli (1884) corrected the name of the genus *Hexamita* as *Hexamitus* since the former name was not an acceptable form of transliteration from Greek (quoted from Sultana, 1976). Ring (1959) and Kulda and Lom (1964) recognised only 3 genera namely, *Hexamita*, *Octomitus* and *Spironucleus* thus ignoring the name *Hexamitus* (cited from Sultana, 1976). However, Sultana, (1976) preferred to retain the generic name *Hexamitus* as valid and assigned the species to genus *Hexamitus* probably a synonym of genus *Octomitus* Prowazek. The genus is retained here since we had no access to the original material for re-examination.

A. *Hexamitus* of insects

78. *Hexamitus murthii*, Sultana, 1976f
(Fig. 33a-d)

1976. *Hexamitus murthii* Sultana, *Riv. Parassitol.*, **37** : 7-11.

Diagnosis : Body ovoid, broader than long, 5.7-13.4 (8.9) μm $\times$ 5.7-14.9 (9.8) μm in size; blepharoplast in two groups, of 3 granules each, on either side of the nucleus; 8 unequal flagella in 2 groups, each group with 3 sub-equal anterior

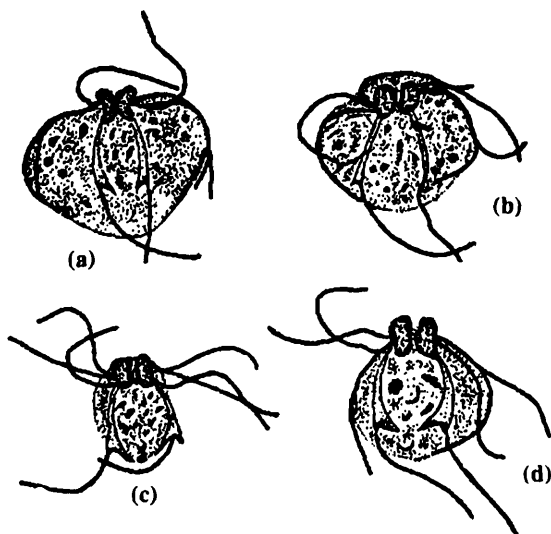


Fig. 33a-d. *Hexamitus murthii*

flagella, 4.1-12.9 μm , 6.7-13.9 μm , 7.7-15.9 μm in size; one caudal flagellum emerging out at the posterior end of the tubular axostyle; free portion of the caudal flagella 2.6-12.3 μm in length; axostyles 2, 4.6-8.2 (6.6) μm long, very slender running parallel to one another through the body; posterior end of the axostyle typically bifid; no distinct capitulum; nuclei 2, anterior, identical, kidney-shaped or elongate, spherical or transversely elongated, 2.1 $\times$ 2.3 μm in size; cytoplasm showing several granular inclusions.

Host : *Periplaneta americana*; site of infection : hind-gut.

Distribution : India : Maharashtra (Aurangabad district).

Remarks : Sultana (1976) reported this species from Maharashtra state.

79. *Hexamitus* sp.

Host : *Periplaneta americana*; site of infection : gut.

Distribution : India : Maharashtra (Aurangabad).

Remarks : Krishnamurthy and Sultana (1972) reported this unnamed species from Maharashtra.

B. *Hexamitus* of amphibians and reptiles

80. *Hexamitus cyanophlycti* Krishnamurthy and Shete, 1981
(Fig. 34a-d)

1981. *Krishnamurthy and Shete, Arch. Protistenk.*, **124** : 391-397.

Diagnosis : Body pyriform; periplast very thin; two blepharoplasts separated from one another, situated at the anterior end of the body; granules giving origin to the mastigont elements comprising of three pairs of anterior flagella and a pair of axostyles running through the body and continuing behind as the caudal flagella; anterior flagella distinctly unequal in length and measuring one and a half to two times the length of the body; caudal flagella also unequal and measuring about one and a half times the length of the body; flagella acronematic in many cases; axostyles slender,

tubular and running backwards somewhat parallel to one another or slightly convergent and uniform in diameter through their length and separated by a maximum distance of $1.7\ \mu\text{m}$ on an average; two nuclei relatively small and spherical or ovoidal in shape distinctly separated from one another partially fused; cytoplasm staining homogenously and containing very few granular inclusions.

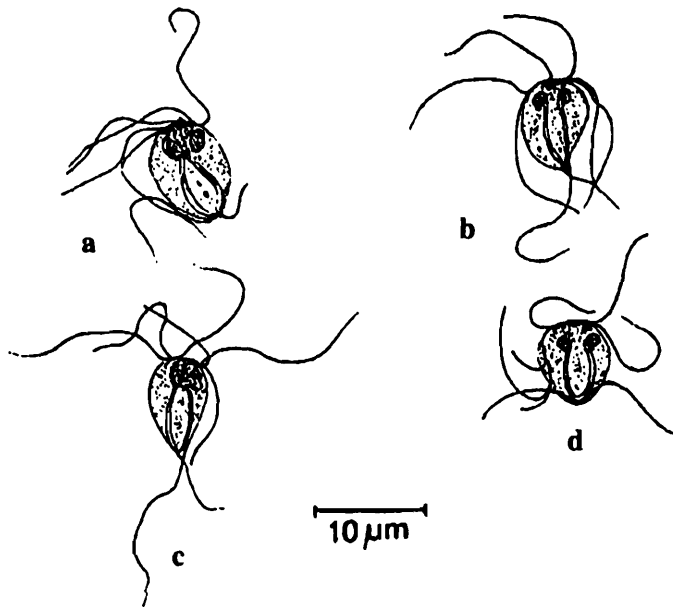


Fig. 34a-d. *Hexamitus cyanophlycti*

Host : *Rana cyanophlyctis*; site of infection : rectum.

Distribution : India : Maharashtra (Aurangabad).

Remarks : Krishnamurthy and Shete (1981) described this species from this state.

81. ***Hexamitus melanosticti*** Krishnamurthy and Shete, 1981
(Fig. 35a-d)

1981. Krishnamurthy and Shete, *Arch. Protistenk.*, 124 : 391-397.

Diagnosis : Body typically spherical or ovoid and occasionally somewhat pyriform in shape; considerably broad body covered over by a delicate periplast; two distinctly separated blepharoplasts situated close to the anterior end giving rise to the mastigont elements; three pairs of anterior flagella slightly unequal and a little longer than the body; caudal flagella distinctly

unequal, the shorter flagella about as long as body and the long one up to one and a half times the body length; many flagella acromatic; axostyles distinctly filamentous, almost of the same thickness as the flagella; axostyles running backwards almost parallel or slightly convergent and continued as the caudal flagella and separated by a distance of about $1.9\ \mu\text{m}$ on an average; near the posterior end of the body, the two axostyles passing through two characteristic ring-like structures before continuing into the caudal flagella; two acromatic rings around the axostyles extremely characteristic to this species; presence of two elongated vacuoles between the axostyles in the anterior half; two nuclei, small spherical and distinctly separated from one another; nuclei measuring $1\ \mu\text{m}$, in diameter on an average; cytoplasm staining homogenously and showing few granular or vacuolar inclusions.

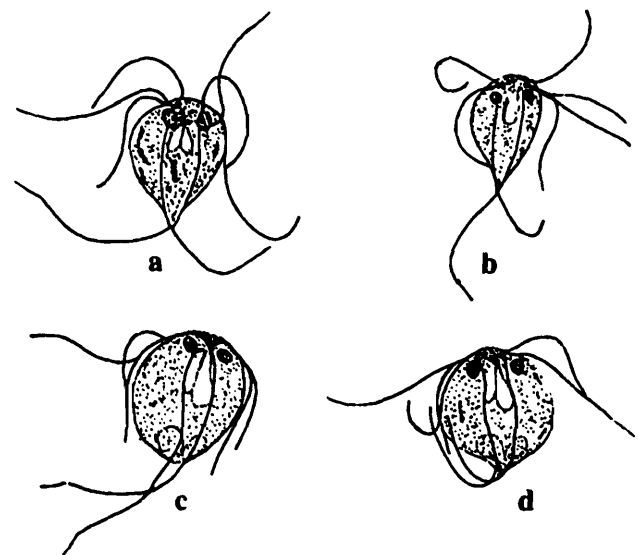


Fig. 35a-d. *Hexamitus melanosticti*

Host : *Bufo melanostictus*; site of infection : rectum.

Distribution : India : Maharashtra (Aurangabad).

Remarks : Krishnamurthy and Shete (1981) described this species from this state.

82. ***Hexamitus* sp.**

Host : *Rana tigrina*; site of infection : intestine.

Distribution : India : Maharashtra (Aurangabad and Nanded).

Remarks : Krishnamurthy and Madre (1975) reported this unnamed species from Maharashtra.

83. *Hexamitus* sp.

Host : *Rana cyanophlyctis*; site of infection : intestine.

Distribution : India : Maharashtra (Aurangabad and Nanded).

Remarks : Krishnamurthy and Madre (1975) reported this unnamed species from Maharashtra.

84. *Hexamitus* sp.

Host : *Bufo melanostictus*; site of infection : intestine.

Distribution : India : Maharashtra (Aurangabad and Nanded).

Remarks : Krishnamurthy and Madre (1975) reported this unnamed species from Maharashtra.

85. *Hexamitus* sp., Krishnamurthy, Sultana and Shete 1979

1979. *Hexamitus* sp. Krishnamurthy, Sultana and Shete, // *Nat. Cong. of Parasitology* : p. 54.

Diagnosis : Incompletely described. Body ovoidal, 8.0-12.7 (9.2) μm $\times$ 7.5-11.8 (9.9) μm in size; parasite characterised by typically well developed axostyles expanded at the posterior end; nuclei partially fused; flagella as long as the body; anterior flagella unequal, posterior flagella equal.

Host : *Calotes versicolor*; site of infection : rectum.

Distribution : India : Maharashtra (Aurangabad district).

Remarks : Krishnamurthy, Sultana and Shete (1979) reported this unnamed species from Maharashtra state.

Genus *Giardia* Kuntzler

1882. *Giaradia* Kuntzler, *C. R. Acad. Sci.*, 47 : 755.

Diagnosis : Body bilaterally symmetrical, pyriform to ellipsoid, broadly round anterior end and drawn out posterior end; ventral side with a

sucking disc in anterior half; two slender axostyles and eight flagella in four pairs present; cytostome absent; parasitic.

86. *Giardia canis* Hegner, 1922

Diagnosis : Body with characteristically broad anterior end, measuring 11.9-170 μm $\times$ 7.6-10.2 μm ; cysts 9-13 μm $\times$ 7-9 μm .

Host : *Canis familiaris*; site of infection : intestine.

Distribution : India : Maharashtra (Parbhani district).

Remarks : Deshpande *et al.* (1981) recorded *Giardia canis* infection in 20% of pet dogs and 6.6% of stray dogs in Parbhani town.

**87. *Giardia intestinalis* (Lambl, 1859)
(Fig. 36a-b)**

1859. *Cercomonas intestinalis* Lambl, *Viert. Prakt. Heilk.*, 61, p. 1.

Diagnosis : Trophozoites broadly pyriform, 9-20 μm $\times$ 5-10 μm ; axostyles needle-like; two nuclei vesicular and located near anterior margin; eight flagella originating in the kinetosomal complex.

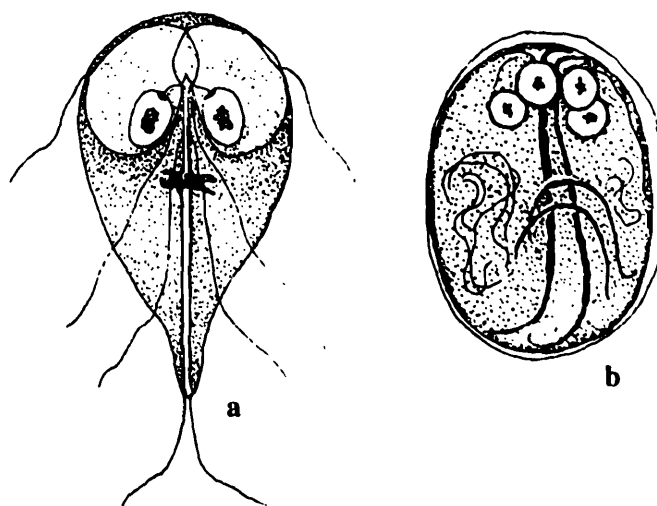


Fig. 36a-b. *Giardia intestinalis*

Host : *Homo sapiens*; site of infection : intestine.

Distribution : India : Maharashtra (Aurangabad district).

Remarks : Giardiasis is prevalent in many countries including India. Kalyankar *et al.* (1981) recorded it from this state.

88. *Giardia* sp.

Host : *Rana cyanophlyctis*; site of infection : intestine.

Distribution : India : Maharashtra (Aurangabad and Nanded).

Remarks : Krishnamurthy and Madre (1975) reported this unnamed species from Maharashtra.

Order OXYMONADIDA

Motile cells with one or more karyomastigonts each with 4 flagella typically arranged in 2 pairs; 2 pairs of basal bodies separated by a preaxostylar lamina; axostyle composed of parallel rows of microtubules; no cytostome; closed mitosis with intra nuclear spindle.

Family POLYMASTIGIDAE

Small flagellates with four free anterior flagella, one being recurrent; nucleus anterior; axostyle slender; non contractile; pelta covering the anterior end.

Key to the genera

1. Body small, oval to pyriform; large anterior nucleus capped with a pelta; funis follows the adhering zone of the recurrent flagellum **Monocercomonoides**
2. Body almond or spindle-shaped; flagella deflected backwards but not adherent to the cell; axostyle inconspicuous; axostyle slender; pelta not protruding posteriorly **Polymastix**

Genus *Monocercomonoides* Travis, 1932

Diagnosis : Cells small, oval to pyriform, 5-15 μm in size, with four flagella separated in two pairs, one trailing flagellum; anterior large nucleus capped with a pelta; axostyle originating from a preaxostyle stretched between the two pairs of

flagellar base; traversing through the cell and protruding posteriorly; a thin fiber or funis following the adhering zone of the recurrent flagellum.

Remarks : Species of this genus are predominantly parasites of insects. Some inhabit the gut of various vertebrates.

A. *Monocercomonoides* species in arthropods

Key to the species

1. Body round or ovoid; axostyle filamentous, uneven in thickness, extending to half or $\frac{1}{3}$ the body; funis seen occasionally *M. adarshii*
2. Body spherical oval or irregular; axostyle indistinct; flagellum thick *M. aurangabadae*
3. Body spherical, pyriform or ovoidal, broader than long, with a thin periplast; axostyle thick and extending up to the posterior end of the body *M. blattae*
4. Body spherical or pyriform or irregular; axostyle extremely delicate extending up to the posterior end of the body or projecting out slightly, posterior tip of the axostyle enlarged into a fine spear-shaped structure tapering in a fine point..... *M. chakravartii*
5. Cell body oval or rounded or irregular; axostyle uniformly thick, originating from dorsal blepharoplast, extending up to the posterior end of the body and projecting outside or curving inside; axostylar ring absent; funis short and filamentous *M. ganapatii*
6. Cell body spherical or somewhat irregular; axostyle in most cases inconspicuous; cytostome and funis absent *M. gryllusae*
7. Cell body pyriform, oval or spherical; axostyle filamentous, straight or curved extending up to the posterior end of the body and projecting outside; terminal part of the axostyle surrounded by a vacuole *M. krishnamurthii*

8. Cell body characterized by a 3 : 1 grouping of flagella *M. khultabadae*
9. Cell body large, round or often irregular with a thin periplast; axostyle flexible, uneven in thickness and passing backwards to the posterior end; funis present
..... *M. marthwadensis*
10. Cell body large spherical or ovoid; axostyle delicate fibril extending through the length of the body; funis absent *M. mehdii*
11. Cell body conspicuously large, irregular or amoeboid; axostyle not seen; funis running along the body surface; nucleus spherical ovoid or triangular *M. omergae*
12. Cell body spherical to oval, posterior end tapering or pointed; axostyle filamentous, shorter than the body; funis absent
..... *M. oryctesae*
13. Cell Body spherical to pyriform with a thin periplast; axostyle filamentous and passes backwards; funis thick, slightly curved and rod-like *M. polyphagae*
14. Body spherical or slightly irregular in outline with tail like projection; funis present; axostyle uniformly thick and extending up to the posterior end *M. qadrii*
15. Cell Body rounded or ovoid with a thin periplast axostyle well defined; broad and sheath-like initially and running as fine thread like posteriorly *M. spirostreptae*

89. *Monocercomonoides adarshii* Mali,
Kulkarni and Mali 2001

2001. *Monocercomonoides adarshii* Mali, Kulkarni and Mali *Geobios.*, 28(4) : 201-204.

Diagnosis : Cell body round or ovoid; 12.85-21.07 μm $\times$ 6.68-21.59 μm in size; pellicle thin; blepharoplasts 2, located at the anterior end lying at the same level, triangular dorsally and dot-like ventrally; 4 flagella in two groups; 3 anterior flagella; unequal, 2 shorter than the body, 5.14-19.53 μm , 6.68-26.8 μm and 8.73-23.13 μm in length; trailing flagellum running for a short

distance along the body and becoming free, 14.9-30.84 μm in size; funis seen occasionally; axostyle filamentous extending to half or $\frac{1}{3}$ the body, uneven in thickness, 5.65-11.82 μm in size; nucleus spherical ovoid or kidney-shaped, surrounded by a halo; cytoplasm granular and vacuolated.

Host : *Oryctes rhinoceros*; site of infection : gut.

Distribution : India : Maharashtra (Aurangabad District).

Remarks : Mali, Kulkarni and Mali (2001) reported this species from Maharashtra state.

90. *Monocercomonoides aurangabadae* Mali
and Patil, 2003

2003. *Monocercomonoides aurangabadae* Mali and Patil, *Uttar Pradesh J. Zool.*, 23(2) : 117-119.

Diagnosis : Body spherical oval or irregular; characterized as having an indistinct axostyle and a thick flagellum.

Host : *Blattella germanica*; site of infection : gut.

Distribution : India : Maharashtra (Aurangabad District).

Remarks : Mali and Patil (2003) reported this species from Maharashtra state.

91. *Monocercomonoides blattae* Sultana and
Krishnamurthy, 1979
(Fig. 37a-b)

1979. *Monocercomonoides blattae* Sultana and Krishnamurthy, *Marthwada Univ. J. Sci.*, 18(2) : 141-143.

Diagnosis : Cell body spherical, pyriform or ovoidal broader than long, with a thin periplast, 4.1-13.4 (8.6) μm $\times$ 3.1-13.4 (6.5) μm ; nucleus anterior, fairly large, oval or spherical 2.6 $\times$ 2.4 μm , close to anterior end; blepharoplast complex with 2 granules; one granule elongated and rod like and the other small and oval located at the anterior end, deeply stained separated from each other by a distance of 1.0-3.1 (1.5) μm , connected by a delicate rhizoplast. 3 anterior flagella slightly

unequal in length 5.7-15.4 (9.7) μm , 7.2-15.4 (11.0) μm , 6.2-18.0 (12.3) μm in size; trailing flagellum long, twice the body size, 10.8-25.7 (17.4) μm ; funis not seen; axostyle thick extending up to the posterior end of the body.

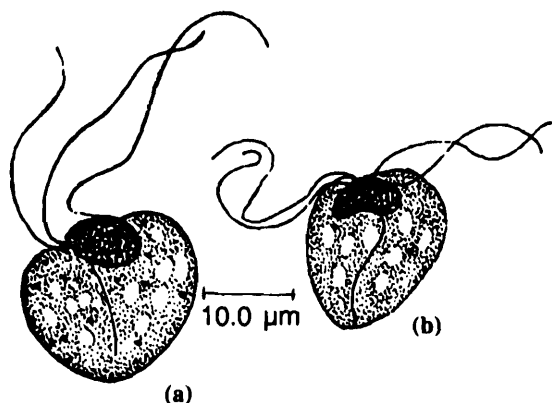


Fig. 37a-b. *Monocercomonoides blattae*

Host : *Blatta* sp.; site of infection : gut.

Distribution : India : Maharashtra (Aurangabad District).

Remarks : Sultana and Krishnamurthy (1979) reported this species from Maharashtra state.

92. *Monocercomonoides chakravartii*

Krishnamurthy and Sultana, 1976a

(Fig. 38a-b)

1976a. *Monocercomonoides chakravartii* Krishnamurthy and Sultana, *Curr. Sci.*, 45(5) : 184-186.

Diagnosis : Cell body spherical or pyriform or irregular, 5.7-9.8 (7.4) μm $\times$ 5.7-13.4 (7.2) μm ; nucleus variable in shape 2.1 $\times$ 2.6 μm , behind the blepharoplast; blepharoplast complex located at the anterior end, with three granules; anterior flagella 3, unequal, 4.6-11.8 (7.4) μm , 6.7-12.8 (8.8) μm and 7.2-14.9 (9.8) μm in length; trailing

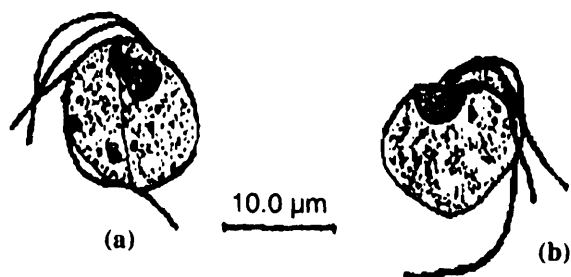


Fig. 38a-b. *Monocercomonoides chakravartii*

flagellum twice the length of the body, 9.8-21.6 (14.5) μm in size; axostyle extremely delicate extending up to the posterior end of the body or projecting out slightly, posterior tip of the axostyle enlarged into a fine spear-shaped structure tapering in a fine point; funis short and filamentous, measuring 2.6-4.6(3.6) μm ; periplast thin; cytoplasm homogenous.

Host : *Polyphaga indica*; site of infection : gut.

Distribution : India : Maharashtra (Aurangabad District).

Remarks : Krishnamurthy and Sultana (1976) reported this species from Maharashtra state.

93. *Monocercomonoides ganapatii*

Bhaskar Rao, 1969

(Fig. 39a-b)

1975. *Monocercomonoides ganapatii*, Sultana, *Marthwada Univ. J. Sci.*, 14 : 229-232.

Diagnosis : Cell body oval or rounded or irregular, 5.14-11.82 (8.09) μm $\times$ 4.11-9.77 (7.49) μm in size; nucleus variable in shape 2.1 $\times$ 2.6 μm , behind the blepharoplast; blepharoplast complex located at the anterior end, with three granules, anterior flagella 3, almost equal, 4.63-14.39 (9.22) μm , 6.16-15.42 (9.48) μm and 5.66-

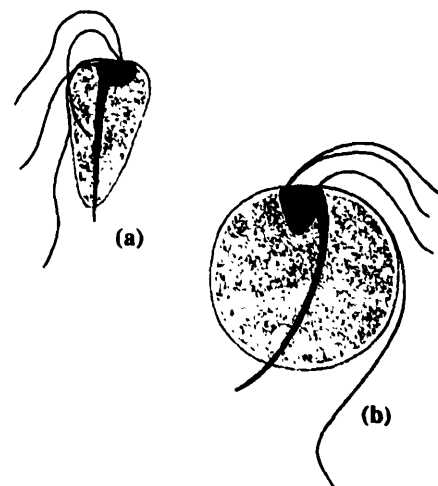


Fig. 39a-b. *Monocercomonoides ganapatii*

14.39 (8.75) μm in length; trailing flagellum twice the length of the body, 7.71-22.11 (15.08) μm ; axostyle uniformly thick, originating from dorsal blepharoplast extending up to the posterior end of

the body and projecting outside or curving inside; axostylar ring not seen; funis short and filamentous; periplast thin; cytoplasm homogenous.

Host : *Gryllotalpa africana*; site of infection : gut.

Distribution : India : Maharashtra (Aurangabad District); Andhra Pradesh.

Remarks : Bhaskar Rao, 1969 reported this from Hyderabad, Andhra Pradesh. It differs from the present form in having axostylar ring and absence of funis. Morphometrically both are identical (Sultana, 1975).

94. *Monocercomonoides gryllusae* Sultana and Krishnamurthy, 1978
(Fig. 40a-d)

1978. *Monocercomonoides gryllusae* Sultana and Krishnamurthy, *Geobios.* 5(3) : 174-175.

Diagnosis : Cell body spherical or somewhat irregular, 6.2-12.3(8.8) μm $\times$ 4.6-11.3 (7.8) μm in size; nucleus spherical, or elongate, oval 1.5-3.6 μm $\times$ 2.1-4.1 μm , 2 blepharoplasts located at the anterior end at the same level about 1.0 μm apart; anterior flagella 3, unequal, 5.1-12.3 μm , 6.7-14.9 μm and 8.7-15.9 μm in length; trailing flagellum twice the length of the body, 9.8-21.1 μm in size; axostyle inconspicuous and rarely discernable; funis and cytostome absent; cytoplasm granular and vacuolated.

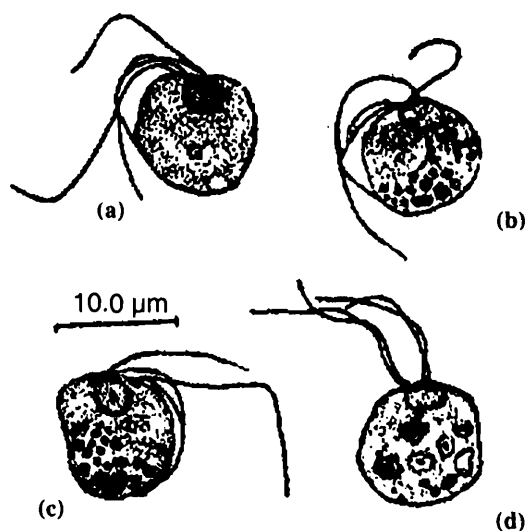


Fig. 40a-d. *Monocercomonoides gryllusae*

Host : *Gryllus bimaculatus*; site of infection : gut.

Distribution : India : Maharashtra (Aurangabad district).

Remarks : Sultana and Krishnamurthy (1978) reported this species from Maharashtra state.

95. *Monocercomonoides krishnamurthii*
Sultana 1976a
(Fig. 41a-b)

1976. *Monocercomonoides krishnamurthii* Sultana, *Marthwada Univ. J. Sci.*, 8 : 149-152.

Diagnosis : Cell body pyriform, oval or spherical, periblast thin, 5.7-9.8 (7.4) μm $\times$ 3.6-7.2 (5.2) μm in size; nucleus spherical, flattened or irregularly lobed 2.1 $\times$ 2.5 μm , behind the blepharoplast; blepharoplast complex located at the anterior end, with two granules, anterior flagella 3, closely set, somewhat unequal, 3.1-19.0 (11.2) μm , 7.2-22.1 (13.3) μm and 7.2-23.1 (13.7) μm in length; trailing flagellum twice the length of the body, 10.8-25.2 (18.9) μm ; axostyle filamentous, straight or curved, extending up to the posterior end of the body and projecting outside; axostylar ring not seen; terminal part of the axostyle surrounded by a vacuole; funis short and filamentous; periplast thin; cytoplasm granular.

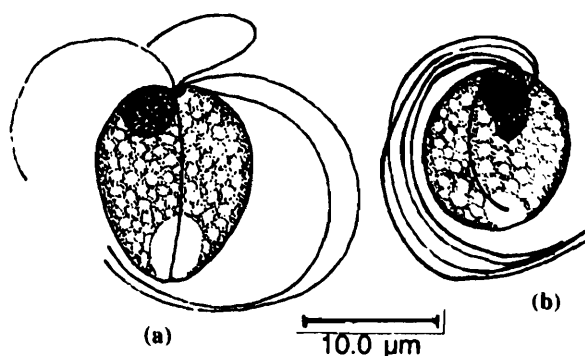


Fig. 41a-b. *Monocercomonoides krishnamurthii*

Host : *Pycnoscelus surinamensis*; site of infection : gut.

Distribution : India : Maharashtra (Aurangabad district); Andhra Pradesh.

Remarks : Sultana (1976) reported this species from Maharashtra state.

96. *Monocercomonoides khultabadae* Mali and Mali, 2004

2004. *Monocercomonoides khultabadae* Mali and Mali, *Uttar Pradesh J. Zool.*, **24**(1) : 55-58.

Diagnosis : Cell body characterized by a 3 : 1 grouping of flagella. The ventral granule giving rise to an anterior flagellum, while the 2 other anterior flagella, the trailing flagellum and the axostyle arising from the dorsal granule.

Host : *Pycnoscelus surinamensis*; site of infection : gut.

Distribution : India : Maharashtra (Aurangabad district).

Remarks : Mali and Mali (2004) reported this species from Maharashtra state.

97. *Monocercomonoides marthwadensis*
Krishnamurthy and Sultana, 1976
(Fig. 42a-d)

1976. *Monocercomonoides marthwadensis* Krishnamurthy and Sultana, *Proc. Indian Acad. Sci.*, **84**(3) : 109-115.

Diagnosis : Cell body large, round or often irregular with a thin periplast, 6.7-14.9 (9.5) μm $\times$ 4.6-14.4 (8.2) μm in size; nucleus anterior, fairly large, close to blepharoplast; blepharoplast consisting of 4 granules arranged in 2 groups, located at the anterior end, deeply stained, about 2.0 μm in size; flagella arising in two groups from two sets of basal granules connected by a thin rhizoplast forming an arch-like loop over the

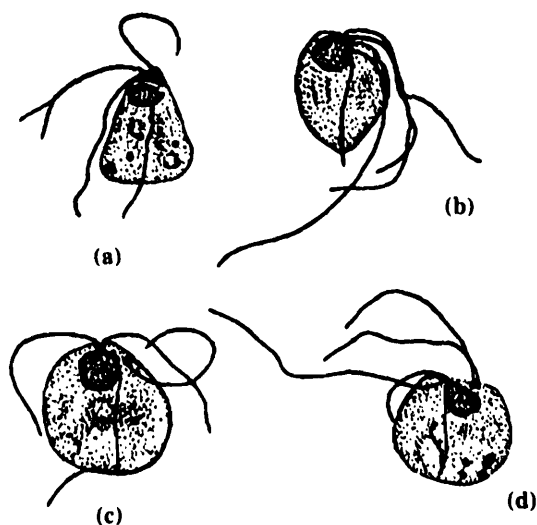


Fig. 42a-d. *Monocercomonoides marthwadensis*

nucleus; anterior flagella equal and small, trailing flagellum long, twice the body size, equal or longer than the body; funis present; axostyle flexible, uneven in thickness and passing backwards to the posterior end.

Host : *Periplaneta americana*; site of infection : gut.

Distribution : India : Maharashtra (Aurangabad district).

Remarks : Krishnamurthy and Sultana (1976) reported this species from Maharashtra state.

98. *Monocercomonoides omergae* Mali, Kulkarni and Mali 2001

2001. *Monocercomonoides omergae* Mali, Kulkarni and Mali, *Geobios.*, **28**(4) : 201-204.

Diagnosis : Cell body conspicuously large, irregular or amoeboid; 8.73-26.21 μm $\times$ 10.79-29.30 μm in size; pellicle thin; blepharoplasts located at the anterior end lying at the same or different levels; rhizoblast delicate forming a loop above the nucleus; nucleus spherical located behind the blepharoplast; 4 flagella in two groups; 3 anterior flagella unequal, uniformly thick, 5.65-19.53 μm , 5.65-21.07 μm and 7.71-22.10 μm in length; trailing flagellum running for a short distance along the body and becoming free; 7.19-25.7 μm in size; funis running along the body surface; axostyle not seen in most organisms; nucleus spherical, ovoid or triangular situated behind the blepharoplasts surrounded by a halo; cytoplasm granular and vacuolated.

Host : *Oryctes rhinoceros*; site of infection : gut.

Distribution : India : Maharashtra (Osmanabad district).

Remarks : Mali, Kulkarni and Mali (2001) reported this species from Maharashtra state.

99. *Monocercomonoides oryctesae*
Krishnamurthy and Sultana, 1977
(Fig. 43a-d)

1977. *Monocercomonoides oryctesae* Krishnamurthy and Sultana, *Arch. Protistenk.*, **119** : 121-126.

Diagnosis : Cell body spherical to oval, posterior end tapering or pointed; 5.7-10.8 μm $\times$ 5.1-10.3 μm in size; nucleus spherical lying behind the blepharoplast; blepharoplast complex located at the anterior end, comprising of 2 distinct granules making up the ventral portion and a large slightly elongated dorsal component located at different levels; rhizoblast not seen; three anterior flagella equal and measuring about $1\frac{1}{2}$ times the length of the body; trailing flagellum running for a short distance along the body surface and then trailing freely; axostyle filamentous, shorter than the body; funis absent.

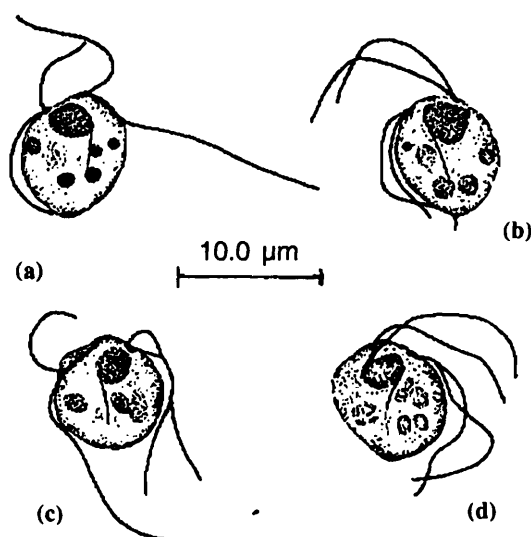


Fig. 43a-d. *Monocercomonoides oryctesae*

Host : *Oryctes rhinoceros* larvae; site of infection : gut.

Distribution : India : Maharashtra (Aurangabad district).

Remarks : Krishnamurthy and Sultana (1977) reported this species from Maharashtra state.

100. *Monocercomonoides polyphagae*
Krishnamurthy and Sultana, 1977
(Fig. 44a-d)

1977. *Monocercomonoides polyphagae* Krishnamurthy and Sultana, *Proc. Indian Acad. Sci.*, **84**(3) : 109-115.

Diagnosis : Cell body spherical to pyriform with a thin periplast, 6.7-12.3 (8.6) μm $\times$ 4.6-10.8 (7.2) μm ; nucleus anterior, fairly large, oval or spherical, 2.9 $\times$ 2.9 μm , sometimes bilobed close

to anterior end; 2 blepharoplasts located at the anterior end, deeply stained about 1.5 μm in size, located at different levels, connected by a thread like rhizoplast; 3 anterior flagella equal and small; trailing flagellum long, twice the body size; funis thick, slightly curved and rod-like; axostyle filamentous and passing backwards somewhat in a curved path.

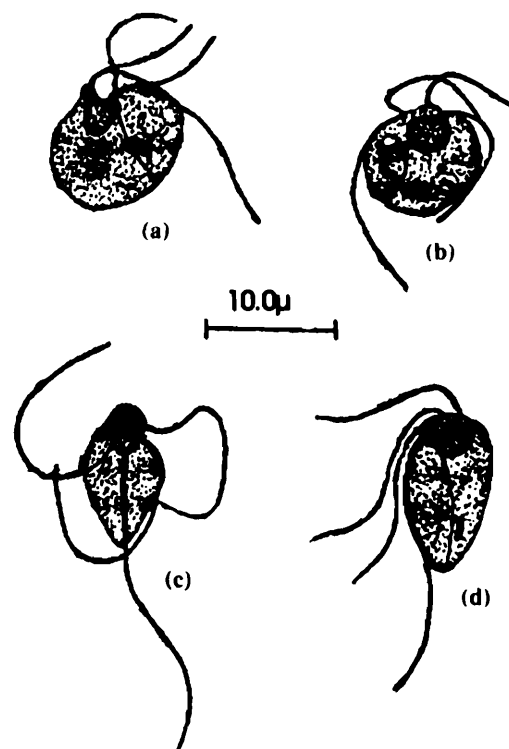


Fig. 44a-d. *Monocercomonoides polyphagae*

Host : *Polyphaga indica*; site of infection : hind-gut.

Distribution : India : Maharashtra (Aurangabad district).

Remarks : Krishnamurthy and Sultana (1977) reported this species from Maharashtra state.

101. *Monocercomonoides qadrii*
Bhaskar Rao 1969
(Fig. 45a-d)

1969. *Monocercomonoides qadrii* Bhaskar Rao, *Proc. Ind. Acad. Sci.*, **70**(5) : 208-214.

1977. *Monocercomonoides qadrii*, Krishnamurthy and Sultana, *Arch. Protistenk.*, **119** : 121-126.

Diagnosis : Organisms fairly large, cell body spherical or slightly irregular outline, 8.2-18.0

(11.8) μm $\times$ 7.2-16.5 (11.3) μm ; nucleus anterior close to blephroplast; blepharoplasts located at the anterior end, deeply stained about 2.0 μm in size, connected by a thread-like rhizoplast; anterior flagella, equal and longer than the body, 6.7-18.5 (13.7) μm in length; trailing flagellum longer, twice the body size, 13.9-32.9 (19.8) μm in length; funis arising from the dorsal blepharoplast passing outwards along the body surface measuring 3.09-9.3 (5.0) μm in length; axostyle uniformly thick and extending up to the posterior end.

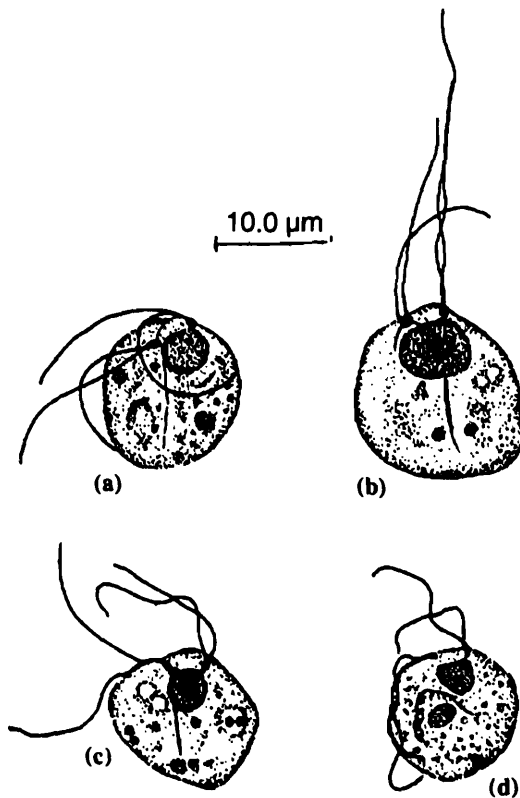


Fig. 45a-d. *Monocercomonoides qadrii*

Host : *Oryctes rhinoceros* larvae; site of infection : gut.

Distribution : India : Maharashtra (Aurangabad District) and Andhra Pradesh.

Remarks : Bhaskar Rao (1969) described this species from Andhra Pradesh from the same host. Cells are much smaller and the author has not seen funis in his specimens. Cytostome described by Bhaskar Rao is not seen in the specimens obtained from Aurangabad (Krishnamurthy and Sultana, 1977) The species requires further examination to ascertain the structure.

102. *Monocercomonoides spirostreptae*

Krishnamurthy and Sultana, 1980

(Fig. 46a-b)

1980. *Monocercomonoides spirostreptae* Krishnamurthy and Sultana, *Acta Parasitol. Polonica*, 29 : 257-260.

Diagnosis : Cell body rounded or ovoid with a thin periplast, 8.2-15.9 (10.9) μm $\times$ 5.1-13.9 (9.8) μm in size; nucleus anterior spherical or quadrangular, 3.4 $\times$ 3.6 μm in size ; blepharoplast complex located at the anterior end; ventral blepharoplast with 2 deeply stained granules placed at slightly different levels above the nuclear membrane; dorsal blepharoplast with 2 elongated or ovoid closely placed granules; rhizoplast thin arching above the nucleus; anterior flagella, equal 4.1-14.9 (10.1) μm in length; recurrent flagellum longer 9.8-24.7(17.8) μm ; funis formed of 2 slender filaments; axostyle 5.1-13.4 (9.0) μm , characteristically well defined broad and sheath-like initially and running as fine thread-like body posteriorly.

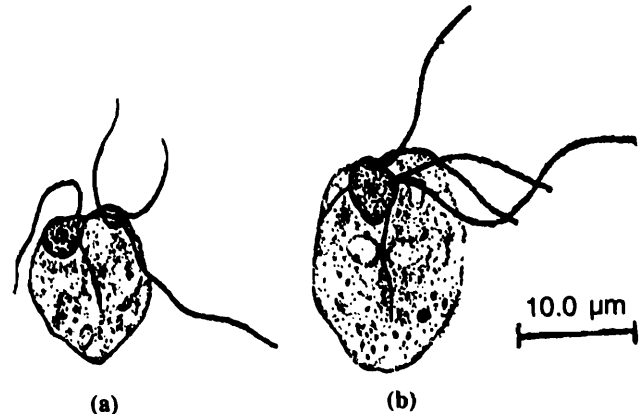


Fig. 46a-b. *Monocercomonoides spirostreptae*

Host : *Spirostreptus* sp. larvae; site of infection : mid-gut.

Distribution : India : Maharashtra (Aurangabad district).

Remarks : Krishnamurthy and Sultana (1980) reported this species from Maharashtra state.

103. *Monocercomonoides termitis*

Krishnamurthy and Sultana, 1981

1981. *Monocercomonoides termites* Krishnamurthy and Sultana (cited from), *Proc. Zool. Soc. Calcutta*, 32 : 51-55.

Diagnosis : Cell body ovoid; blepharoplastic complex with four granules and four flagella, each granule giving rise to one flagella; funis absent; axostyle with posterior subterminal knob-like thickening on a long projecting spike. Description is based on a review and key to the species by Krishnamurthy and Sultana, 1979 (1981).

Host : Termite; site of infection : gut.

Distribution : India : Maharashtra.

Remarks : Krishnamurthy and Sultana (1981) reported about this species while reviewing the flagellates of the genus *Monocercomonoides* Travis, 1932 from insects in India along with two figures (Text figs. 1K and 2L.) from unpublished data. The species is referred herein as *Monocercomonoides termitis* Krishnamurthy and Sultana, 1981 based on the review cited above but it requires redescription and/or reporting from further study.

104. *Monocercomonoides* sp.

Host : *Spirotreptus* sp.; site of infection : intestine.

Distribution : India : Maharashtra.

Remarks : Krishnamurthy and Sultana (1972) recorded this unnamed species from this state.

105. *Monocercomonoides* sp.

Host : *Blaberus* sp. site of infection : gut.

Distribution : India : Maharashtra.

Remarks : Krishnamurthy and Sultana (1972) recorded this unnamed species from this state.

106. *Monocercomonoides* sp.

Host : *Gryllus* sp; site of infection : gut.

Distribution : India : Maharashtra.

Remarks : Krishnamurthy and Sultana (1972) recorded this unnamed species from this state.

107. *Monocercomonoides* sp.

Host : *Blatta germanica*; site of infection : gut.

Distribution : India : Maharashtra.

Remarks : Krishnamurthy and Sultana (1972) recorded this unnamed species from Maharashtra state.

108. *Monocercomonoides* sp.

Host : *Blatta* sp.; site of infection : gut.

Distribution : India : Maharashtra.

Remarks : Krishnamurthy and Sultana (1972) recorded this unnamed species from Maharashtra state.

109. *Monocercomonoides* sp.

Host : *Gryllotalpa* sp. site of infection : gut.

Distribution : India : Maharashtra.

Remarks : Krishnamurthy and Sultana (1972) recorded this unnamed species from Maharashtra state.

110. *Monocercomonoides* sp.

Host : *Periplaneta americana*; site of infection : gut.

Distribution : India : Maharashtra.

Remarks : Krishnamurthy and Sultana (1972) recorded this unnamed species from Maharashtra state.

111. *Monocercomonoides* sp.

Host : *Oryctes rhinoceros*; site of infection : intestine.

Distribution : India : Maharashtra.

Remarks : Krishnamurthy and Sultana (1972) recorded this unnamed species from Maharashtra state.

112. *Monocercomonoides* sp.

Host : *Gryllus domestica*; site of infection : intestine.

Distribution : India : Maharashtra.

Remarks : Krishnamurthy and Sultana (1972) recorded this unnamed species from Maharashtra state.

B. *Monocercomonoides* species in amphibians

113. *Monocercomonoides dobelli*

Krishnamurthy and Madre, 1979

(Fig. 47a-d)

1979. *Monocercomonoides dobelli* Krishnamurthy and Madre, *Acta Protozool.*, 18(2) : 251-257.

Diagnosis : Body spherical, elongated, ovoidal or irregular in shape, 6.7-14.4 (9.2) μm $\times$ 5.1-12.9 (7.7) μm ; two blepharoplasts located close to the anterior end; two granules lying at the same or slightly different levels; two anterior flagella unequal arising from the ventral blepharoplast while the third flagellum from the dorsal one; trailing flagellum 11.8-30.5 (22.6) μm long; funis not seen; axoneme arising from the dorsal blepharoplast and extending up to the posterior end of the body; nucleus broader than long, located with its upper border abutting against the blepharoplasts; cytoplasm vacuolated and having a few deeply staining granules; three anterior flagella measuring 8.7-16.5 (12.3) μm , 10.8-24.7 (15.3) μm and 9.3-17.5 μm respectively.

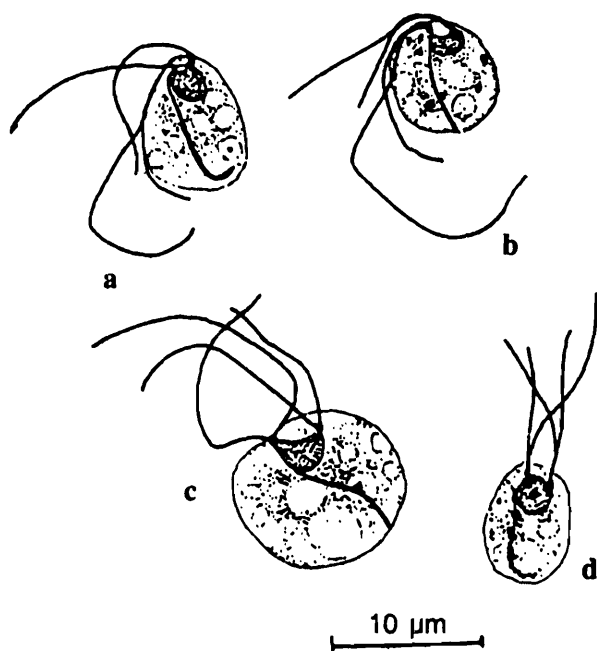


Fig. 47a-d. *Monocercomonoides dobelli*

Host : *Bufo melanostictus*; site of infection : rectum.

Distribution : India : Maharashtra (Aurangabad district).

Remarks : Krishnamurthy and Madre (1979) reported this species from Maharashtra state.

114. *Monocercomonoides* sp.

Host : *Bufo melanostictus*; site of infection : intestine.

Distribution : India : Maharashtra (Aurangabad and Nanded district).

Remarks : Krishnamurthy and Madre (1975) reported this species from Maharashtra state.

C. *Monocercomonoides* species in reptiles

115. *Monocercomonoides mehdii*

Krishnamurthy, 1967

(Fig. 48a-d)

1967. *Monocercomonoides mehdii* Krishnamurthy, *Proc. Indian Acad. Sci.*, 66(b) : 184-191.

Diagnosis : Cell body large spherical or ovoid, 7.20-17.48 (11.44) μm $\times$ 5.66-17.99 (10.57) μm in size; nucleus anterior, fairly large, 2.96 $\times$ 2.8 μm , endosome conspicuous surrounded by a clear space; 2 blepharoplasts located at the anterior end, 1.0 μm apart; 3 anterior flagella unequal 8.23-17.48 (11.95) μm , 8.74-19.54 (14.22) μm and 8.74-19.02 (14.34) μm in size; trailing flagellum long, 19.02-38.04 (28.03) μm in size; funis absent; axostyle delicate fibril, extending through the length of the body.

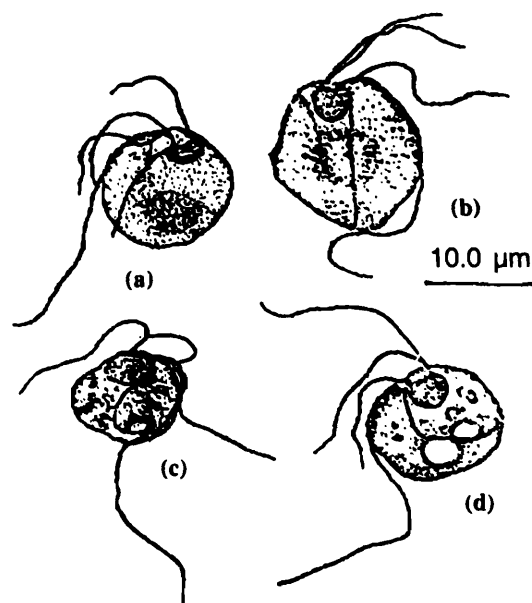


Fig. 48a-d. *Monocercomonoides mehdii*

Host : *Calotes versicolor*; site of infection : large intestine.

Distribution : India : Maharashtra (Aurangabad District).

Remarks : Krishnamurthy (1967) reported this species from Maharashtra state.

116. *Monocercomonoides viperae* Madre and Krishnamurthy, 1976
(Fig. 49a-d)

1976. *Monocercomonoides viperae* Madre and Krishnamurthy, *Marathwada Univ. J. Sci. (Bio. Sci.)*, 15(8) : 143-147.

Diagnosis : Body somewhat spherical or irregular in outlines, 6.7-13.4 (10.3) μm $\times$ 5.7-14.4 (9.2) μm ; cytoplasm vacuolated and containing several deeply staining granules; cytostome absent; two blepharoplasts located close to the anterior end at the same or slightly different levels, one of them giving rise three anterior flagella while the other to posterior flagellum and axostyle; three anterior flagella, slightly unequal, measuring 6.9-18.0 μm , 9.2-23.1 μm and 10.3-23.1 (16.9) μm respectively; posterior flagellum comparatively longer, 15.9-33 (25.7) μm ; funis absent; axostyle almost straight, 6.2-12.9 (9.8) μm , but variable in its thickness; nucleus ovoidal or somewhat irregular, averaging 2.6 μm $\times$ 3.4 μm .

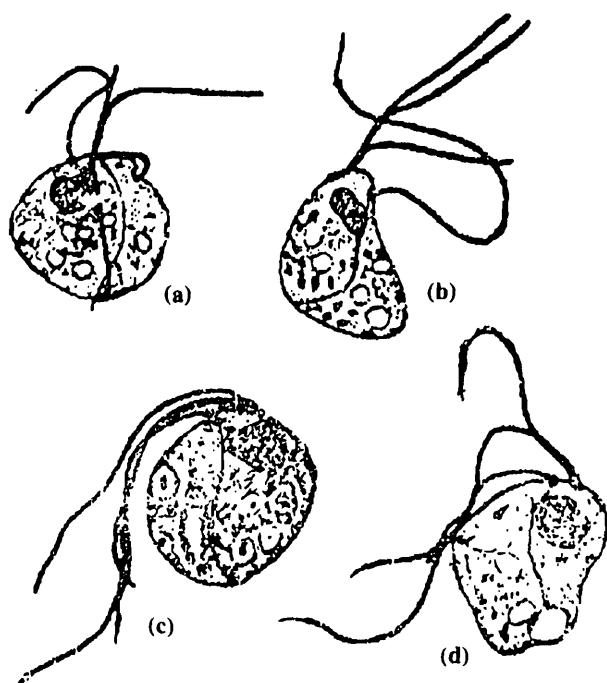


Fig. 49a-d. *Monocercomonoides viperae*

Host : *Vipera russeli*; site of infection : rectum.

Distribution : India : Maharashtra (Aurangabad district).

Remarks : Madre and Krishnamurthy, (1976) reported this species from Maharashtra state.

117. *Monocercomonoides* sp.

Host : *Calotes versicolor*; site of infection : intestine.

Distribution : India : Maharashtra (Aurangabad, Nanded).

Remarks : Krishnamurthy and Made (1975) recorded this unnamed species from this state.

118. *Monocercomonoides* sp.

Host : *Eublepharus* sp.; site of infection : intestine.

Distribution : India : Maharashtra (Aurangabad).

Remarks : Krishnamurthy and Deshmukh (1971) reported this species from this state.

Genus *Polymastix* Butschli, 1884

Diagnosis : Body almond or spindle-shaped with four free anterior flagella arranged in two pairs; flagella deflected backwards but not adherent to the cell body; nucleus pointed anteriorly, reduced; cytostome and axostyle inconspicuous; anterior pelta and slender axostyle generally not protruding posteriorly; commensals in insects.

Key to species

1. Body stumpy
 - 1.(1). Body stumpy; axostyle as long as the body taking a curved course; nucleus oval or slightly elongated, located behind the blepharoplast *P. ganapatii*
2. Body elongated
 - 2.(1). Body elongated and spindle-shaped; axostyle slender and thread-like, running a curved or wavy course; parabasal body hemispherical; nucleus spherical or slightly elongated *P. indica*

2.(2). Body elongated, small $13.22 \times 10.9 \mu\text{m}$ in size; axostyle typical, long flagella
..... *P. oryctesae*

2.(3). Body elongated or spindle-shaped, large; axostyle conspicuous curving round the nucleus, projecting out at the posterior end; nucleus spherical or slightly elongated; pellicle covered with several ectocommensal bacteria *P. rayi*

3. Body fusiform

3.(1) Body fusiform, small $13.62 \times 9.07 \mu\text{m}$ in size; axostyle absent *P. krishnamurthyi*

119. *Polymastix ganapatii* Sultana, 1976
(Fig. 50a-d)

1976. *Polymastix ganapatii* Sultana, *Acta Protozool.*, 15(1) : 1-8.

Diagnosis : Body relatively stumpy, $12.8-24.2$ (17.1) $\mu\text{m} \times 7.2-15.9$ (11.2) μm in size; anterior half very broad and rounded, posterior narrow and conical, pellicle covered with several ectocommensal bacteria; a pair of small blepharoplasts, elongated or sometimes bilobed situated at the anterior tip close together; a pair of equal flagella arising from posterior granule, and the other granule giving rise to a pair of unequal flagella; axostyle as long as the body taking a

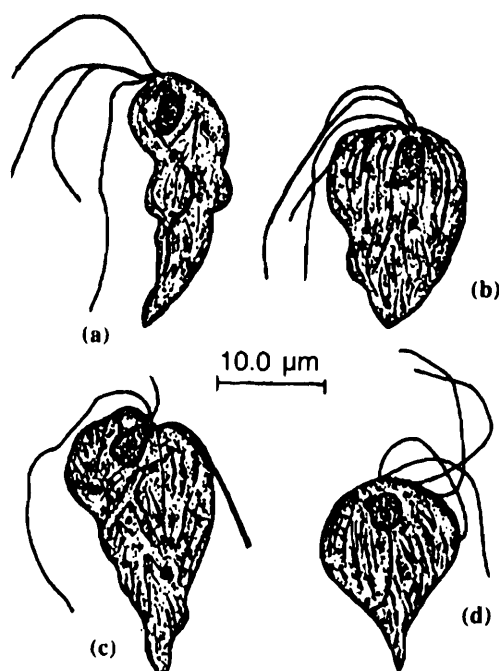


Fig. 50a-d. *Polymastix ganapatii*

curved course; nucleus oval or slightly elongated, located behind the blepharoplast, $2.1-5.1$ (3.5) $\mu\text{m} \times 1.5-4.1$ (2.6) μm in size; cytoplasm with several irregularly scattered inclusions and bacteria.

Host : Scarabaeid larvae; site of infection : hind-gut.

Distribution : India : Maharashtra (Aurangabad district).

Remarks : Sultana (1976) reported this species from Maharashtra state.

120. *Polymastix indica* Krishnamurthy and Sultana, 1978
(Fig. 51a-b)

1978. *Polymastix indica* Krishnamurthy and Sultana, *Arch. Protistenk.*, 120 : 301-303.

Diagnosis : Body elongated and spindle-shaped, $7.7-24.2$ (15.4) $\mu\text{m} \times 3.1-7.7$ (5.4) μm in size; anterior end broad, posterior rounded, pellicle covered with elongated ectocommensal bacteria; cytoplasm with several irregularly scattered inclusions; blepharoplast complex with two

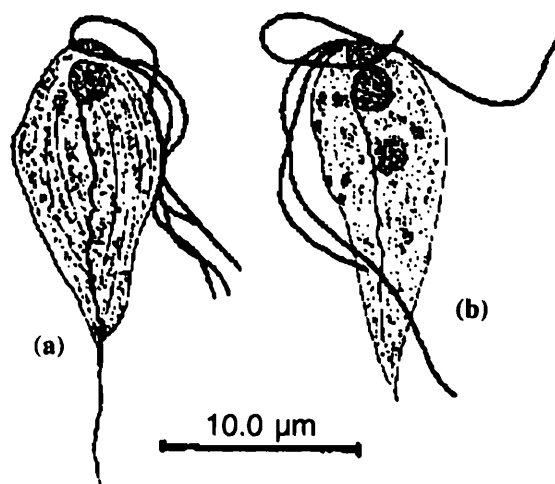


Fig. 51a-b. *Polymastix indica*

granules, present at the anterior end; 2 pairs of flagella, one small and equal, the second long and unequal; axostyle slender and thread-like, running in a curved or wavy course; parabasal body hemispherical; nucleus spherical or slightly elongated, $2.2 \mu\text{m} \times 1.9 \mu\text{m}$ on an average.

Host : *Polyphaga indica*; site of infection : hind-gut.

Distribution : India : Maharashtra (Aurangabad district).

Remarks : Krishnamurthy and Sultana (1978) reported this species from Maharashtra state.

121. *Polymastix jadhavii* Mali, 1993

1993. *Polymastix jadhavii*, *Geobios New Rep.*, **14**(2) : 89-91.

Diagnosis : Not available.

Host : *Periplaneta americana*; site of infection : gut.

Distribution : India : Maharashtra (Aurangabad district).

Remarks : Mali (1993) described this species from this state.

122. *Polymastix krishnamurthyi* Sultana and Hulsurkar, 1995

1995. *Polymastix krishnamurthyi* Sultana and Hulsurkar, *Nat. Symp. on Env. Implications of free-living and parasitic protozoa*. 1995 Abs. 2.3 pp 8.

Diagnosis : Incompletely described; parasites fusiform, small $13.62 \times 9.07 \mu\text{m}$ in size; axostyle absent.

Host : Larva of *Oryctes rhinoceros*; site of infection : gut.

Distribution : India : Maharashtra (Aurangabad district).

Remarks : Sultana and Hulsurkar (1995) reported this species from Maharashtra state.

123. *Polymastix oryctesae* Sultana and Hulsurkar, 1995

1995. *Polymastix oryctesae* Sultana and Hulsurkar, *Nat. Symp. on Env. Implications of free-living and parasitic protozoa*. 1995 Abs. 2.3. pp. 8.

Diagnosis : Incompletely described; parasites elongate, small $13.22 \times 10.9 \mu\text{m}$ in size; axostyle typical, long flagella.

Host : Larva of *Oryctes rhinoceros*; site of infection : gut.

Distribution : India : Maharashtra (Aurangabad district).

Remarks : Sultana and Hulsurkar (1995) reported this species from Maharashtra state.

124. *Polymastix rayi* Sultana, 1976b (Fig. 52a-d)

1976. *Polymastix rayi* Sultana, *Acta Protozool.*, **15**(1) : 1-8.

Diagnosis : Parasites fairly large elongated and somewhat spindle-shaped, $11.8-25.7(18.1) \mu\text{m} \times 5.7-11.8(8.4) \mu\text{m}$ in size; anterior end broad and round, posterior narrow and tapering; pellicle covered with several ectocommensal bacteria; a pair of closely located blepharoplasts seen near the anterior end; two granules similar; 2 pairs of flagella, one small and equal, the second long and unequal seen; axostyle conspicuous, $6.7-24.2(16.9) \mu\text{m}$, appearing thin as it curving round the nucleus, following a wavy course and projecting out at the posterior end; posterior projection $3.6-6.2(5.0) \mu\text{m}$ in size; parabasal body hemispherical; nucleus spherical or slightly elongated $2.2 \times 1.9 \mu\text{m}$ in size; a characteristic deeply stained horizontal rod-like body present between the nucleus and the blepharoplast; above this a less stained cap-like structure; cytoplasm with several irregularly scattered inclusions and bacteria.

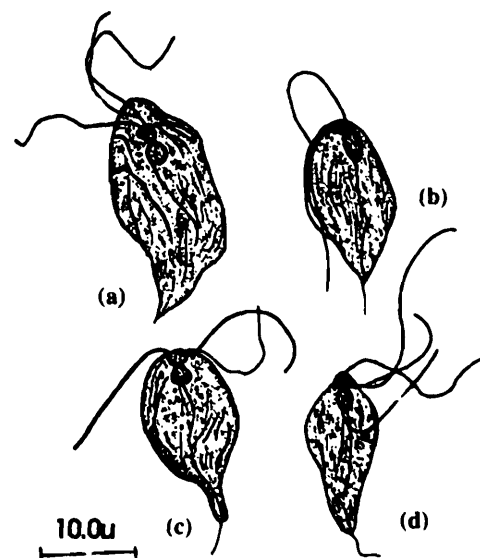


Fig. 52a-d *Polymastix rayi*

Host : *Periplaneta americana*; site of infection : hind-gut.

Distribution : India : Maharashtra (Aurangabad district).

125. *Polymastix* sp.

Host : *Gryllotalpa* sp.; site of infection : gut.

Distribution : India : Maharashtra.

Remarks : Krishnamurthy and Sultana (1972) reported this species from Maharashtra state.

Order TRICHOMONADIDA

Key to families

- Costa and cresta absent; undulating membrane absent or poorly developed MONOCEROMONADIDAE
- Cells with permanent polymonad organization CALONYMPHIDAE

Family MONOCERCOMONADIDAE

Diagnosis : As in the key

Key to the genera

- 1(2) Recurrent flagellum free or with proximal part adherent to body for some distance, typically not much longer than anterior flagella; axostylar trunk variable in thickness *Monocercomonas*
- 2(1) Small flagellates, with 5 grouped anterior free flagella and a recurrent non adherent flagellum; axostyle well developed; parabasal body 'V' shaped *Hexamastix*

Genus *Monocercomonas* Grassi, 1879

Diagnosis : As in the key.

A. *Monocercomonas* species from insects

Key to the species

- 1.(2) Cell body with 3 anterior flagella, 2 equal, long and one short
- 1.(1) Body spherical, or pyriform or somewhat irregular; nucleus central, spherical; anterior flagella, unequal; axostyle delicate, extending up to the posterior end of the body *M. digranulae*

- 1.2 Cell Body oval, or pyriform with a thin periplast; 3 anterior flagella, with 2 equal running close together, one short and separate; trailing flagellum long, axostyle slender and projecting out posteriorly like small thin spike *M. indica*

- 2(1). Cell body with 3 anterior flagella, all unequal
Body spindle-shaped or spherical; nucleus spherical or ovoid or irregular; anterior flagella unequal; axostyle very slender, tubular, long and extending beyond the posterior end of the body *M. nathi*

126. *Monocercomonas digranulae*

Krishnamurthy and Sultana, 1976b

(Fig. 53a-b)

1976. *Monocercomonas digranulae* Krishnamurthy and Sultana, *Marthwada Univ. J. Sci.*, 15(8) : 133-141.

Diagnosis : Cell body spherical, or pyriform or somewhat irregular in shape with a thin periplast, large, 5.7-12.3(8.5) μm x 3.6-10.3 (7.0) μm , nucleus central, spherical 1.0-3.6(2.2) μm x 1.5-3.1 (2.2) μm ; 2 blepharoplasts placed close together located at the anterior end; 3 anterior flagella; 2 equal and long and, the third short; trailing flagellum long, 1½ times the length of the

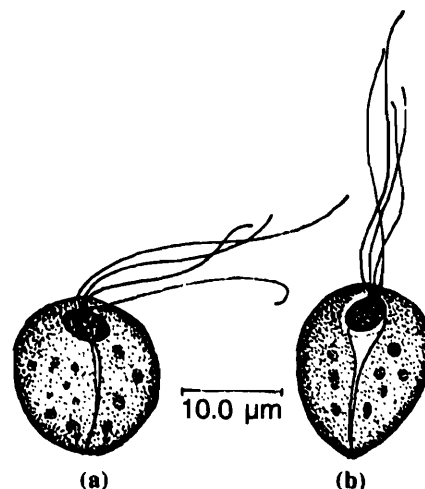


Fig. 53a-b. *Monocercomonas digranulae*

body size; axostyle extremely delicate and extending up to the posterior end of the body and in some projecting out like small spike.

Host : *Gryllotalpa africana*; site of infection : mid and hind-gut.

Distribution : India : Maharashtra (Aurangabad District).

Remarks : Krishnamurthy and Sultana (1976b) reported this species from Maharashtra state.

127. *Monocercomonas indica* Krishnamurthy and Sultana, 1976b
(Fig. 54a-b)

1976. *Monocercomonas indica* Krishnamurthy and Sultana, *Marthwada Univ. J. Sci.*, **15**(8) : 133-141.

Diagnosis : Cell body oval, or pyriform with a thin periplast, 5.7-12.9(8.8) μm $\times$ 4.1-10.3 (6.6) μm , nucleus central, spherical, 1.5-3.1 μm in diameter; blepharoplast elongated and dot-like located at the anterior end; 3 anterior flagella; 2 equal running close together and one short and separate; trailing flagellum long, 1½ times the length of the body size; axostyle slender and extending up to the posterior end of the body and projecting out like small thin spike.

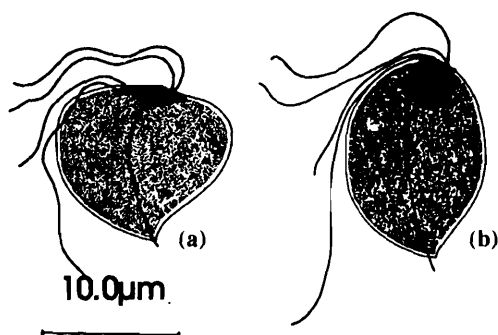


Fig. 54a-b. *Monocercomonas indica*

Host : *Pycnoscelus surinamensis*; site of infection : mid-gut.

Distribution : India : Maharashtra (Aurangabad District).

Remarks : Krishnamurthy and Sultana (1976b) reported this species from Maharashtra state.

128. *Monocercomonas nathi* Sultana and Krishnamurthy, 1976
(Fig. 55a-d)

1976. *Monocercomonas nathi* Sultana and Krishnamurthy, *Riv. Parassitol.*, **37**(2-3) : 129-131.

Diagnosis : Cell body spindle-shaped or somewhat spherical, with a thin periplast, large,

4.1-10.3(7.0) μm $\times$ 3.6-8.2 (5.7) μm , posterior end typically pointed, anterior conical or obtuse; nucleus behind the anterior end, spherical or ovoid or irregular 1.8 μm $\times$ 1.9 μm ; 2 blepharoplast complex comprising of 2 minute granules placed one above the other, each giving rise to 2 flagella; 3 anterior flagella, unequal measuring 4.1-12.3 μm , 4.6-13.9 μm , 5.7-15.4 μm ; trailing flagellum long, 7.7-15.9 (11.5) μm in length and in some cases ending in an acroneme; accessory filament not seen; axostyle very slender, tubular, long and extending beyond the posterior end of the body; pelta elongate 3.5 μm in length.

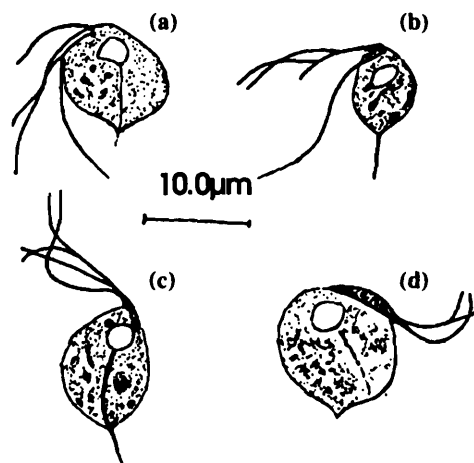


Fig. 55a-d. *Monocercomonas nathi*

Host : *Polyphaga indica*; site of infection : gut.

Distribution : India : Maharashtra (Aurangabad District).

Remarks : Sultana and Krishnamurthy (1976) reported this species from Maharashtra state.

129. *Monocercomonas* sp.

Host : *Blaberus* sp. site of infection : gut.

Distribution : India : Maharashtra (Aurangabad and Nanded).

Remarks : Krishnamurthy and Sultana (1972) recorded this unnamed species from this state.

130. *Monocercomonas* sp.

Host : *Gryllotalpa* sp.; site of infection : gut.

Distribution : India : Maharashtra.

Remarks : Krishnamurthy and Sultana (1972) recorded this unnamed species from this state.

131. *Monocercomonas* sp.

Host : *Oryctes rhinoceros* larvae; site of infection : gut.

Distribution : India : Maharashtra.

Remarks : Krishnamurthy and Sultana (1972) recorded this unnamed species from this state.

B. *Monocercomonas* from amphibians

Key to the species

1. Body typically pyriform in shape, nucleus longer than broad or rounded; axostyle well developed; pelta short and half sickle-shaped *M. aurangabadensis*
- Body not pyriform, varying from spherical to oval or ovoid in shape 2
2. Body spherical or ovoid in shape 3
- Body spherical or oval or pyriform in shape 4
- 3a. Flagellates with axostyle slender, tubular, uniform; spike broad; nucleus large, ovoid; cytostome absent *M. maharashtrae*
- 3b. Flagellates with large nucleus, elongated or kidney-shaped; accessory filament present; axostyle slender, tubular, uniform; cytostome absent *M. sultanae*
- 4a. Body spherical, or oval; nucleus central, spherical; axostyle tubular, small spike-like projection; pelta narrow and triangular *M. cyanophlycti*
- 4b. Body spherical, or pyriform, nucleus central, spherical or ovoid; axostyle slender; pelta absent *M. melanosticti*

132. *Monocercomonas cyanophlycti*

Krishnamurthy and Madre, 1979

(Fig. 56a-c)

1976. *Monocercomonas cyanophlycti* Krishnamurthy and Madre, *Arch. Protistenk.*, 121 : 64-79.

Diagnosis : Cell body spherical, or oval in shape; 6.2-13.2(9.10) μm $\times$ 5.6-10.8 (7.8) μm , nucleus central, spherical 1.5 $\times$ 1.3 μm to 4.10 $\times$ 3.10 (3.1 $\times$ 2.01) μm ; 2 blepharoplasts located at the anterior end giving rise to 3 unequal anterior flagella and a trailing flagellum; anterior flagella 8.2-19.02 (12.34) μm , 11.3-20.56 (16.15) μm , 12.3-23.10 (16.64) μm in length; trailing flagellum 12.9-37.01 (23.56) μm long, 2-3 times the length of the body size; axostyle tubular and hyaline extending up to the posterior end of the body and projecting out like small spike; no endaxostylar granules; periaxostylar granules near the posterior end; pelta narrow and triangular; cytoplasm uniformly stained.

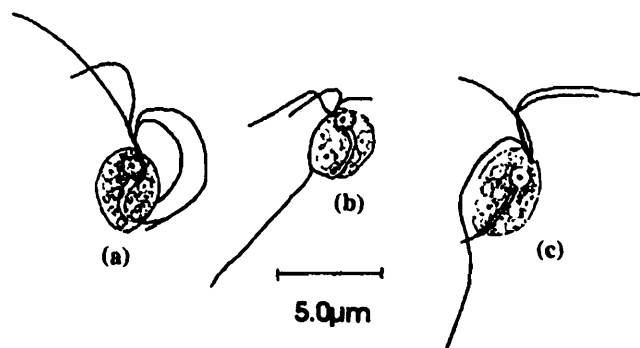


Fig. 56a-c. *Monocercomonas cyanophlycti*

Host : *Rana cyanophlyctis*; site of infection : rectum.

Distribution : India : Maharashtra (Aurangabad District).

Remarks : Krishnamurthy and Madre (1979) reported this species from Maharashtra state.

133. *Monocercomonas melanosticti*

Krishnamurthy and Madre, 1979

(Fig. 57a-d)

1976. *Monocercomonas melanosticti* Krishnamurthy and Madre, *Arch. Protistenk.*, 121 : 64-79.

Diagnosis : Cell body spherical, or pyriform in shape, posterior end slightly tapering, 7.2-13.4 (10.17) μm $\times$ 7.2-13.4 (9.9) μm ; nucleus central, spherical or ovoid 2.1-4.6 (3.15) μm $\times$ 1.3-3.6 (2.14) μm ; 2 blepharoplast located at the anterior end giving rise to 3 unequal anterior flagella and a trailing flagellum; anterior flagella 7.7-17.99

(10.80) μm , 10.3×18.5 (15.35) μm , 10.8-19.53 (16.39) μm in length; trailing flagellum 14.4-25.7 (19.99) long, 2-3 times the length of the body size; axostyle slender extending up to the posterior end of the body and projecting out like small spike; no endaxostylar granules; pelta absent; cytoplasm uniformly stained without any inclusions.

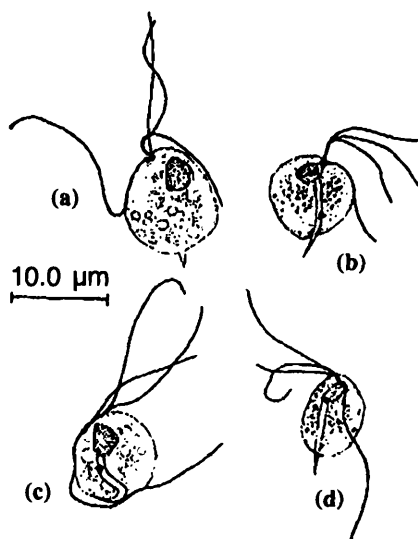


Fig. 57a-d. *Monocercomonas melanosticti*

Host : *Bufo melanostictus*; site of infection : rectum.

Distribution : India : Maharashtra (Aurangabad District).

Remarks : Krishnamurthy and Madre (1979) reported this species from Maharashtra state.

134. *Monocercomonas aurangabadensis*

Krishnamurthy and Madre, 1979

(Fig. 58a-d)

1979. *Monocercomonas aurangabadensis* Krishnamurthy and Madre, *Arch. Protistenk.*, **121** : 64-79.

Diagnosis : Cell body typically pyriform, posterior end slightly tapering, 7.71-15.94(11.25) $\mu\text{m} \times 4.63$ -11.82(7.99) μm in size; nucleus longer than broad or rounded 2.57-4.63 $\times$ 3.03-3.6 (3.45 $\times$ 2.4) μm ; 2 blepharoplast located at the anterior end giving rise to 3 unequal anterior flagella and a trailing flagellum; anterior flagella 10.28-20.56 (16.1) μm , 13.90 $\times$ 25.70 (20.57) μm , 13.9-28.27 (20.6) μm in length; trailing flagellum 21.08-44.73(32.96) μm long, 2-3 times the length of the body size; axostyle well developed extending up

to the posterior end of the body and projecting out like filamentous spike; capitulum absent; no endaxostylar granules; pelta short and half sickle-shaped; cytoplasm uniformly stained without any inclusions.

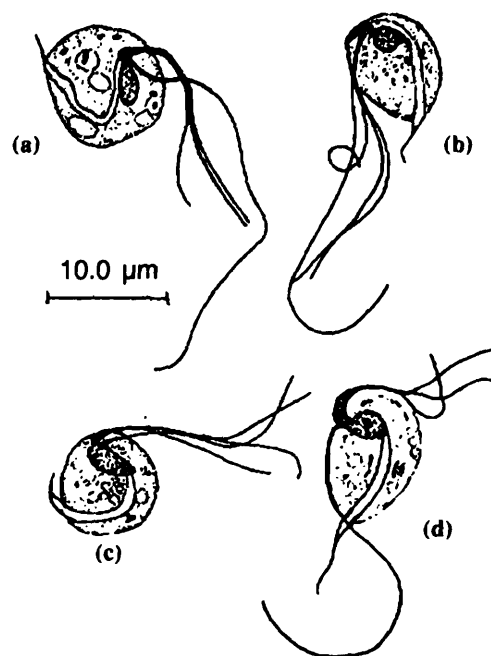


Fig. 58a-d. *Monocercomonas aurangabadensis*

Host : *Bufo melanostictus*; site of infection : rectum.

Distribution : India : Maharashtra (Aurangabad District).

Remarks : Krishnamurthy and Madre (1979) reported this species from Maharashtra state.

135. *Monocercomonas maharashtra*

Krishnamurthy and Shete, 1981

(Fig. 59a-d)

1981. *Monocercomonas maharashtra* Krishnamurthy and Shete, *Arch. Protistenk.*, **124** : 398-404.

Diagnosis : Cell body spherical or ovoid; 6.1-10.8(8.5) $\mu\text{m} \times 5.6$ -9.4(7.2) μm in size; periplast thin; blepharoplast anterior close and above the nucleus; 3 unequal anterior flagella measuring 5.7-15.5 μm , 12.7-18.8 μm , 14.1-19.8 μm respectively; trailing flagellum long, 17.4-29.2 μm in length; axostyle slender, tubular, uniform in diameter and extending beyond the posterior end of the body as abroad spike; endoxostylar granules present;

accessory filament not seen; nucleus large, ovoid $1.9-3.8(3.2) \mu\text{m} \times 1.4-2.4(2.1) \mu\text{m}$; cytoplasm granular; cytostome absent.

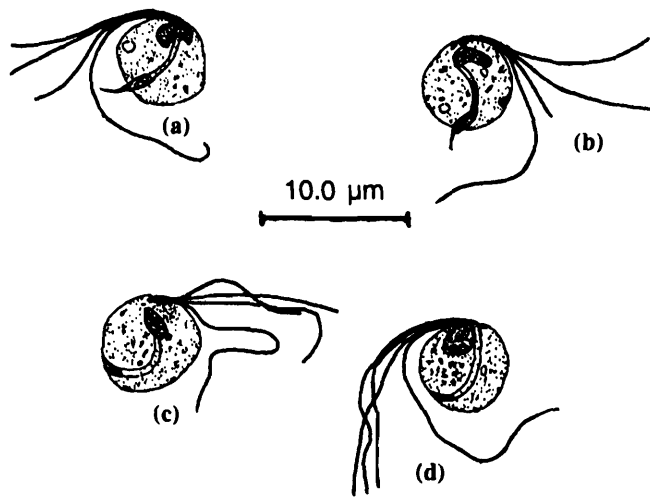


Fig. 59a-d. *Monocercomonas maharashtra*

Host : *Rana cyanophlyctis*; site of infection : rectum.

Distribution : India : Maharashtra (Aurangabad District).

Remarks : Krishnamurthy and Shete (1981) reported this species from Maharashtra state.

136. *Monocercomonas sultanae* Krishnamurthy and Shete, 1981
(Fig. 60a-c)

1981. *Monocercomonas sultanae* Krishnamurthy and Shete, *Arch. Protistenk.*, 124 : 398-404.

Diagnosis : Cell body spherical or ovoid; $7.0-13.2(10.2) \mu\text{m} \times 5.6-10.8(8.8) \mu\text{m}$ in size; periplast

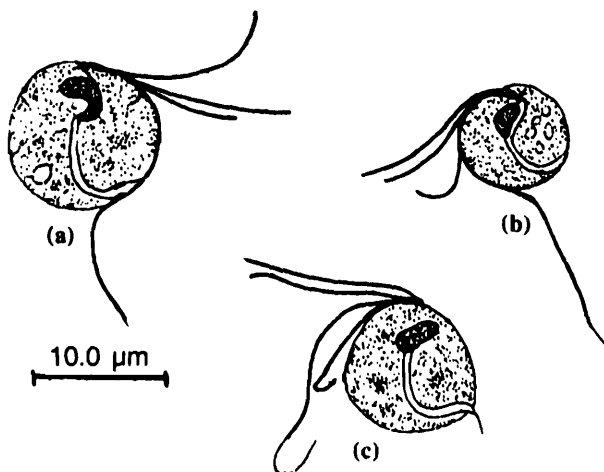


Fig. 60a-c. *Monocercomonas sultanae*

thin; blepharoplast anterior close and above the nucleus; 3 unequal anterior flagella measuring $7.5-15.5(11.1) \mu\text{m}$, $8.0-19.8(14.4) \mu\text{m}$, $9.4-21.7(16.2) \mu\text{m}$ respectively; trailing flagellum long, $16.0-30.1(21.6) \mu\text{m}$ in length; accessory filament present; axostyle slender, tubular, uniform in diameter and extending beyond the posterior end of the body as abroad spike; nucleus large, elongated or kidney-shaped, $1.9-3.8(2.9) \mu\text{m} \times 0.9-1.9(1.6) \mu\text{m}$; cytoplasm vacuolated; cytostome absent.

Host : *Rana tigrina*; site of infection : rectum.

Distribution : India : Maharashtra (Aurangabad District).

Remarks : Krishnamurthy and Shete (1981) reported this species from Maharashtra state.

137. *Monocercomonas* sp.

Host : *Rana cyanophlyctis*; site of infection : intestine.

Distribution : India : Maharashtra (Aurangabad and Nanded).

Remarks : Krishnamurthy and Madre (1975) recorded this unnamed species from this state.

138. *Monocercomonas* spp(2)

Host : *Bufo melanostictus*; site of infection : intestine.

Distribution : India : Maharashtra (Aurangabad and Nanded).

Remarks : Krishnamurthy and Madre (1975) recorded this unnamed species from this state.

C. *Monocercomonas* from reptiles

Key to the species

1. Body large, pyriform 3
2. Body relatively small, pyriform 4
- 3.1. Body large, typically pyriform; trailing flagellum short; pelta delicate and filamentous; axostyle slender; spike shorter *M. breviflagellata*

- 3.2. Body large, typically pyriform; accessory filament slightly longer; pelta absent; axostyle more slender; spike shorter *M. calotesi*
- 4.1. Body typically pyriform; cytostome absent; axostyle very slender, tubular, long; capitulum not distinct; pelta slender long and crescent-shaped; nucleus large, ovoid
..... *M. garnhami*
- 4.2. Body typically pyriform; accessory filament slightly longer; pelta broad leaf-like or half sickle shaped; moderately developed with long spike *M. marathwadensis*

139. *Monocercomonas breviflagellata*

Mali, 1978

1978. *Monocercomonas breviflagellata* Mali, *Riv. Parassitol.*, **39**(1) : 43-53.

Diagnosis : Cell body large, typically pyriform in living condition but tending to become rounded on fixation; trailing flagellum short; accessory filament slightly longer; pelta delicate and filamentous; axostyle more slender; spike shorter.

Host : *Naja naja*; site of infection : rectum.

Distribution : India : Maharashtra (Aurangabad district).

Remarks : Mali (1978) reported this species from Maharashtra state.

140. *Monocercomonas garnhami*

Krishnamurthy, 1968b

(Fig. 61a-b)

1968. *Monocercomonas garnhami* Krishnamurthy. *Riv. Parassitol.*, **29**(1) : 8-11.

Diagnosis : Cell body typically pyriform in living condition but tending to become rounded on fixation; cytoplasm without inclusions; cytostome absent; 3 unequal anterior flagella measuring 8.5-9.8 μm , 14.9-22.6 μm , 16.5-22.6 μm respectively; trailing flagellum long, 19.5-37.0 μm in length, a short accessory filament associated with its proximal portion, distal end of the flagellum with an acroneme of 1.0-5.7 μm in length; axostyle very slender, tubular, long and extending beyond the posterior end of the body;

capitulum not distinct; no endoaxostylar granules or periaxostylar chromatic rings; pelta slender long and crescent-shaped; nucleus large, ovoid, 1.5-3.6 (2.6) μm $\times$ 1.0-3.6 (2.2) μm in size, located behind blepharoplast.

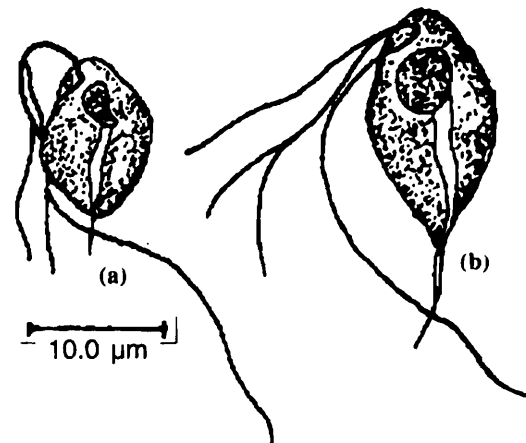


Fig. 61a-b. *Monocercomonas garnhami*

Host : *Lycodon aulicus*; site of infection : rectum.

Distribution : India : Maharashtra (place not mentioned) and Andhra Pradesh.

Remarks : Krishnamurthy (1968) reported this species from Maharashtra state.

141. *Monocercomonas marathwadensis*

Mali, 1978

1978. *Monocercomonas marathwadensis* Mali, *Riv. Parassitol.*, **39**(1) : 43-53.

Diagnosis : Cell body typically pyriform in living condition but tending to become rounded on fixation; accessory filament slightly longer; pelta broad leaf-like or half sickle-shaped; nucleus without endosome ; peripheral chromatin granules only few; axostyle moderately developed with long spike.

Host : *Hemidactylus giganteus*; site of infection : rectum.

Distribution : India : Maharashtra (Aurangabad district).

Remarks : Mali (1978) reported this species from Maharashtra state.

142. *Monocercomonas calotesi* Madre, 1978

1978. *Monocercomonas calotesi* Madre, *Riv. Parassitol.*, 39(1) : 43-53.

Diagnosis : Cell body large, typically pyriform in living condition but tending to become rounded on fixation; accessory filament slightly longer. pelta absent ; endoaxostylar granules present; axostyle more slender ; spike shorter.

Host : *Calotes versicolor*; site of infection : rectum.

Distribution : India : Maharashtra (Aurangabad).

Remarks : Madre (1978) described this species from Maharashtra state, Saratchandra (1979) also described a species of the same name but belonging to different subgenus viz., *Alimonas*. These two species require reexamination and review.

143. *Monocercomonas (Alimonas) hemidactyli* Madre, 1979

1979. *Monocercomonas (Alimonas) hemidactyli* Madre, *Riv. Parasitol.*, 40(1-2) : 91-96.

Diagnosis : Not available.

Host : *Hemidactylus giganteus*; site of infection : intestine.

Distribution : India : Maharashtra.

Remarks : Madre (1979) described this species from Maharashtra.

144. *Monocercomonas najae* Krishnamurthy, 1968 (Fig. 62a-d)

1968. *Monocercomonas najae* Krishnamurthy, *Riv. Parassitol.*, 29(1) : 1-16.

Diagnosis : Flagellates oval or pyriform, 8.2-15.4 (11.5) μm $\times$ 6.2-12.3 (9.1) μm , with long accessory filament, 4.2 μm in length; cytostome absent; anterior flagella unequal, three in number, measuring 10.8-18.0 (15.3) μm , 12.9-22.6 (18.0) μm and 14.4-22.6 (19.3) μm ; trailing flagellum longer, 19.0-40.6 (31.8) μm , with an accessory filament at its base; ratio of accessory/trailing flagellum-0.13; pelta large, broad and sickle-

shaped; axostyle tubular, very slender end sharply tapering and projecting outside the body; periaxostylar rings absent; spike 0.5-4.1 (1.5) μm in length; nucleus typically elongated and without endosome.

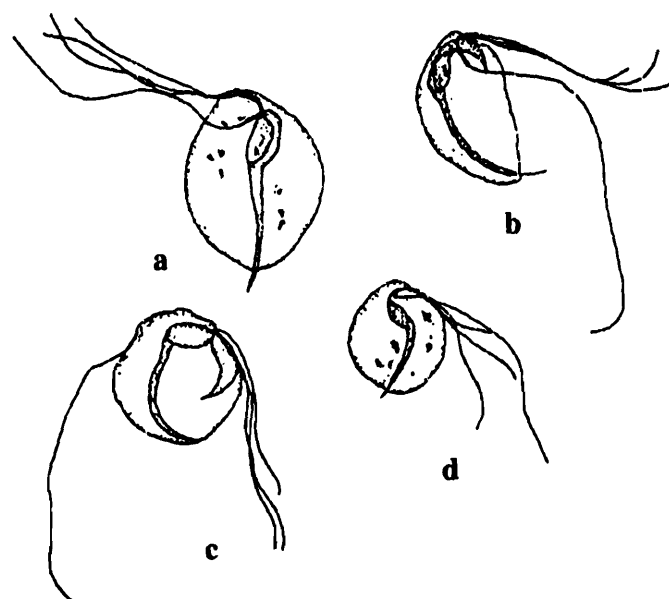


Fig. 62a-d. *Monocercomonas najae*

Host : *Naja naja*; site of infection : large intestine.

Distribution : India : Maharashtra (Aurangabad).

Remarks : Krishnamurthy (1968) described this species from Maharashtra.

145. *Monocercomonas shortii* Krishnamurthy, 1968 (Fig. 63a-e)

1968. *Monocercomonas shortii* Krishnamurthy, *Riv. Parassitol.*, 29 : 81-90.

Diagnosis : Flagellates pyriform, 5.7-12.3 (6.8) μm $\times$ 3.6-8.7 (5.3) μm , with long accessory filament, 3.8 μm in length; anterior half broad and posterior half conical; cytoplasm uniformly stained but devoid of any inclusions; three anterior flagella unequal, 8.7-17.5 μm , 9.8-20.1 μm and 13.9-21.6 μm respectively; posterior flagellum 20.6-33.9 μm long; ratio accessory filament / trailing flagellum-0.13; pelta broad, flag-like; axostyle broad with a spike of 2.1-7.2 (5.3) μm but without capitulum; ratio of spike/body length-

0.78; periaxostylar chromatic rings absent; nucleus pyriform averaging $2.6 \mu\text{m} \times 1.8 \mu\text{m}$ and with endosome.

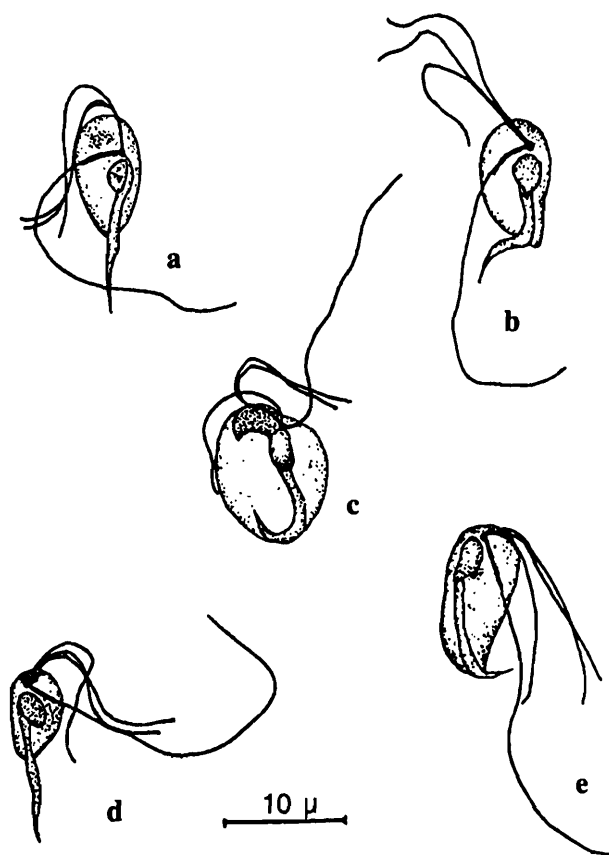


Fig. 63a-e. *Monocercomonas shortii*

Host : *Hemidactylus brooki*; site of infection : intestine.

Distribution : India : Maharashtra.

Remarks : Krishnamurthy (1968) described this species from Maharashtra.

146. *Monocercomonas longiflagellata*

Krishnamurthy, 1968

(Fig. 64a-d)

1968. *Monocercomonas shortii* Krishnamurthy, *Riv Parassitol.*, **29** : 81-90.

Diagnosis : Flagellates pyriform, 7-15.4 (11.3) $\mu\text{m} \times 4.1-9.3$ (5.9) μm ; without accessory filament; cytoplasm uniformly stained with only a few granules on the lateral side of the nucleus; three unequal anterior flagella, measuring 12.9-18.0 μm , 13.9-20.6 μm and 15.4-22.1 μm respectively; posteriorly flagellum extremely conspicuous and long, 36.5-56.6 μm in length, axostyle long and slender with its anterior end expanded to form a

small capitulum; pelta large, crescentic; axostylar spike long – 3.1-11.3 (7.6); ratio of spike/body length 0.32; trailing flagellum more than four times body length.

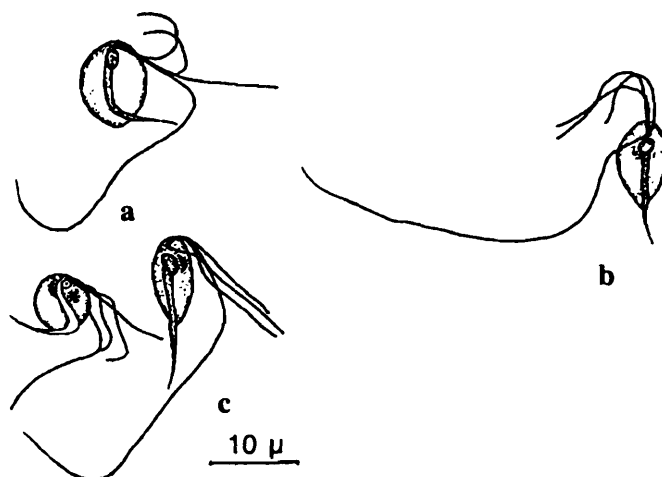


Fig. 64a-d. *Monocercomonas longiflagellata*

Host : *Calotes versicolor*; site of infection : intestine.

Distribution : India : Maharashtra.

Remarks : Krishnamurthy (1968) described this species from Maharashtra.

147. *Monocercomonas desh mukhi*

Krishnamurthy and Deshmukh 1971

(Fig. 65a-d)

1971. *Monocercomonas desh mukhi* Krishnamurthy and Deshmukh, *Marathwada Univ. J.*, **10**(3) : 109-112.

Diagnosis : Cell body ovoid to pyriform in shape and somewhat variable in size; cytoplasm devoid of any granules, but vacuolated in some forms; three anterior and one posterior flagella originated from the blepharoplast; anterior flagella slightly unequal, measuring 9.25-17.99 μm , 11.82-22.62 μm and 13.37-22.62 μm in length; posterior flagellum longer, 14.39-39.59 μm in length; axostyle tubular, flexible and well developed, anterior part expanded to form a small calyx, middle portion somewhat narrower, granules absent; nucleus large, ovoid or elliptical in shape.

Host : *Eublepharus* sp. site of infection : rectum.

Distribution : India : Maharashtra (Aurangabad).

Remarks : Krishnamurthy and Deshmukh (1971) described this species from this state.

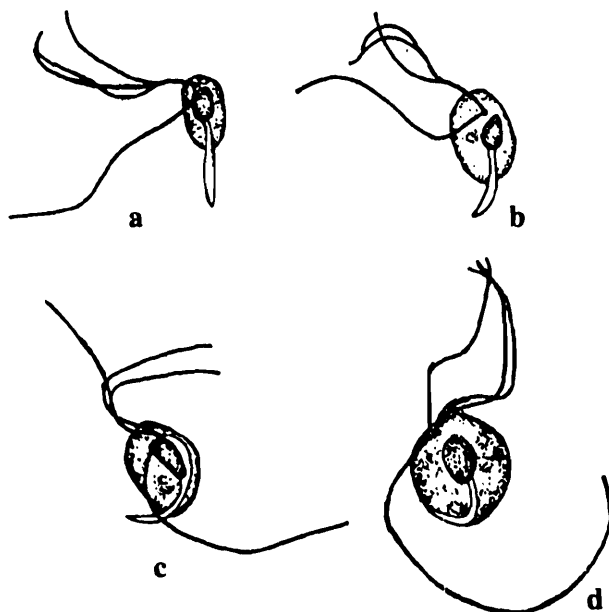


Fig. 65a-d. *Monocercomonas deshmukhi*

148. *Monocercomonas elapheae*

Krishnamurthy, 1968

(Fig. 66a-d)

1968. *Monocercomonas elapheae* Krishnamurthy, Rev. Parasitol., 29 : 1-16.

Diagnosis : Body oval or elliptical in shape, 8.2-14.9 (11.6) μm $\times$ 4.1-12.9 (7.7) μm ; anterior half somewhat narrower than the posterior half; cytoplasm filled with deeply staining and irregularly scattered granules; blepharoplast little distance behind the anterior end of the body giving origin to the flagella and axostyle; anterior flagella unequal, measuring 9.8-19.5(14.9) μm , 10.3-21.6 (17.1) μm and 11.3-22.1 (18.2) μm ; trailing flagellum 19.0-39.6 (29.4) μm long; acrosome on the distal end, measuring average length 3.9 μm ; accessory filament absent; axostyle tubular, uniform diameter throughout its course inside the body; anterior end slightly expanded in some forms; distinct capitulum lacking; posterior portion, projecting outside the body tapering sharply to a fine point, measuring 2.1-7.2(3.7) μm ; periaxostylar chromatic rings absent; nucleus somewhat elliptical, situated a little above the middle of the body, 2.1-4.1 (12.8) μm $\times$ 1.0-4.1 (1.9) μm ; small eccentric endosome in well differentiated specimens.

Host : *Elapha* (= *Coluber*) *helena*; site of infection : large intestine and rectum.

Distribution : India : Maharashtra.

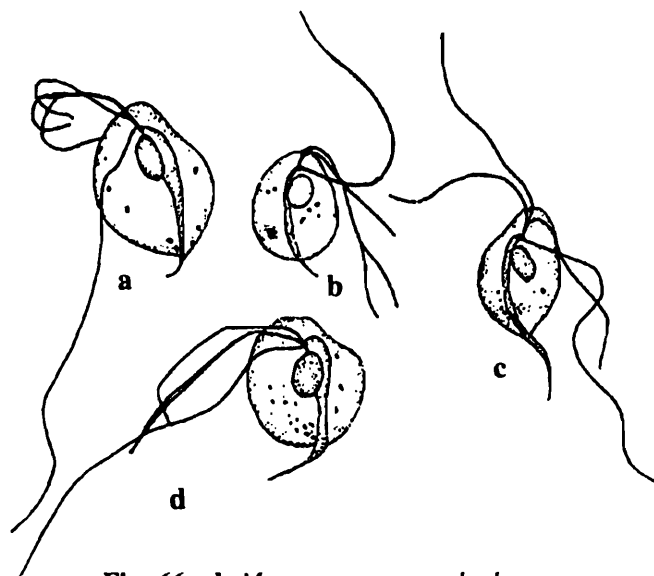


Fig. 66a-d. *Monocercomonas elapheae*

Remarks : Krishnamurthy (1968) described this species from Maharashtra.

149. *Monocercomonas* sp.

Host : *Chameleon zeylanicus*; site of infection : intestine.

Distribution : India : Maharashtra (Aurangabad and Nanded).

Remarks : Krishnamurthy and Madre (1975) recorded this species from this state.

150. *Monocercomonas* spp. (2)

Host : *Calotes versicolor*; site of infection : intestine.

Distribution : India : Maharashtra (Aurangabad and Nanded).

Remarks : Krishnamurthy and Madre (1975) recorded this species from this state.

151. *Monocercomonas* sp.

Host : *Hemidactylus brooki*; site of infection : intestine.

Distribution : India : Maharashtra (Aurangabad and Nanded).

Remarks : Krishnamurthy and Madre (1975) recorded this species from this state.

152. *Monocercomonas* sp.

Host : *Hemidactylus coctaei*; site of infection : intestine.

Distribution : India : Maharashtra.

Remarks : Krishnamurthy and Madre (1975) recorded this species from this state.

153. *Monocercomonas* spp. (3)

Host : *Hemidactylus giganteus*; site of infection : intestine.

Distribution : India : Maharashtra (Aurangabad and Nanded).

Remarks : Krishnamurthy and Madre (1975) recorded this unnamed species from this state.

154. *Monocercomonas* sp.

Host : *Varanus indica*; site of infection : intestine.

Distribution : India : Maharashtra (Aurangabad and Nanded).

Remarks : Krishnamurthy and Madre (1975) recorded this unnamed species from this state.

155. *Monocercomonas* sp.

Host : *Varanus* sp. site of infection : intestine.

Distribution : India : Maharashtra.

Remarks : Krishnamurthy and Madre (1975) recorded this unnamed species from this state.

156. *Monocercomonas* spp. (2)

Host : *Naja naja*; site of infection : intestine.

Distribution : India : Maharashtra (Aurangabad and Nanded).

Remarks : Krishnamurthy and Madre (1975) recorded this species from this state.

157. *Monocercomonas* sp.

Host : *Vipera russelli*; site of infection : intestine.

Distribution : India : Maharashtra (Aurangabad and Nanded).

Remarks : Krishnamurthy and Madre (1975) recorded this species from this state.

Genus *Hexamastix* Alexeieff, 1911

Diagnosis : Small flagellates, with 5 grouped anterior free flagella and a recurrent non adherent flagellum; axostyle well developed; parabasal body 'V' shaped;

A. *Hexamastix* species from insects

Key to the species

- 1(2) Body round or pyriform; axostyle slender, tubular; flagella unequal; no distinct capitulum; nucleus spherical or oval pelta well defined, flag-like or cap-like
.....*H. alexeieffi*
- 2(1) Body fusiform blepharoplast with 2 distinct granules; axostylar spike and funis conspicuously long; pelta, parabasal body and cytostome absent*H. sanagappae*
- 2.1 Body fusiform, ovoid or rounded; 6 unequal flagella; axostyle very slender running through the body and projecting out like spike at the posterior end; no distinct capitulum; nucleus spherical or transversely elongated
.....*H. marthwadensis*
- 2.2 Body fusiform, ovoid or elliptical; flagella unequal; axostyle thin, slender appearing flexible; nucleus spherical or ovoid
.....*H. polyphagae*

158. *Hexamastix alexeieffi* Sultana, 1975
(Fig. 67a-b)

1975. *Hexamastix alexeieffi* Sultana. *Marthwada Univ. J. Sci.*, **14** : 224-228.

Diagnosis : Body round or pyriform; 5.7-13.9 (9.5) μm $\times$ 4.6-12.3 (8.1) μm in size; fully grown forms with 6 flagella, cytoplasm with several irregularly scattered inclusions; blepharoplast complex of two granules situated one above the other; 6 unequal flagella of which 4 long and anterior; all flagella directed forwards, variable in size; axostyle slender, tubular, 5.14-11.82 (8.78)

μm long, running through the body and projecting out like a spike at the posterior end; no distinct capitulum; nucleus spherical or oval $1.54\text{--}4.63$ (2.84) $\mu\text{m} \times 1.54\text{--}4.11$ (2.97) μm in size; pellicle thin; pelta well defined, flag-like or cap-like.

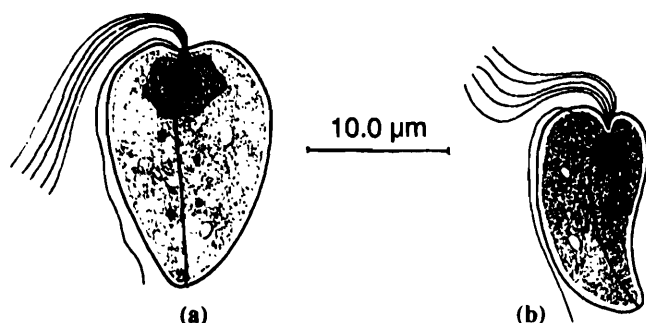


Fig. 67a-d. *Hexamastix alexei*

Host : *Polyphaga indica*; site of infection : hind-gut.

Distribution : India : Maharashtra (Aurangabad District).

Remarks : Sultana (1975) reported this species from Maharashtra state.

159. *Hexamastix marthwadensis*
Krishnamurthy and Sultana, 1977a
(Fig. 68a-d)

1977. *Hexamastix marthwadensis* Krishnamurthy and Sultana, *Acta Protozool.*, 16(3/4) : 219-223.

Diagnosis : Body fusiform, ovoid or somewhat rounded; fully grown forms with 6 flagella, $8.2\text{--}10.3$ (9.0) $\mu\text{m} \times 6.7\text{--}9.8$ (8.5) μm in size; cytoplasm

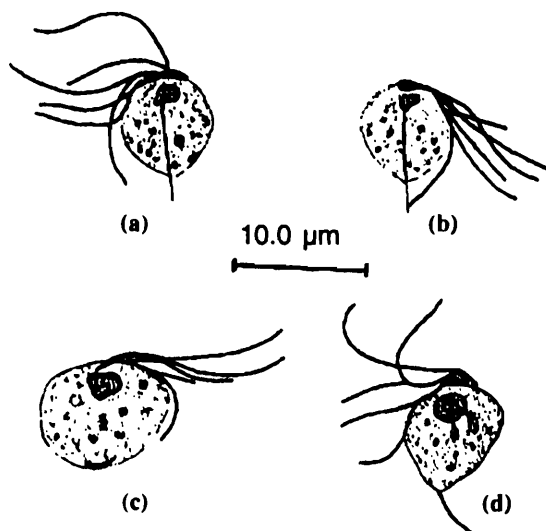


Fig. 68a-d. *Hexamastix marthwadensis*

with several irregularly scattered inclusions; blepharoplast single granule masked by pelta; 6 unequal flagella, 5 anteriorly directed and one posteriorly directed; variable in size; axostyle very slender running through the body and projecting out like spike at the posterior end; no distinct capitulum; nucleus spherical or transversely elongated, $1.0\text{--}2.6$ (2.1) $\mu\text{m} \times 2.1\text{--}2.6$ (2.3) μm in size.

Host : *Polyphaga indica*; site of infection : hind-gut.

Distribution : India : Maharashtra (Aurangabad District).

Remarks : Krishnamurthy and Sultana (1977) reported this species from Maharashtra state.

160. *Hexamastix polyphagae* Sultana, 1976
(Fig. 69a-d)

1976. *Hexamastix polyphagae* Sultana, *Riv. Parassitol.*, 37(1) : 1-5.

Diagnosis : Body fusiform, ovoid or elliptical; fully grown forms with 6 flagella, measuring $8.7\text{--}12.9$ (9.8) $\mu\text{m} \times 5.7\text{--}15.4$ (8.5) μm in size; cytoplasm with several irregularly scattered inclusions;

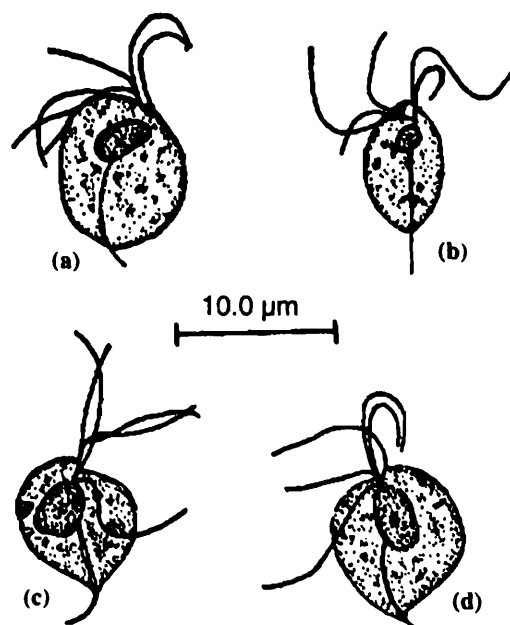


Fig. 69a-d. *Hexamastix polyphagae*

blepharoplast distinct giving rise to axostyle and 6 unequal flagella; 5 flagella anteriorly directed and one trailing on the side of the body with variable size; axostyle thin slender appearing

flexible, 7.7-11.3(10.3) μm in size, running through the body and projecting out like a filamentous spike at the posterior end; nucleus spherical or ovoid, 2.1-5.1 $\mu\text{m} \times$ 2.1-3.6 μm in size.

Host : *Polyphaga indica*; site of infection : hind-gut.

Distribution : India : Maharashtra (Aurangabad District).

Remarks : Sultana (1976) reported this species from Maharashtra state.

161. *Hexamastix sanagappae* Mali, 2003
(Fig.70a-d)

1995. *Hexamastix sanagappae* Mali, *Nat. Symp. on Env. Implications of free-living and parasitic Protozoa*. 1995 Abs. 2.2.

2003. *Hexamastix sanagappae* Mali, *Geobios*, **30** : 80-82.

Diagnosis : Body fusiform, measuring 5.65-11.31 $\mu\text{m} \times$ 4.62-11.28 μm in size; blepharoplast with 3 distinct granules arranged in triangular manner; rounded or ovoidal nucleus; cytoplasm with large darkly staining bodies of various sizes and shapes; tubular axostyle projecting outside the body as axostylar spike and funis conspicuously long; pelta, parabasal body and cytostome absent.

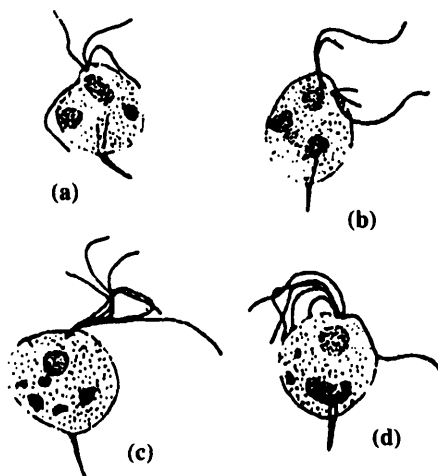


Fig. 70a-d. *Hexamastix sanagappae*

Host : *Pycnoscelus surinamensis*; site of infection : hind-gut.

Distribution : India : Maharashtra (Aurangabad District).

Remarks : Mali (1995) reported this species from Maharashtra state.

162. *Hexamartix* sp.

Host : *Gryllotalpa* sp.; site of infection : gut.

Distribution : India : Maharashtra.

Remarks : Krishnamurthy and Sultana (1972) reported this unnamed species from this state.

B. *Hexamastix* species from reptiles

Key to the species

1. Body oval or spherical; blepharoplast single, masked by pelta; axostyle hyaline narrows towards the posterior end; pelta crescent shaped; nucleus spherical or oval *H. lacertae*
2. Body pyriform or oval; blepharoplast with 2 distinct granules; axostyle slender; parabasal body rod-like; axostylar spike and funis conspicuously long *H. dobelli*

163. *Hexamastix lacertae* Janakidevi, 1961
(Fig.71a-d)

1961. *Hexamastix lacertae* Janakidevi, 1961, *Z. Parasitenk.*, **21**(3/4) : 151-154.

1968. *Hexamastix lacertae* : Krishnamurthy, *Riv. Parassitol.*, **29**(4) : 1-16.

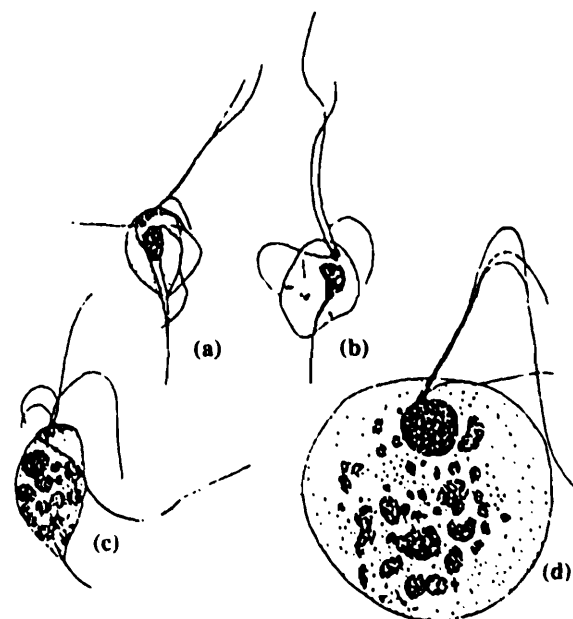


Fig.71a-d. *Hexamastix lacertae*

Diagnosis : Body oval or spherical; fully grown forms with 6 flagella, $4.5-12.0(5.1) \mu\text{m} \times 2.5-10.0 (5.1) \mu\text{m}$ in size; cytoplasm with several irregularly scattered inclusions; blepharoplast single granule masked by pelta; 6 unequal flagella; 5 anteriorly directed and one posteriorly directed with variable size; axostyle very hyaline narrowing towards the posterior end of the cytostome and coming out of the body like a thin filament; pelta crescent-shaped; nucleus spherical or oval, $2.0 \mu\text{m}$ in diameter.

Host : *Uromastix hardwickii*; site of infection : large intestine.

Distribution : India : Maharashtra (exact locality mentioned) and Andhra Pradesh.

Remarks : Krishnamurthy (1968) reported this species from Maharashtra state.

164. *Hexamastix dobelli* Janakidevi, 1961
(Fig. 72a-b)

1961. *Hexamastix dobelli* Janakidevi, *J. Protozool.*, 8(3) : 294-296.

1968. *Hexamastix dobelli* Krishnamurthy, *Riv. Parassitol.*, 29(4) : 1-16.

Diagnosis : Body pyriform or oval or round, measuring $6.0-16.5 \mu\text{m} \times 2.0-10.3 \mu\text{m}$ in size; anterior flagella unequal; blepharoplast with 2 distinct granules; axostyle slender projecting like a spine; perinnuclear granules present in the

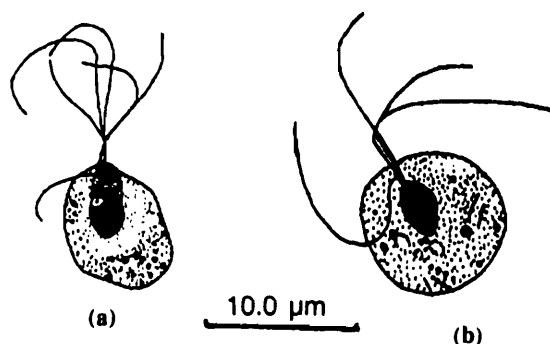


Fig. 72a-b. *Hexamastix dobelli*

anterior half of the body; axostylar spike and funis conspicuously long; pelta, parabasal body and cytostome absent.

Host : *Testudo elegans*; site of infection : hind-gut.

Distribution : India : Maharashtra (Aurangabad District) and Andhra Pradesh.

Remarks : Krishnamurthy (1968) reported this species from Maharashtra state.

Family CALONYMPHIDAE

Diagnosis : As in the key.

Genus *Metastephanonympha* De Mello and Brito, 1929

165. *Metastephanonympha karnataki* De Mello and Uttangi, 1959

1959. *Metastephanonympha karnataki* De Mello and Uttangi, *Curr. Sci.*, 19 : 122-123.

1956. *Metastephanonympha karnataki* : Karandikar and Rodgi. *J. Univ. Bombay*, 25 : 1-11.

Diagnosis : Body small, oval and tiny, anterior end broad, posterior rounded with variable number of karyomastigonts and each mastigont giving off anteriorly a pair of hair like flagella and a pair of basal granules, the parabasal body, cresta and axostyle; axostyles serially arranged.

Host : *Thyropygus nigrolabiatus*; site of infection : hind-gut.

Distribution : India : Maharashtra (Bombay).

Remarks : Karandikar and Rodgi (1956) reported this species from Maharashtra state.

Family TRICHOMONADIDAE

Diagnosis : Four to six flagella including one recurrent; undulating membrane supported by costa; axostyle of varying structure; parabasal apparatus with one or more filaments.

Genus *Pentatrichomonas* Mesnil, 1914

1914. *Pentatrichomonas* Mesnil, *Bull. Inst. Pasteur.*, 12 : 968.

Diagnosis : Five anterior flagella of two types in fully developed forms, well developed undulating membrane and costa; capitulum of axostyle, spatulate; large pelta and parabasal apparatus present.

166. *Pentatrichomonas* sp.

Host : *Canis familiaris*; site of infection : intestine.

Distribution : India : Maharashtra (Parbhani district).

Remarks : Deshpande *et al.* (1981) recorded infection of this unnamed species in teeming numbers in a solitary pet dog in Parbhani town.

167. *Pentatrichomonas* sp.

1981. *Pentatrichomonas* sp. Krishnamurthy and Deshmukh *Proc. All India Symp. on Perspectives in Research on Protozoa*, Aurangabad, p. 28.

Host : *Lobivanelus indicus*; site of infection : intestine.

Distribution : India : Maharashtra.

Remarks : Krishnamurthy and Deshmukh (1981) recorded this species from this state.

168. *Pentatrichomonas* sp.

1981. *Pentatrichomonas* sp. Krishnamurthy and Deshmukh *Proc. All India Symp. on Perspectives in Research on Protozoa*, Aurangabad, p. 28.

Diagnosis : Average body dimensions $9.54\ \mu\text{m} \times 8.23\ \mu\text{m}$, characterized by its unequal anterior flagella, axostyle with well developed crescentic capitulum.

Host : *Keptupa zeylonensis*; site of infection : intestine.

Distribution : India : Maharashtra.

Remarks : Krishnamurthy and Deshmukh (1981) recorded this unnamed species from this state.

Genus *Trichomit* Swezy, 1915

1915. *Trichomit* Swezy. *Univ. Calif. Publ. Zool.*, **16** : 89.

Diagnosis : Three anterior flagella; undulating membrane varying in length, height and number of undulations; free posterior flagellum; costa slender in most, very weakly developed in some species; capitulum spatulate or spoon-shaped, often with ventro-lateral extensions continuing anteriorly into a well developed pelta; trunk of axostyle variable; parabasal body predominantly V-shaped; associated with parabasal fibril.

169. *Trichomit* *aurangabadensis*

Krishnamurthy and Shete, 1981

(Fig. 73a-d)

1981. *Trichomit* *aurangabadensis* Krishnamurthy and Shete. *Arch. Protistenk.*, **124** : 405-409.

Diagnosis : Body elongated, fusiform, $10.3\text{--}25.4\ (19.0)\ \mu\text{m}$, with a broader anterior half and a conical and narrow posterior half; distinct blepharoplast close to the anterior end, giving rise to the mastigont elements; three anterior flagella unequal in length, $8.4\text{--}23.5\ (6.2)\ \mu\text{m}$; $12.2\text{--}24.4\ (18.0)\ \mu\text{m}$ and $14.5\text{--}26.3\ (22.3)\ \mu\text{m}$ respectively; posterior flagellum running along the border of an undulating membrane and becoming free posteriorly, free part $13.1\text{--}26.8\ (19.7)\ \mu\text{m}$, about as long as the body; undulating membrane conspicuous, extending to about one-third of the body length and thrown into 3-5 folds, bordered by an accessory filament; costa as long as undulating membrane and of same thickness as three flagella, no paracostal granules present; axostyle extremely well developed, stout and tubular, posteriorly projecting out of the body.

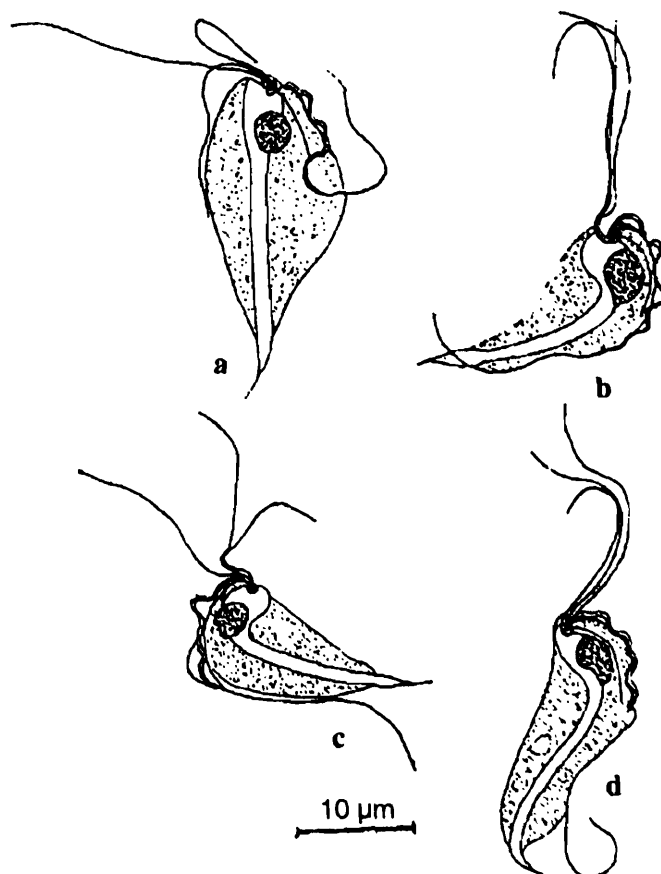


Fig. 73a-d. *Trichomit* *aurangabadensis*

tapering into a fine spike of 1.8-5.1 (2.8) μm in length; nucleus conspicuous, spherical, elongated kidney-shaped, lying near the capitulum; (3.9 μm $\times$ 2.7 μm in average); cytoplasm vacuolated and devoid of granular inclusions.

Host : *Rana tigrina*; site of infection : rectum.

Distribution : India : Maharashtra (Aurangabad).

Remarks : Krishnamurthy and Shete (1981) described this species from Maharashtra.

170. *Trichomitus batrachorum* Perty, 1852
(Fig. 74a-b)

1852. *Trichomitus batrachorum* Perty, *Zur kenntnis Kleinster Lebensforme, Jena und reinert, bern.* P.170.

1965. *Trichomitus batrachorum* (Perty, 1852) : Krishnamurthy, *Curr. Sci.*, 36(24) : 672-674.

1975. *Trichomitus batrachorum* (Perty, 1852) : Krishnamurthy and Madre, *Marthwada Univ. J. Sci.*, 14(7) : 219-222.

Diagnosis : Body spherical, ovoid or pyriform, 8.74-16.45 (12.22) μm $\times$ 5.4-11.82 (8.47) μm in size; nucleus spherical or oval measuring 2.28 μm $\times$ 2.57 μm located lateral to capitulum having a small eccentric endosome body; blepharoplasts large and conspicuous granule, located very near the anterior end giving rise to various mastigont

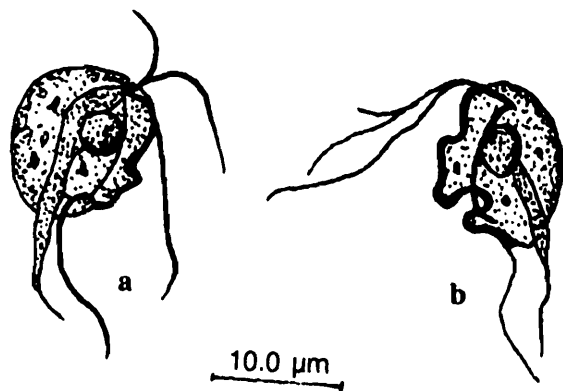


Fig. 74a-b. *Trichomitus batrachorum*

elements; 3 unequal anterior flagella measuring on an average 11.25 μm , 14.4 μm and 16.3 μm in length; posterior flagellum running along the outer border of the undulating membrane and free posteriorly; undulating membrane extending almost up to the posterior end of the body and thrown into 3-5 folds; costa thin, thread-like and running below the base of the undulating

membrane for its whole length; axostyle well developed; capitulum spoon-shaped, free spike-like part measuring 4.67 μm in length; two unequal flagella 26.5-54.5 (42.33) μm and 19.0-36.5 (27.99) μm long; rhizoplast well developed running forward from the nuclear membrane to the blepharoplast; periaxostylar chromatic rings, pelta and cytostome absent; cytoplasm hyaline without any granules.

Hosts : *Rana tigrina*, *Bufo melanostictus*, *Hemidactylus brooki*, *H. giganteus*.; site of infection : intestine.

Distribution : India : Maharashtra (Aurangabad, Nanded); Andhra Pradesh.

Remarks : Krishnamurthy (1967) recorded this parasite from *Eryx johni* and *Varanus* sp. from Hyderabad Andhra Pradesh. Krishnamurthy and Madre (1975) recorded this species from several hosts collected from Aurangabad and Nanded districts in Maharashtra state.

171. *Trichomitus granulae* Krishnamurthy and Madre, 1977

1977. *Trichomitus granulatus* Krishnamurthy and Madre *Proc. Nat. Congr. Parasitol.* p. 15.

Diagnosis : Not available.

Host : *Rana cyanophlyctis*; site of infection : rectum.

Distribution : India : Maharashtra.

Remarks : Krishnamurthy and Made (1977) reported this species from Maharashtra.

172. *Trichomitus* sp.

Host : *Vatranus indica*; site of infection : intestine.

Distribution : India : Maharashtra (Aurangabad and Nanded.)

Remarks : Krishnamurthy and Made (1975) reported this unnamed species from Maharashtra.

173. *Trichomitus* sp.

Host : *Rana cyanophlyctis*; site of infection : rectum.

Distribution : India : Maharashtra (Aurangabad and Nanded).

Remarks : Krishnamurthy and Madre (1975) reported this unnamed species from Maharashtra.

Genus *Tritrichomonas* Kofoid, 1920

1920. *Tritrichomonas* Kofoid, Univ. Calif. Pub. Zool., 20 : 145.

Diagnosis : Typically with 3 anterior flagella; well developed undulating membrane; costa slender or stout; parabasal body associated with filament.

174. *Tritrichomonas augusta* Alexeieff, 1911

1911. *Trichomitus augusta* Alexeieff Arch. Zool. Exp. Gen., 46(5-6) : 491.

Diagnosis : Not available.

Host : *Rana tigrina* and *Bufo melanostictus*; site of infection : intestine.

Distribution : India : Maharashtra (Aurangabad and Nanded).

Remarks : Krishnamurthy and Madre (1975) reported this species from Maharashtra.

Incertae sedis to class Zoomastigophorea

Genus *Rhizomastix* Alexeieff, 1911

1911. Alexeieff, Arch. Zool. Exp. Gen., 45(5,6) : 491-527.

Diagnosis : Body amoeboid; nucleus central; blepharoplast located between nucleus and posterior end; a long fibre running from it to anterior end and continued into the flagellum; without contractile vacuole; division in spherical cyst.

175. *Rhizomastix dastagiri* Sultana, 1976e
(Fig.75a-b)

1976. *Rhizomastix dastagiri* Sultana, Acta Protozool., 15(1) : 9-13.

Diagnosis : Body variable in shape, ovoid to irregular, 5.7-12.3(8.6) μm $\times$ 4.1-8.7(5.7) μm in size; blepharoplast variable in size, shape and position, located behind the nucleus; rhizostyle well defined, variable in diameter 1.0-9.2(4.1) μm in length, running forward to the body surface

and continuing as free flagellum; flagellum single, 4.6-17.5(10.8) μm in length; nucleus large, spherical, elongated or irregular, 1.5-3.6 μm in size; cytoplasm showing several granular inclusions and bacteria.

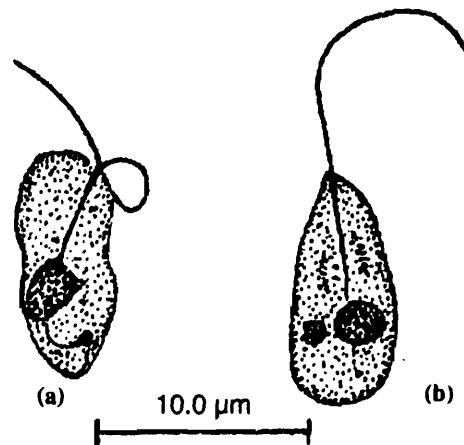


Fig. 75a-b. *Rhizomastix dastagiri*

Host : *Periplaneta americana*; site of infection : hind-gut.

Distribution : India : Maharashtra (Paithan, Aurangabad District).

Remarks : Sultana (1976) reported this species from Maharashtra state.

176. *Rhizomastix murthii* Mali,
Kulkarni and Mali, 2002
(Fig. 76a-d)

2002. *Rhizomastix murthii* Mali, Kulkarni and Mali, Proc. Zool. Soc. Calcutta, 55(1) : 77-80.

Diagnosis : Body ovoidal or somewhat triangular, 7.10-15.93 μm , characterised by the largest size and short rhizostyle; blepharoplast variable in size, either dot-like or large spherical, located close to the nucleus; rhizostyle shorter than half of the body length, running from the nucleus to the body surface; flagellum thicker than rhizostyle; free flagellum about twice as long as the body, measuring 9.25-35.99 (20.20) μm in length; nucleus spherical situated near the middle of the body; cytoplasm uniformly stained with thin periplast.

Host : *Periplaneta americana*; site of infection : hind-gut.

Distribution : India : Maharashtra (Aurangabad).

Remarks : Mali *et al.* (2002) described this species from Maharashtra state.

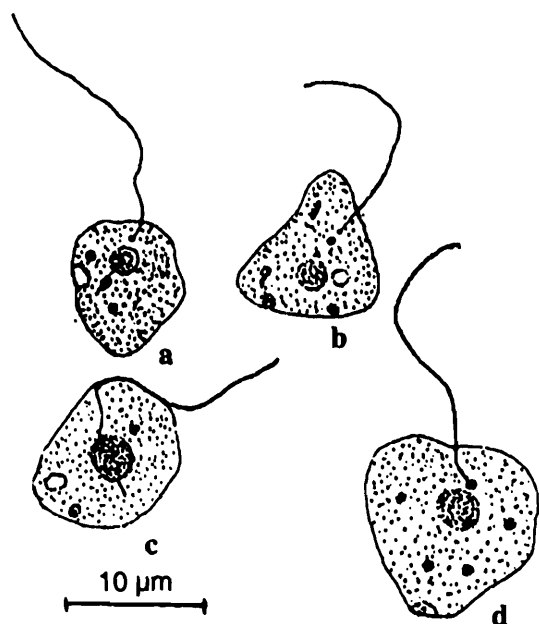


Fig. 76a-d. *Rhizomastix murthii*

177. *Rhizomastix ranae* Krishnamurthy, 1969
(Fig. 77)

1976. *Rhizomastix ranae* Krishnamurthy, *Marth. Univ. J. Sci.*, 8 : 133-136.

Diagnosis : Body elongated, 7.20-20.05 (11.67) μm $\times$ 4.11-11.82 μm ; anterior end rounded and posterior end somewhat conical; nucleus fairly large, spherical or ovoid, averaging 5.47 μm in diameter, located in the middle of the body; cytoplasm uniformly stained without bacteria or granules; single blepharoplast located in little behind the nucleus, giving rise to a well defined rhizostyle of about $\frac{1}{2}$ to $\frac{3}{4}$ of the body length; free flagellum 10.28-25.71 (16.81) μm , measuring less than twice the body length.

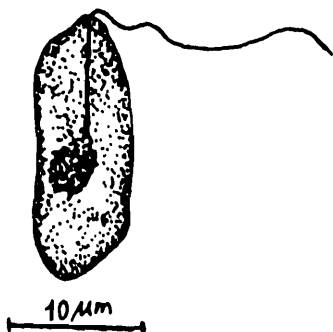


Fig. 77. *Rhizomastix ranae*

Host : *Rana tigrina*; site of infection : rectum.

Distribution : India : Maharashtra (Aurangabad district).

Remarks : Krishnamurthy (1969) reported this species from Maharashtra state.

178. *Rhizomastix* sp.

Host : *Rana tigrina*; site of infection : intestine.

Distribution : India : Maharashtra (Aurangabad and Nanded).

Remarks : Krishnamurthy and Madre (1975) reported this unnamed species from Maharashtra.

179. *Rhizomastix* sp.

Host : *Gryllotalpa* sp. ; site of infection : gut.

Distribution : India : Maharashtra.

Remarks : Krishnamurthy and Sultana (1972) reported this unnamed species from this state.

180. *Rhizomastix* sp.

Host : *Periplaneta americana*; site of infection : gut.

Distribution : India : Maharashtra.

Remarks : Krishnamurthy and Sultana (1972) reported this unnamed species from this state.

Genus *Tubulimonoides* Krishnamurthy and Sultana, 1976

Diagnosis : Axostyle tubular, 4 flagella arising from two distinctly separated blepharoplasts in the grouping 3 : 1.

181. *Tubulimonoides aurangabadae* Mali, Kulkarni and Mali, 2003

2003. *Tubulimonoides aurangabadae* Mali, Kulkarni and Mali, *Geobios*, 30 : 291-292.

Diagnosis : Not available.

Host : *Oryctes rhinoceros*; site of infection : gut.

Distribution : India : Maharashtra (Aurangabad).

Remarks : Mali *et al.* (2003) described this species from this state.

182. *Tubulimonoides gryllotalpae*

Krishnamurthy and Sultana, 1976

(Fig. 78a-b)

1976. Krishnamurthy and Sultana. *Tubulimonoides gryllotalpae*. *Proc. Indian Acad. Sci.*, **84**(4): 137-140.

Diagnosis : Cell body spherical or oval or sometimes irregular with a thin periplast, 7.7-19.0(11.7) $\times$ 4.6-19.5 (9.3) μ m; nucleus fairly large, spherical, 2.6 $\times$ 6.2 μ m in diameter close to anterior end; 2 blepharoplasts located at the anterior end, somewhat conical or triangular or flattened and rod-like, connected by a thin rhizoplast; anterior flagella 3, two equal and one short, 4.6-26.2 (14.4) μ m, 7.7-38.6 (17.0) μ m, 6.2-38.6 (24.9) μ m in length, directed forward; trailing flagellum long, 2-2½ times the body length; axostyle characteristic, anterior part of the axostyle obscured by the nucleus; trunk region delicate tubular, posterior part tapering into a fine filament emerging out of the body, 5.1-19.0 (10.6) μ m in size.

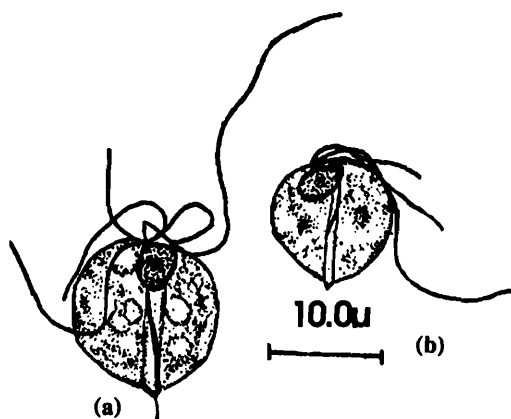


Fig. 78a-b. *Tubulimonoides gryllotalpae*

Host : *Gryllotalpa africana*; site of infection : hind-gut.

Distribution : India : Maharashtra (Aurangabad, Aurangabad District)

Remarks : This genus is of questionable validity. No reference has been made to this genus after its description in 1976 in the order Oxymonadida. Krishnamurthy and Sultana (1976) described this species from this state.

183. *Tubulimonoides shivamurthi* Mali and

Sultana, 1993

1993. *Tubulimonoides shivamurthi* Mali and Sultana, *Geobios New Rep.*, **12**(1) : 30-32.

Diagnosis : Not available.

Host : *Oryctes rhinoceros*; site of infection : gut.

Distribution : India : Maharashtra (Aurangabad).

Remarks : Mali and Sultana (1993) described this species from this state.

Subphylum OPALINATA

Class OPALINATEA

Order OPALINIDA

Family OPALINIDAE

Unicellular organisms covered with numerous parallel rows of metachronally beating flagella; delicate parallel folds on cell surface between kineties giving opalescent appearance.

Genus *Protoopalina*, Metcalf, 1998

Diagnosis : Body binucleated with a short broad, axial falx at most parallel to the outer posterior axis of the cell; kineties covering body evenly.

184. *Protoopalina caudata microhyla* Nie, 1935

Diagnosis : Body 200 μ m $\times$ 95 μ m; nucleus 40 μ m $\times$ 26 μ m; posterior pole broad and abruptly tapering to sharp point; posterior end not curved; nuclei six in number.

Hosts : *Microhyla ornata*; site of infection : rectum.

Distribution : India : Maharashtra (Ratnagiri district).

Remarks : Nie (1935) reported this species from this state after obtaining a specimen (Indian Museum Reg. No. 17287) which was collected at Harnai, Ratnagiri district (*vide* Metcalf, 1940, p. 472 and Uttangi, 1951, p. 139).

Subphylum SARCODINA
 Class LOBOSEA
 Subclass GYMNAMEOBIA
 Order AMOEBIDA
 Suborder TUBULINA
 Family ENDAMOEBIDAE
 Genus *Entamoeba* Casagrandi and
 Brbagallo, 1995

Key to the species

- 1(2) Mature cysts tetranucleate, trophozoites
 measuring 20-30 μ m in length *E. histolytica*
 *E. histolytica*
 2(1) Mature cysts octonucleate, trophozoites
 measuring 15-20 μ m in length *E. coli*

185. *Entamoeba coli* (Grassi, 1879) (Fig. 79a-b)

1879. *Amoeba coli* Grassi, *Gaz. Med. Ital. Lombard.*, 39 : 445.

1966. *Entamoeba coli* : Kudo, *Protozoology*, p. 540.

Diagnosis : Trophozoites 15-50 μ m in diameter; cytoplasm with thin ectoplasm; nucleus with large eccentric endosome; mature cysts 10-30 μ m in diameter with 8 nuclei; cysts containing splinter-like chromatid bodies.

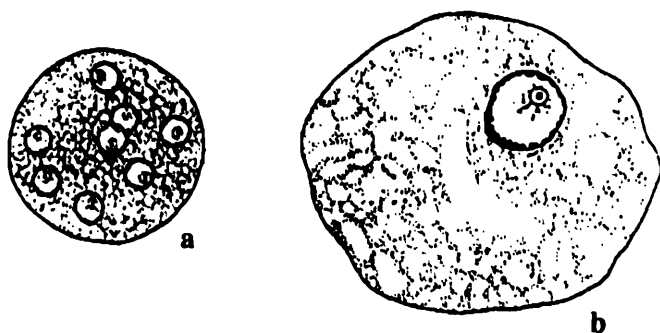


Fig. 79a-b. *Entamoeba coli*

Host : *Homo sapiens*; site of infection : caecum and colon.

Distribution : India : Maharashtra (Aurangabad); cosmopolitan.

Remarks : This is a common and cosmopolitan species occurring in man. Kalyankar *et al.* (1981) reported this species from this state.

186. *Entamoeba histolytica* Schaudinn, 1903 (Fig. 80a-c)

Diagnosis : Trophozoites 22-30 μ m in diameter in large pathogenic race and 12-15 μ m in diameter in smaller race; distinct clear ectoplasm and granular endoplasm present; nucleus with small central endosome, a ring of small peripheral granules and a few scattered chromatin within; mature cysts 10-20 μ m in diameter with four prominent nuclei in both races.

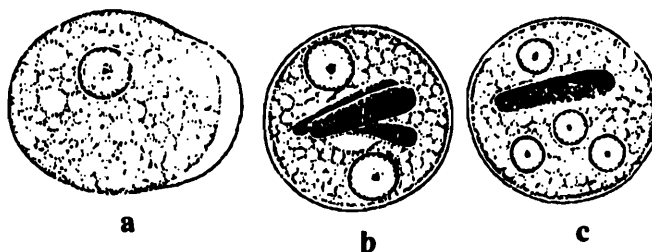


Fig. 80a-c. *Entamoeba histolytica*

Hosts : *Homo sapiens*; site of infection : caecum and colon.

Distribution : India : Maharashtra (Aurangabad); cosmopolitan.

Remarks : This is a pathogenic species occurring in man. Kalyankar *et al.* (1981) reported this species from this state indicating greater occurrences in males than females.

Phylum APICOMPLEXA
 Class SPOROZOEA
 Subclass GREGARINIA
 Order EUGREGARINIDA
 Suborder ASEPTATINA
 Family LECUDINIDAE

Diagnosis : Gamonts elongate, their motion not pendulum-like or coiling but gliding; first stage of development generally intracellular; syzygy lateral or frontal; oocysts ellipsoidal or ovoid, with wall slightly thickened at one end; intestinal parasites of annelids, sipunculids or echiurids.

Genus *Lankesteria* Mingazzini, 1891

Diagnosis : Mucron present although not always apparent, usually simple but sometimes

complex; gamonts more or less spatulate; syzygy head to head or scissors-like; gametocysts spherical; anisogamy present; oocysts ellipsoidal, often with a plug.

187. *Lankesteria* sp.

Host : *Aedes albopictus*; site of infection : not known.

Distribution : India : Maharashtra (Pune district).

Remarks : Mourya and Dhanda (1981) recorded this species from this state and considered it as *Ascocystis* (= *Lankesteria*) *taiwanensis* Lien and Levine in the addendum.

188. *Lankesteria* sp.

Host : *Armigeres subalbatus*; site of infection : alimentary canal/malpighian tubules.

Distribution : India : Maharashtra (Pune, Panvel and Chowk of Raigad, Thane and Aurangabad districts).

Remarks : Dhanda and Mourya (1981) examined a total of 1,697 mosquitoes belonging to 37 species and recorded three morphologically distinct species of *Lankesteria* (unnamed) from this state. As addendum to this paper, it was referred to as *Ascocystis* (= *Lankesteria*) *armigeri* Lien and Levine.

189. *Lankesteria* sp.

Host : *Aedes aegypti*; site of infection : alimentary canal / malpighian tubules.

Distribution : India : Maharashtra (Panvel and Chowk of the then Raigad district, and also Thane and Aurangabad districts).

Remarks : Dhanda and Mourya (1981) recorded this unnamed species from this state as mentioned above.

Genus *Ascogregarina* Ward, Levine and Craig, 1982

Diagnosis : Mucron present although not always apparent, usually simple but sometimes

complex; gamonts more or less spatulate; syzygy head to head or scissor-like; gametocysts spherical; anisogamy present; oocysts ellipsoidal, often with a plug at each end; parasitic in insects.

190. *Ascogregarina cheopisi* Mourya, Geevarghese and Gokhale, 1996

1996. *Ascogregarina cheopisi* Mourya, Geevarghese and Gokhale, *Entomon*, 21(1) : 103-104.

Diagnosis : Not available.

Host : Flea, *Xenopsylla* (*Xenopsylla*) *cheopis*; site of infection : intestine.

Distribution : India : Maharashtra (Beed district).

Remarks : Mourya, Geevarghese and Gokhale (1996) described this species from this state.

Family MONOCYSTIDAE

Diagnosis : Gamonts spherical to cylindrical, with anterior end little differentiated if at all; oocysts biconical or navicular; mostly coelomic ; the great majority parasites of oligochaetes.

Subfamily MONOCYSTINAE

Diagnosis : Gamonts nematoid, cylindrical or oval, without mucron or with an inconspicuous one; syzygy late; ends of oocysts thickened; ordinary habitat seminal vesicle of oligochaetes, although some occurring in coelom.

Genus *Monocystis* Stein, 1848

1848. *Monocystis* Stein, *Arch. Anat. Physiol. Wiss. Med.*, p. 182.

1988. *Monocystis* : Levine, *The Protozoan Phylum Apicomplexa*, Vol. I, p. 30.

Diagnosis : Mucron not marked; gamonts ovoid; short or elongate, solitary; oocysts biconical, symmetrical.

191. *Monocystis pheretimae* Bhatia and Chatterjee, 1925 (Fig. 81)

1925. *Monocystis pheretimi* Bhatia and Chatterjee, *Arch. Protistenk.*, 52 : 189-206.

1938. *Monocystis pheretimi* : Bhatia, *The Fauna of British India, including Ceylon and Burma, Protozoa : Sporozoa*, Taylor and Francis Ltd., London : 58-59.

1988. *Monocystis pheretimae* : Levine, *The Protozoan Phylum Apicomplexa*, Vol. I, p. 32.

Diagnosis : Trophozoites spherical, ovoid, ellipsoidal, or dumbbell-shaped, measuring up to $220\ \mu\text{m} \times 50\ \mu\text{m}$; epicyte thin, without striations; sarcocyte well developed; myocyte fibrils delicate; endoplasm with vacuoles; nucleus generally spherical, sometimes ovoidal, with a single spherical karyosome eccentrically located; gametocysts spherical; sporocysts biconical.

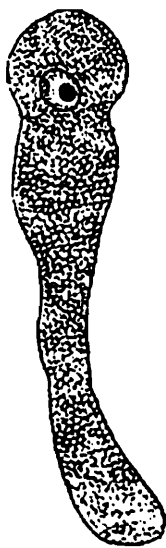


Fig. 81. *Monocystis pheretimae*

Host : *Pheretima posthuma*; site of infection : seminal vesicle.

Distribution : India : Maharashtra (Mumbai).

Remarks : Bhatia and Chatterjee (1925) recorded this species from this state.

Genus *Apolocystis* Cognetti, 1923

1923. *Apolocystis* Cognetti, *Monit. Zool. Ital. Firenze*, **34** : 250-253.

1988. *Apolocystis* : Levine, *The Protozoan Phylum Apicomplexa*, Vol. I, p. 34.

Diagnosis : Trophozoite solitary, spherical without any marked principal axis and without polar differentiation; oocysts biconical.

192. *Apolocystis mattheii*

(Bhatia and Setna, 1926)

(Fig. 82)

1926. *Monoocystis matthaii* Bhatia and Setna, *Arch. Protistenk.*, **53** : 361.

1938. *Apolocystis mattheii* : Bhatia, *The Fauna of British India, including Ceylon and Burma, Protozoa : Sporozoa*, Taylor and Francis Ltd., London, : 59-60.

1988. *Apolocystis matheii* : Levine, *The Protozoan Phylum Apicomplexa*, Vol. I, p. 35.

Diagnosis : Trophozoites usually spherical, sometimes ovoid or kidney-shaped, up to $238\ \mu\text{m}$; epicyte thin and without any striations; sarcocyte hyaline and little developed; myocyte fibres indistinguishable; endoplasm very dark, finely granular, with compactly arranged alveoli and large grains of reserve material; nucleus spherical, with single spherical karyosome, eccentrically placed; gametocysts ellipsoidal, up to $468\ \mu\text{m}$ in longer diameter.

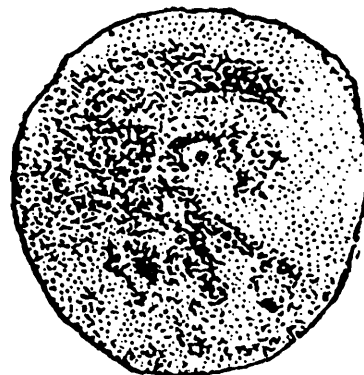


Fig. 82. *Apolocystis mattheii*

Host : *Megascolex tribolatus* (Steph.); site of infection : seminal vesicle.

Distribution : India : Maharashtra (Mumbai).

Remarks : Bhatia and Setna (1926) recorded this species from erstwhile Bombay.

Subfamily RHYNCHOCYSTINAE

Diagnosis : Gamonts ovoid, spherical or elongated, with a conical or cylindroconical trunk at the anterior end, solitary; oocysts biconical, with similar nonappendiculate ends; with eight sporozoite.

Genus *Rhynchocystis* Hesse, 1909

1909. *Rhynchocystis* Hesse, *Arch. Zool. Exp. Gen.*, **43** : 27.

1988. *Rhynchocystis* : Levine, *The Protozoan Phylum Apicomplexa*, Vol. I, p. 37.

Diagnosis : Rostrum of gamonts metabolic, most often elongated into a conical or cylindroconical trunk.

193. *Rhynchocystis awatii* Bhatia and

Setna, 1926

(Fig. 83)

1926. *Rhynchocystis awatii* Bhatia and Setna, *Arch. Protistenk.*, **53** : 371-373.

1938. *Rhynchocystis awatii* : Bhatia, *The Fauna of British India, including Ceylon and Burma, Protozoa : Sporozoa*, Taylor and Francis Ltd., London, : 66-67.

1988. *Rhynchocystis awatii* : Levine, *The Protozoan Phylum Apicomplexa*, Vol. I, p. 37.

Diagnosis : Trophozoites elongated cylindrical, $400\ \mu\text{m} \times 50\ \mu\text{m}$, anterior end usually with a cylindroconical epimerite; epicyte with fine longitudinal striations, distinct and spaced over the epimeritic region; sarcocyte poorly developed and free from granules; nucleus oval, with a large eccentric karyosome, placed about the middle of the body.



Fig. 83. *Rhynchocystis awatii*

Host : *Pheretima elongata* (E. Per.); site of infection : seminal vesicle.

Distribution : India : Maharashtra (Mumbai).

Remarks : Bhatia and Setna (1926) recorded this species from erstwhile Bombay.

194. *Rhynchocystis mammillata* Bhatia and

Setna, 1926

(Fig. 84)

1926. *Rhynchocystis mammillata* Bhatia and Setna, *Arch. Protistenk.*, **53** : 361-377.

1938. *Rhynchocystis mammillata* : Bhatia, *The Fauna of British India, including Ceylon and Burma, Protozoa : Sporozoa*, Taylor and Francis Ltd., London, : 67-68.

1988. *Rhynchocystis mamillata* : Levine, *The Protozoan Phylum Apicomplexa*, Vol. I, p. 37.

Diagnosis : Trophozoite elongate pear-shaped, $126\ \mu\text{m} \times 52\ \mu\text{m}$, anterior end broader; epimerite consisting of nipple-shaped mucron, with well developed sarcocyte and having a ring surrounded at its base; nucleus oval, $14\text{-}16\ \mu\text{m} \times 8\text{-}11\ \mu\text{m}$, and situated in the posterior half of the body.

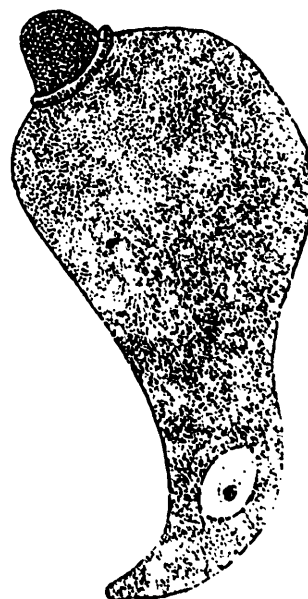


Fig. 84. *Rhynchocystis mammillata*

Host : *Pheretima elongata* (E. Parr.); site of infection : seminal vesicle.

Distribution : India : Maharashtra (Mumbai).

Remarks : Bhatia and Setna (1926) recorded this species from erstwhile Bombay.

Genus *Dirhynchocystis* Cognetti de Martiis, 1921

1921. *Dirhynchocystis* Cognetti de Martiis, 1921, *Monit. Zool. Ital.*, 31 : 149.

1988. *Dirhynchocystis* : Levine, *The Protozoan Phylum Apicomplexa*, Vol. I, p. 37.

Diagnosis : Rostrum of gamonts metabolic, most often elongated into a conical or cylindroconical trunk; gamonts with projections at both ends.

195. *Dirhynchocystis globosa* (Bhatia and Chatterjee, 1925)
(Fig. 85)

1925. *Echinocystis globosa* Bhatia and Chatterjee, *Arch. Protistenk.*, 52 : 189.

1938. *Monocystis pheretimi* : Bhatia, *The Fauna of British India, including Ceylon and Burma, Protozoa : Sporozoa*, Taylor and Francis Ltd., London, : 87-88.

1988. *Dirhynchocystis globosa* : Levine, *The Protozoan Phylum Apicomplexa*, Vol. I, p. 37.

Diagnosis : Trophozoites more or less spherical, 174 μm $\times$ 65 μm , with two spine-like structures radiating from the surface; nucleus large, generally ovoid and containing a single karyosome; sporocysts biconical, with two similar truncated poles.

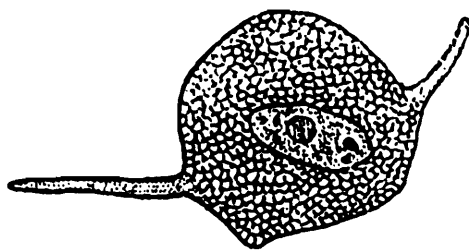


Fig. 85. *Dirhynchocystis globosa*

Host : *Pheretima posthuma* (L. Vaill.); site of infection : seminal vesicle.

Distribution : India : Maharashtra (Mumbai); Uttar Pradesh.

Elsewhere : Pakistan.

Remarks : Bhatia and Chatterjee (1925) recorded this species from erstwhile Bombay.

Genus *Grayallia* Setna, 1927

1927. *Grayallia* Setna, *Parasitology*, 19 : 335.

1988. *Grayallia* : Levine, *The Protozoan Phylum Apicomplexa*, Vol. I, p. 38.

Diagnosis : Gamonts long and slender, with four spines at each end.

196. *Grayalla quadrispina* Setna, 1927
(Fig. 86)

1938. *Grayalla quadrispina* : Bhatia, *The Fauna of British India, including Ceylon and Burma, Protozoa : Sporozoa*, Taylor and Francis Ltd., London, : 58-59.

1988. *Grayallia quadrispina* : Levine, *The Protozoan Phylum Apicomplexa*, Vol. I, p. 38.

Diagnosis : Trophozoites worm-like, chalky-white in colour and highly deformable, with four spine-like processes radiating backwards at either end; nucleus large and oval, containing a variable number of karyosomes.

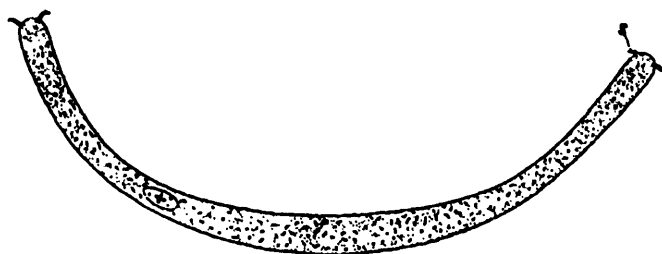


Fig. 86. *Grayalla quadrispina*

Host : *Pheretima heterochaeta* (Mchlsn.); site of infection : seminal vesicle.

Distribution : India : Maharashtra (Mumbai).

Remarks : Setna (1927) recorded this species from erstwhile Bombay.

Subfamily STOMATOPHORINAE

Diagnosis : Gamonts highly variable in shape, solitary; mucron transformed into a sucker; myocyte complex; oocysts navicular, with truncate ends and with eight sporozoites.

Genus *Stomatophora* Drazhevetskii, 1907

1907. *Stomatophora* Drazhevetskii, C. R. St.-Petersburg Trav. Soc. Nat., 38 : 203.

1988. *Stomatophora* : Levine, *The Protozoan Phylum Apicomplexa*, Vol. I, p. 38.

Diagnosis : Gamonts spherical or ovoid; sucker petaloid, with radiating sides; oocysts biconical, with a flattened button at each end, attached to each other end to end in long chains inside gametocysts.

197. *Stomatophora bulbifera* Bhatia and setna, 1926
(Fig. 87)

1926. *Stomatophora bulbifera* Bhatia and Setna, *Arch. Protistenk.*, **53** : 371-373.
1938. *Stomatophora bulbifera* : Bhatia, *The Fauna of British India, including Ceylon and Burma, Protozoa : Sporozoa*, Taylor and Francis Ltd., London, p.70.
1988. *Stomatophora bulbifera* : Levine, *The Protozoan Phylum Apicomplexa*, Vol. I, p. 38.

Diagnosis : Trophozoites elongate cylindro-conical; with broad and round anterior end and narrow and pointed posterior end; without epicytal striations; sucker appearing as an inverted ballon-shaped depression at the anterior end with a central mucron and radial epicytal striations; nucleus oval, with a large spherical striations.

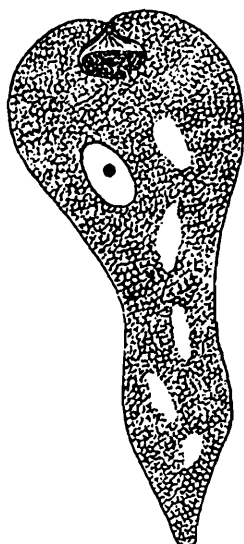


Fig. 87. *Stomatophora bulbifera*

Host : *Pheretima elongata* (E. Parr.); site of infection : seminal vesicle.

Distribution : India : Maharashtra (Mumbai).

Remarks : Bhatia and Setna (1926) recorded this species from erstwhile Bombay.

Suborder SEPTATIŃA

Superfamily GREGARINICAE

Key to the families

1. Mucron always simple; early development extracellular; syzygy caudo-frontal, often early; anisogamy moderately marked; gametocysts with sporoducts; oocysts clearly elongate or cylindrical, symmetrical Family GREGARINIDAE
2. Mucron ordinarily papilla-like or simple knob-like; gametocysts dehisce by simple rupture; oocysts ellipsoidal, prismatic, fusiform, ovoid or even spherical Family HIRMOCYSTIDAE

Family GREGARINIDAE

Diagnosis : As in the key.

Genus *Gregarina* Dufour, 1828

1828. *Gregarina* Dufour. *Ann. Sci. Nat.*, **13** : 366-368.
1988. *Gregarina* : Levine, *The Protozoan Phylum Apicomplexa*, Vol. I, p. 50.

Diagnosis : Mucron conical, button-shaped, globular or cylindrical; syzygy rather precocious; oocysts doliform, navicular or spherical; occurring in intestine of insects.

Key to the species

198. *Gregarina bidari* Patil, 1982
(Fig. 88a-g)

1982. *Gregarina bidari* Patil, *Studies on Protozoa Infecting Certain Arthropod from North East Region of Karnataka*, Ph. D. Thesis, Gulbarga University.
1988. *Gregarina bidari* : Levine, *The Protozoan Phylum Apicomplexa*, Vol. I, CRC Press, Inc., Florida, p. 51.

Material examined : Sev. exs., Parli Vaijnath, Beed, 2001, S. R. Nikam.

Dignosis : Sporont measuring in an average 32 μ m in length before forming the syzygy; syzygium elongated, cylindrical in general appearance, varying in length from 110 μ m to 470 μ m; protomerite in early syzygy dome-shaped in both primitive and satellite; nucleus oval in shape

in the primaite, also situated in the satellite and also at the posterior region of the deutomerite.

Host : *Rhytinota* sp. (Coleoptera); site of infection : mid intestine.

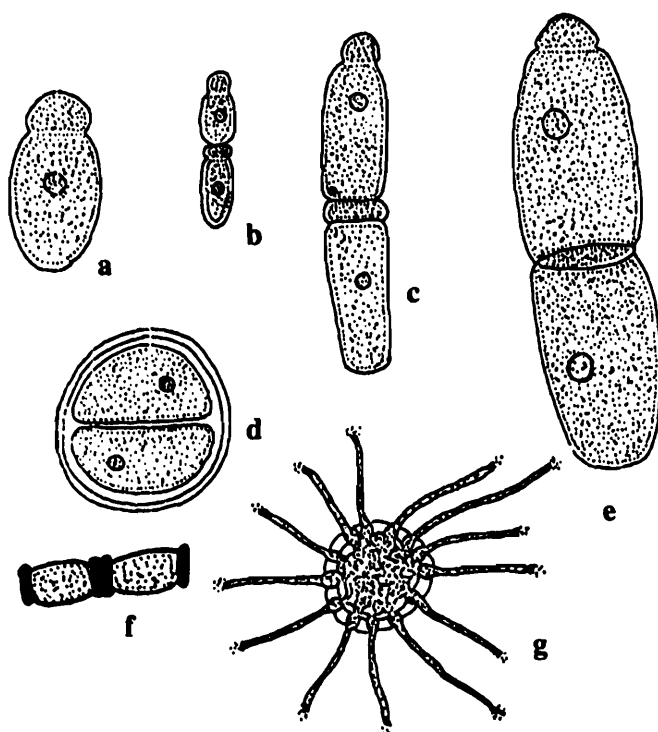


Fig. 88a-g. *Gregarina bidari*

Distribution : India : Maharashtra (Beed district).

Remarks : Nikam (2001) encountered this species from this state. (pers. com.).

199. *Gregarina blattarum* Siebold, 1839

1839. *Gregarina blattarum* Siebold, *Schr. Naturforsch. Ges. Danzig.*, 3 : 56.

1988. *Gregarina blattarum* : Levine, *The Protozoan Phylum Apicomplexa*, Vol. I, CRC Press, Inc., Florida, p. 52.

Material examined : Sev. exs., Parli Vaijnath, Beed, 2001, S. R. Nikam.

Diagnosis : Sporont elongated, cylindrical bottle-like, measuring 190 μ m to 560 μ m in length and 150 μ m to 450 μ m in breadth; protomerite large, rectangular in shape, 35 μ m to 100 μ m in length and 45 μ m to 139 μ m in breadth; deutomerite elongated, broad at the anterior end and blunt at posterior end; nucleus spherical in shape, 30 μ m to 50 μ m in diameter.

Host : Cockroach, *Periplaneta americana*; site of infection : mid-gut.

Distribution : India : Maharashtra (Beed district).

Remarks : Nikam (2001) encountered this species from this state. (pers. com.).

200. *Gregarina havanuri* Amoji, 1976 (Fig. 89a-f)

1976. *Gregarina havanuri* Amoji, cited from Ph. D. Thesis of V. D. Gulbhile (2005), Marathwada University, Aurangabad.

Material examined : Sev. exs., Parli Vaijnath, Beed, 2001, S. R. Nikam.

Dignosis : Sporonts biassociative, slender, elongated tubular in shape; maximum length of association 825 μ m and the width 65 μ m; primitive longer than the satellite; primitive protomerite hood-like, length (41 μ m), always more than the width (23 μ m); deutomerite elongated tube-like, little wider than the protomerite and terminating in a flat end; satellite smaller and with an almost

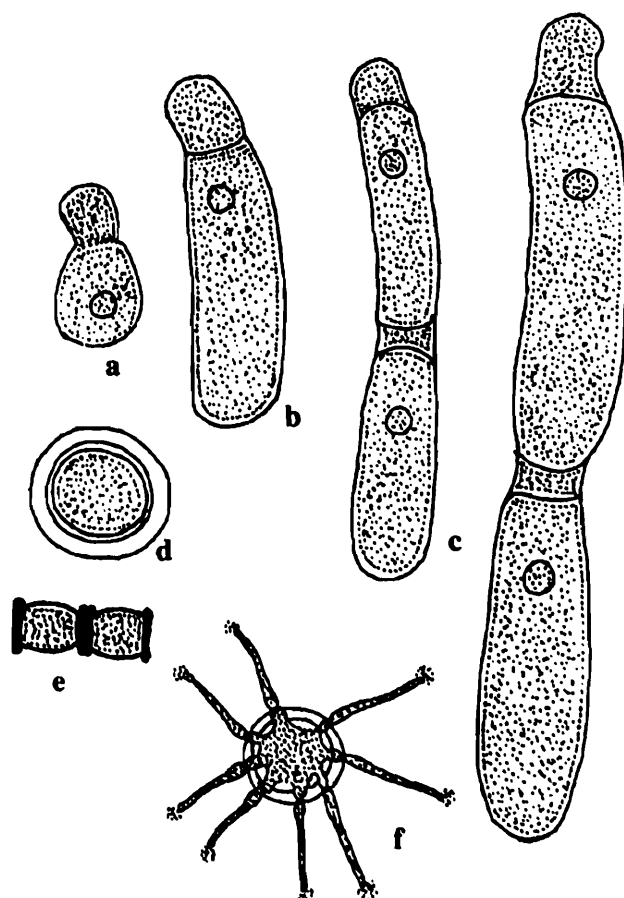


Fig. 89a-f *Gregarina havanuri*

rectangular protomerite; deutomerite same in shape but its posterior parts terminating in round end; nucleus anterior and about 17 µm in diameter.

Host : *Rhytinota* sp. (Coleoptera); site of infection : mid intestine.

Distribution : India : Maharashtra (Beed district).

Remarks : Amoji (1976) first described this species in *Ganocephalum depressum* from Havanur, Gulbarga district, Karnataka. Gulbhile and Nikam (2005) recorded this species from Parli Vajinath, Maharashtra State. However, this species requires review and revalidation.

Family HIRMOCYSTIDAE

Diagnosis : As in the key.

Key to the genera

1. Mucron very labile, a conical button; gamonts most often associated in chains of up to 12 individuals; oocysts ovoid, ellipsoidal or cylindroid; parasitic in insects
..... Genus *Hirmocystis*
2. Mucron unknown; young gamonts always elongate; syzygy head to tail, tongue-like; gametocysts dehisce by simple rupture; oocysts keg-shaped, with one spine at each corner; development intracellular; parasitic in orthopteran insects
..... Genus *Protomagalhaensia*

Genus *Hirmocystis* Labbe, 1899

1899. *Hirmocystis* Labbe, Sporozoa vol. 5; in *Terreich. Eine Zusammenstellung Kennzeichnung der Rezenten Tierformen*, F. E. Schulze and O. Butschli (eds.); Friedlander & Sohn, Berlin.

Diagnosis : As in the key.

Species incertae sedis

201. *Hirmocystis* (?) *parapeneopsis* Setna and Bhatia, 1934
(Fig. 90a-c)

1934. *Hirmocystis parapeneopsis* Setna and Bhatia, *Parasitology*, 26 : 34.

1938. *Hirmocystis parapeneopsis* : Bhatia, *The Fauna of British India, including Ceylon and Burma, Protozoa : Sporozoa*, Taylor and Francis Ltd., London : 106-107.

Diagnosis : Sporonts stout, forming early syzygy; associations of 2-3 individuals in linear chains or two primite with single satellite; epimerite small rounded knob-like; protomerite hemispherical or flattened, constricted at the septum; deutomerite cylindrical or barrel-shaped, broadly rounded or flattened behind; satellite longer than primite; nucleus spherical with a single karyosome; gametocysts spherical or slightly elliptical.

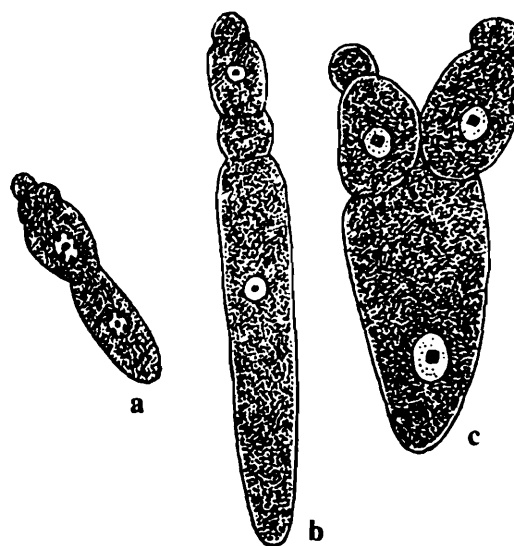


Fig. 90a-c *Hirmocystis* (?) *parapeneopsis*

Host : *Parapeneopsis sculptilis* (Heller); site of infection : intestine.

Distribution : India : Maharashtra (Mumbai).

Remarks : Setna and Bhatia (1934) reported this species from this state.

Genus *Protomagalhaensia* Pinto, 1918

1918. *Protomagalhaensia* Pinto, *Bras. Med.*, 32 : 321.

Diagnosis : As in the key.

202. *Protomagalhaensia* (?) *attenuata* Setna and Bhatia, 1934
(Fig. 91a-d)

1934. *Hirmocystis parapeneopsis* Setna and Bhatia, *Parasitology*, 26 : 34.

1938. *Monocystis pheretimi* : Bhatia, *The Fauna of British India, including Ceylon and Burma, Protozoa : Sporozoa*, Taylor and Francis Ltd., London : 58-59.

Diagnosis : Sporonts attenuate forming early syzygy; association of two to several individuals, often attached laterally; epimerite simple rounded knob; protomerite hemispherical or flattened, constricted at the septum; deutomerite cylindrical, rounded or flattened behind; satellite usually longer than primitive; nucleus spherical, with a single karyosome.

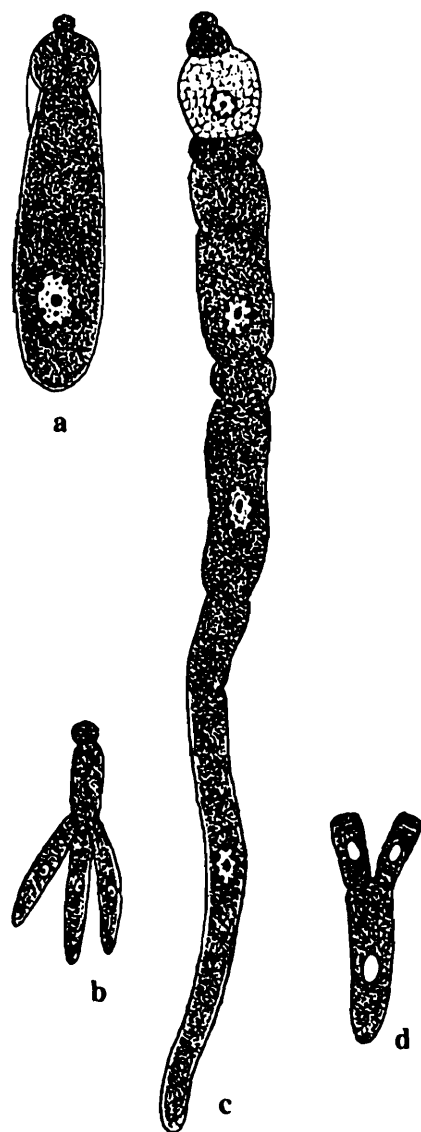


Fig. 91a-d. *Protomagalhaensia* (?) *attenuata*

Host : *Parapeneopsis sculptilis* (Heller); site of infection : intestine.

Distribution : India : Maharashtra (Mumbai).

Remarks : Setna and Bhatia (1934) reported this species from this state.

Superfamily STENOPHORICAE Levine, 1970

1979. Stenophoricae, Levine, *J. Protozol.*, 26(4) : 532-536.

Diagnosis : Gamonts solitary, early development intra or extracellular, epimerite simple or complex, gametocysts with or without sporoducts.

Key to the families

1. Early development intracellular, syzygy caudofrontal, gametes anisogamous, anisogamy accentuated, dehiscence by simple rupture, oocysts ovoid or ellipsoidal
.....STENOPHORIDAE
2. Early development intracellular, epimerite present or absent, if present, with prongs; with deep myocyte composed of 2 axial bundles; gametocyte with a single sporoduct; oocyst ellipsoidal or ovoid, with hyaline episporic; oocyst with eight sporozoites
.....MONODUCTIDAE
3. Early development extracellular, epimerite elongated with or without appendages, syzygy frontal, gametocyst residuum present, oocyst hat-shaped emitted in chains
.....STYLOCEPHALIDAE

Family STENOPHORIDAE Leger and Duboscq, 1904

1904. Stenophoridae Leger and Duboscq. *Arch. Protistenk.*, 4 : 335-383.

Genus *Stenophora* Laabe, 1899

1899. *Stenophora* Laabe, *Sporozoa*. In : *das tierreich*, 5 : p. 196.

Diagnosis : Development intracellular; oocysts ovoid, with prominent equatorial suture.

203. *Stenophora mruthunjayi* Rodgi and Amoji, 1969

1969. *Stenophora mruthunjayi* Rodgi and Amoji, *J. Anim. Morphol. Physiol.*, 16 : 196.
1988. *Stenophora mruthunjayi* : Levine : *The Protozoan Phylum Apicomplexa*, Vol. 1, CRC Press, Inc., Florida, p. 72.

Material examined : Sev. exs., Parli Vajinath, Beed, 2001, S. R. Nikam.

Diagnosis : Cephalonts relatively small in size, measuring 56-108 μm $\times$ 28 μm ; sporont ovate, broadly rounded at the posterior end and gradually tapering towards protomerite; protomerite head-shaped, broader than its length, 15-25 μm , broad at $\frac{1}{3}$ distance from the septum with a clear indentation in the middle, an apical spore seen at the tip of the protomerite; deutomerite with an oval nucleus, located in the middle or anterior half of the deutomerite.

Host : Millipede, *Chondromorpha kelaarti* Hembert; site of infection : proventricular region and gut.

Distribution : India : Maharashtra (Beed district); Karnataka.

Remarks : Rodgi and Amoji (1969) described this species from Karnataka state, while Gulbhile and Nikam (2005) recorded this species from this state.

204. *Stenophora ozakii* Hukui, 1955

1955. *Stenophora ozakii* Hukui, *J. Sci. Hiroshima Univ. Ser. B, Div. 1*, 13 : 91.

1988. *Stenophora ozakii* : Levine, *The Protozoan Phylum Apicomplexa*, Vol. 1, CRC Press, Inc., Florida, : 73.

Material examined : Sev. exs., Parli Vajinath, Beed, 2001, S. R. Nikam.

Diagnosis : Sporont elongated, measuring about 125-280 μm $\times$ 40-76 μm ; protomerite and deutomerite separated by an ectoplasmic indentation; protomerite ball or knob-shaped, measuring 14 μm in length and 18 μm in breadth and slightly varying in size; deutomerite elongated, swollen at $\frac{2}{3}$ from the anterior end, suddenly tapering to a narrow cylindrical form, terminating posteriorly to a blunt end.

Host : Millipede, *Chondromorpha severini* Silv.; site of infection : proventricular region of gut.

Distribution : India : Maharashtra (Beed district).

Remarks : Gulbhile and Nikam (2005) recorded this species from this state.

205. *Stenophora mahabaleshwari* Amoji and Rodgi, 1972

1972. *Stenophora mahabaleshwari* Amoji and Rodgi, *J. Karnatak Univ.*, 17 : 96.

1988. *Stenophora mahabaleshwari* : Levine, *The Protozoan Phylum Apicomplexa*, Vol. 1, CRC Press, Inc., Florida, p. 72.

Material examined : Sev. exs., Parli Vajinath, Beed, 2001, S. R. Nikam.

Diagnosis : Sporont 124-180 μm in length and 58 to 90 μm in breadth, appearing as a leaf-like body; protomerite broader [24 μm] than its length [20 μm], pot-shaped, fairly convex and fitted into deutomerite; deutomerite broader at $\frac{2}{3}$ from the anterior end and tapering gradually at either ends with an indentation in the middle of the body; nucleus oval, enclosing relatively large, usually centrally located in the posterior region of the deutomerite.

Host : Millipede, *Chondromorpha sevirini* Silv.; site of infection : proventricular region of gut.

Distribution : India : Maharashtra (Beed dist., Marathwada region).

Remarks : Amoji and Rodgi (1972) described this species from this state. Nikam (2001) also encountered this species from Maharashtra.

206. *Stenophora nematoides* Leger and Duboscq, 1903

1903. *Stenophora nematoides* Leger and Duboscq, *Arch. Zool. Exp. Gen.*, 31 : 307.

1988. *Stenophora nematoides* : Levine, *The Protozoan Phylum Apicomplexa*, Vol. 1, CRC Press, Inc., Florida, p. 72.

Material examined : Sev. exs., Parli Vajinath, Beed, 2001, S. R. Nikam.

Diagnosis : Sporont elongated worm-like, measuring about 465 to 580 μm in length and 30 to 45 μm in breadth; deutomerite slightly curved, anteriorly bearing a tiny belljar-shaped protomerite of about 35 μm in length and 25 μm in breadth;

constricted between these two parts a prominent septa rim seen in early stages, but less so in later ones.

Host : Millipede, *Chondromorpha sevirini*; site of infection : proventricular region of gut.

Distribution : India : Maharashtra (Beed district).

Remarks : Gulbhile and Nikam (2005) recorded this species from this state.

Family MONODUCTIDAE Ray and Chakravarty, 1933

1933. Monoductidae Ray and Chakravarty. *Arch. Protistenk.*, **81** : 352-360.

Diagnosis : As in the key.

Key to the genera

1. Epimerite present with a deep myocyte composed of two axial bundles, one retracting the epimerite; syzygy late, anisogamous; oocysts extruded in chains; parasitic in millipedes *Monoductus*
2. Epimerite absent in mature gamont; isogamous; oocysts extruded in chains; parasitic in millipedes *Stenodactylus*

Genus *Monoductus* Ray and Chakravarty, 1933

1933. *Monoductus* Ray and Chakravarty. *Arch. Protistenk.*, **81** : 352-360.

Diagnosis : As in the key.

207. *Monoductus lunatus* Ray and Chakravarty, 1933 (Fig. 92a-b)

1933. *Monoductus lunatus* Ray and Chakravarty. *Arch. Protistenk.*, **81** : 352-360.

1988. *Monoductus lunatus* : Levine, *The Protozoan Phylum Apicomplexa*, Vol. 1, CRC Press, Inc., Florida, : 76.

Material examined : Sev. exs., Parli Vaijnath, Beed, 2001, S. R. Nikam.

Diagnosis : Cephalonts with simple knob-like epimerite, varying in length from 5 to 18 μm and

average dimension, 10.8 μm $\times$ 11.0 μm ; protomerite slightly bigger than the epimerite measuring 13 μm $\times$ 15 μm ; deutomerite elongated, 256 μm $\times$ 37 μm , slightly broad in the anterior $\frac{1}{3}$ of the body, remaining posterior part narrow cylindrical with blunt posterior extremity; nucleus crescent-shaped, 11 μm $\times$ 13 μm , placed at anterior region of the body; sporont, two segmented, with protomerite, 15.8 μm $\times$ 17.8 μm in size, attaining bell-shaped to dome-shaped forms.

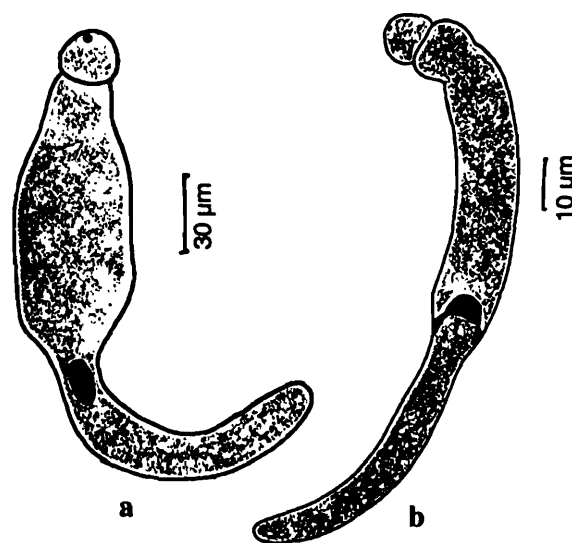


Fig. 92a-b. *Monoductus lunatus*

Host : *Chodromorpha kelaarti* Humb.; site of infection : proventricular region and gut.

Distribution : India : Maharashtra (Beed district), West Bengal.

Remarks : Gulbhile and Nikam (2005) recorded this species from this state.

Genus *Stenoductus* Ramachandran, 1976

1976. *Stenoductus* Ramachandran, *Zool. Anz.*, **196** : 125.

Diagnosis : As in the key.

208. *Stenodutut* sp. (Fig. 93a-d)

Diagnosis : Early stages of cephalont vase-like, with knob-like protomerite and slightly tapering end; nucleus boat-shaped and centrally placed; sporont, 432 μm $\times$ 846 μm , white in colour,

solitary and elongated, anterior region broad and posterior end narrow and tapering; protomerite hemispherical and broad; deutomerite cylindrical, about $458\ \mu\text{m} \times 665\ \mu\text{m}$ in length and $90\ \mu\text{m} \times 154\ \mu\text{m}$ in width, broad at anterior end and rounded at posterior end; nucleus boat-shaped.

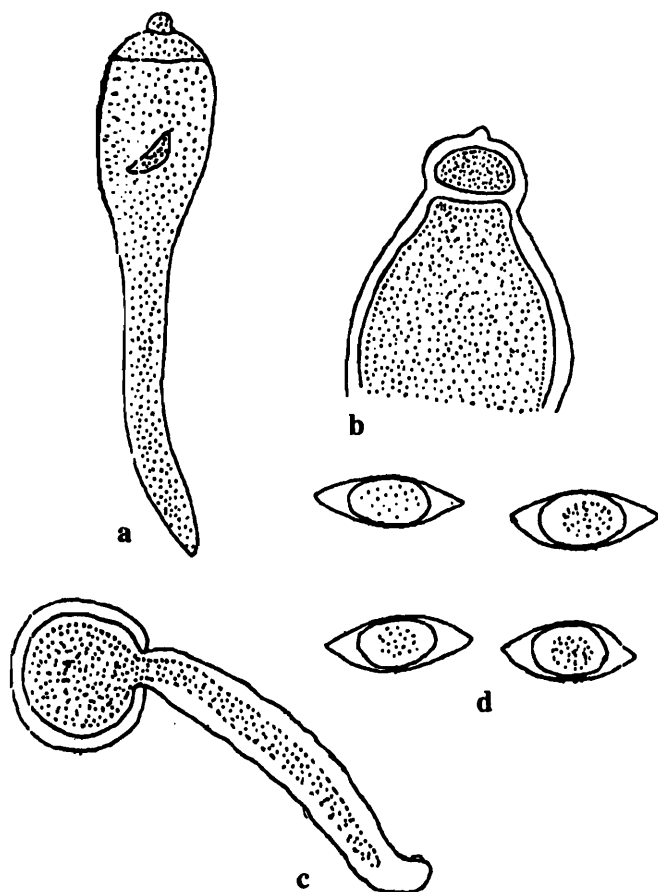


Fig. 93a-d. *Stenodutus* sp.

Host : *Chondromorpha kelaarei* Humb.; site of infection : mid gut and hind gut.

Distribution : India : Maharashtra (Beed district).

Remarks : In their unpublished work, Gulbhile V.D. and Nikam S.R. (2005) recorded this parasite as *Stenoductus vaidhynathi* n. sp. from this state (Pers. Com.). But mainly being unpublished and being not studied the relevant literature critically it is treated herein as unnamed species.

Family STYLOCEPHALIDAE Ellis, 1912

1912. Stylocephalidae Ellis. *Zool. Anz.*, **39** : 680.

Diagnosis : As in the key.

Genus *Xiphocephalus* Theodorides, 1964
emend. Corbel, 1971

1971. *Xiphocephalus* : Corbel, *Nat. Can.*, **98** : 1.

Diagnosis : Epimerite very long, with a sharp or blunt point, on a filiform neck; parasitic in insects.

209. *Xiphocephalus africanus* Theodorides, 1964

1964. *Xiphocephalus africanus* Theodorides, *C. R. 88th Congr. Natl. Soc. Savantes Sect. Sci.*, **11** : 679.

1988. *Xiphocephalus africanus* : Levine, *The Protozoan Phylum Apicomplexa*, Vol. 1, CRC Press, Inc., Florida, p. 76.

Material examined : Sev. exs., Parli Vaijnath, Beed, 2001, S. R. Nikam.

Diagnosis : Cephalont oval, measuring about $25\ \mu\text{m}$ in length and $5\ \mu\text{m}$ in width; epimerite cone-shaped, $12\ \mu\text{m}$ in length; protomerite hemispherical, $1.6\ \mu\text{m}$ in length and $4\ \mu\text{m}$ in breadth; deutomerite oval, $11\ \mu\text{m}$ in length; nucleus ovoidal; with growth of parasite collar of epimerite, protomerite and deutomerite increased in size; sporont solitary, about $630\ \mu\text{m}$ in length and $40\ \mu\text{m}$ in breadth.

Host : *Rhytinota* sp. (Coleoptera); site of infection : mid intestine.

Distribution : India : Maharashtra (Beed district).

Remarks : In their unpublished work, Gulbhile V.D. and Nikam S.R. (2005) recorded this parasite from this state (Pers. Com.).

Subclass COCCIDIA

Order EUCOCCIDA

Suborder ADELINA

Family HAEMOGREGARINIDAE

Diagnosis : Oocyst producing sporoblasts, each of which developing into a spore with two or four sporozoites; occurring in two hosts, circulatory system of vertebrates and digestive system of invertebrates.

Genus *Haemogregarina* Danilewsky, 1885

1885. *Haemogregarina* Danilewsky, *Arch. micr. Anat.*, **24** : 588-598.
1988. *Haemogregarina* : Levine, *The Protozoan Phylum Apicomplexa*, Vol. 1, CRC Press, Inc., Florida, p. 118.

Diagnosis : Oocysts with 8 or more naked sporozoites; infection of vertebrate host by the bite of an invertebrate; schizogony occurring in erythrocytes of vertebrates; merogony ordinarily in vertebrate internal organs; sporogony in invertebrates; no sporokinetes.

A. *Haemogregarina* of amphibians

210. *Haemogregarina berestneffi* Castellani and Willey, 1905
(Fig. 94a-b)

1905. *Haemogregarina berestneffi* Castellani and Willey, *Quart. J. Microsc. Sci.*, **49** : 383-402.
1938. *Haemogregarina berestneffi* : Bhatia : *The Fauna of British India, including Ceylon and Burma. Protozoa : Sporozoa*. Taylor and Francis, London, p. 119.
1988. *Haemogregarina berestneffi* : Levine, *The Protozoan Phylum Apicomplexa*, Vol. 1, CRC Press, Inc., Florida, p. 119.

Diagnosis : Intra-corpuseular forms varying in shapes and sizes, 26-28 $\mu\text{m} \times 4.0$ -5.5 μm , often with a characteristic pink-staining sheath; free gregariniform parasites motile in blood plasma; parasite embracing the displaced host cell nucleus like a halteridium, lying with both ends rounded and curved within a strongly refringent colourless capsule.

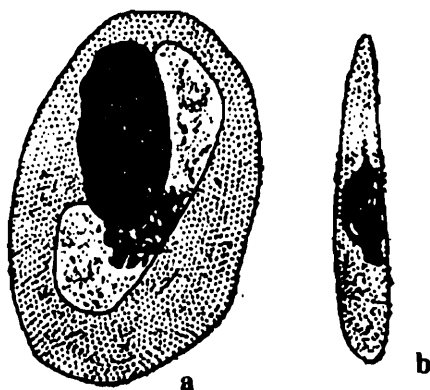


Fig. 94a-b. *Haemogregarina berestneffi*

Host : *Rana tigrina* Daud.; site of infection : blood.

Distribution : India : Maharashtra, Goa and Tamil Nadu.

Elsewhere : Sri Lanka.

Remarks : This species is reported from two species of frogs viz., *Rana tigrina* and *R. limnocharis*, from this state (vide Bhatia, 1938).

211. *Haemogregarina magna* (Grassi and Feletti, 1892)
(Fig. 95a-d)

1892. *Drepanidium magnum* Grassi and Feletti, *Atti Acad. Gioenia Sci. Nat. Catania*, 4 ser. V, i, Mem., **5** : 81.
1938. *Haemogregarina magna* : Bhatia : *The Fauna of British India, including Ceylon and Burma. Protozoa : Sporozoa*. Taylor and Francis, London, p. 124.
1988. *Haemogregarina magna* : Levine, *The Protozoan Phylum Apicomplexa*, Vol. 1, CRC Press, Inc., Florida, p. 123.

Diagnosis : Gametocyte elongated, anteriorly broad and rounded and posteriorly narrower, 12.4 $\mu\text{m} \times 4.06 \mu\text{m}$ and 44.5 μm^2 in area; cytoplasm hyaline and homogeneous; nucleus broad to oval, sometimes rounded or band-shaped, 4.4 $\mu\text{m} \times 3.3 \mu\text{m}$ and 12.1 μm^2 in area, located centrally or towards the broader end.

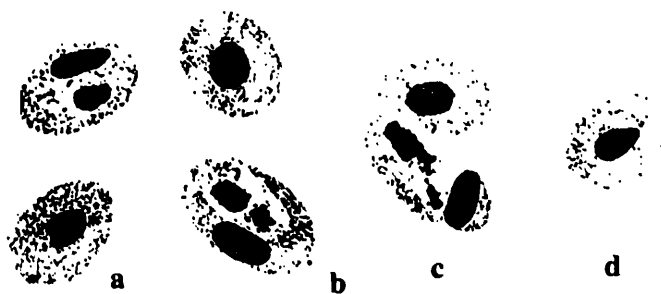


Fig. 94a-d. *Haemogregarina magna*

Host : *Rana tigrina* Daud and *R. limnocharis* Wiegmann; site of infection : blood.

Distribution : India : Maharashtra, and Tamil Nadu.

Remarks : This species is reported from two species of frogs viz., *Rana tigrina* and *R. limnocharis*, from this state (vide Bhatia, 1938).

B. *Haemogregarina* from reptiles

212. *Haemogregarina mirabilis* Castellani and Willey, 1904 (Fig. 96a-f)

1904. *Haemogregarina mirabilis* Castellani and Willey, *Spolia Zeylanica*, 2, p. 86.
1938. *Haemogregarina magna* : Bhatia : *The Fauna of British India, including Ceylon and Burma. Protozoa : Sporozoa*. Taylor and Francis, London, p. 128.
1988. *Haemogregarina mirabilis* : Levine, *The Protozoan Phylum Apicomplexa*, Vol. 1, CRC Press, Inc., Florida, p. 124.

Diagnosis : Macrogametocyte 12 µm in length, gregarine-like, elongated, thick and bent; cytoplasm staining uniformly blue; nucleus reddish blue.

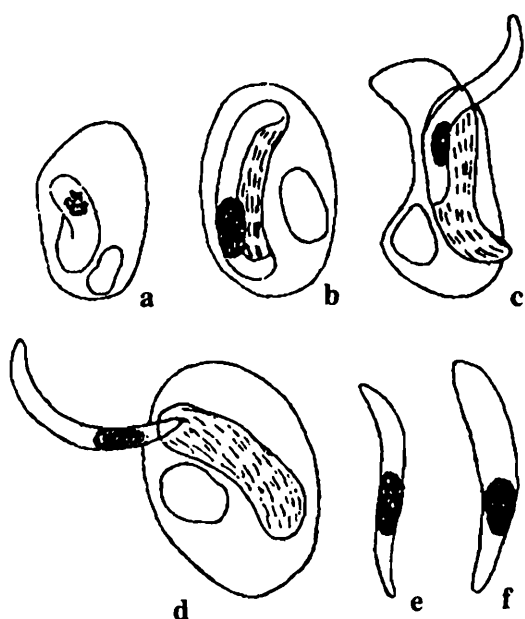


Fig. 96a-b. *Haemogregarina mirabilis*

Host : *Xenochrophis piscator*; site of infection : blood.

Distribution : India : Maharashtra (Mumbai), Tamil Nadu.

Elsewhere : Sri Lanka.

Remarks : Ball (1958) reported this species in *Xenochrophis piscator* from this state.

213. *Haemogregarina* sp.

Host : *Ptyas mucosus* : site of infection : blood.

Distribution : India : Maharashtra.

Remarks : Present report as examined in 1873 (NCN).

214. *Haemogregarina* sp.

Host : *Ptyas karolini* : site of infection : blood.

Distribution : India : Maharashtra (Mumbai vicinity).

Remarks : Ball (1957) reported this species in *Ptyas karolini* from this state.

Genus *Hepatozoon* Miller, 1908

1908. *Hepatozoon* Miller, U. S. Treasury Department Hygiene Laboratory, *Bull. No.*, 46.
1988. *Hepatozoon* : Levine, *The Protozoan Phylum Apicomplexa*, Vol. 1, CRC Press, Inc., Florida, p. 129.

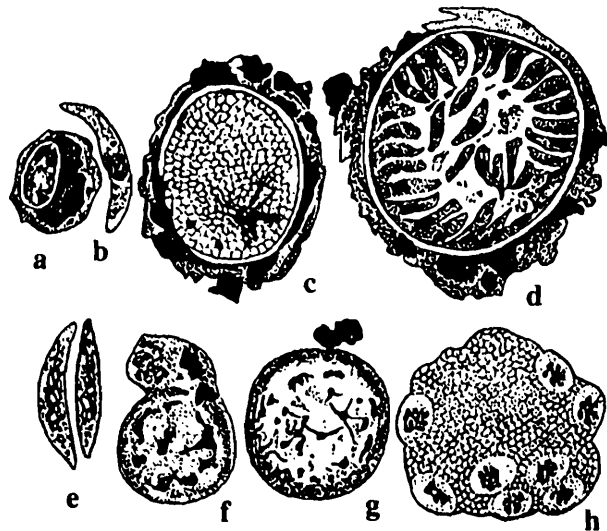
Diagnosis : Large oocysts containing many sporocysts, each with 4-16 or more sporozoites; vertebrate hosts amphibians, reptiles, birds and mammals; invertebrate hosts mites, ticks, insects and leeches; infection of vertebrate hosts by ingestion of invertebrate hosts; gamonts in erythrocytes or leucocytes; merogony in vertebrate internal organs; sporogony in invertebrate host; no sporokinets.

215. *Hepatozoon canis* (James, 1905) (Fig.97a-h)

1905. *Leucocytozoon canis* James, *Sci. Mem. Off. Med. San. Dept. Govt. India*, 15 : 1-12.
1988. *Hepatozoon canis* : Levine, *The Protozoan Phylum Apicomplexa*, Vol. 1, CRC Press, Inc., Florida, p. 130.

Diagnosis : Schizonts of several types, some producing smaller number of larger merozoites for infecting mononuclear or polymorphonuclear leucocytes and eventually become gametocytes; schizogony occurring in spleen, bone-marrow or liver; free vermiform forms in the gut of ticks; large oocysts about 100 µm in longest diameter containing 30-50 sporocysts each having 16 sporozoites and a residual mass in the gut tissue of ticks.

Host : *Canis familiaris*; site of infection : blood.

Fig. 97a-h. *Hepatozoon canis*

Distribution : India : Maharashtra (Mumbai).

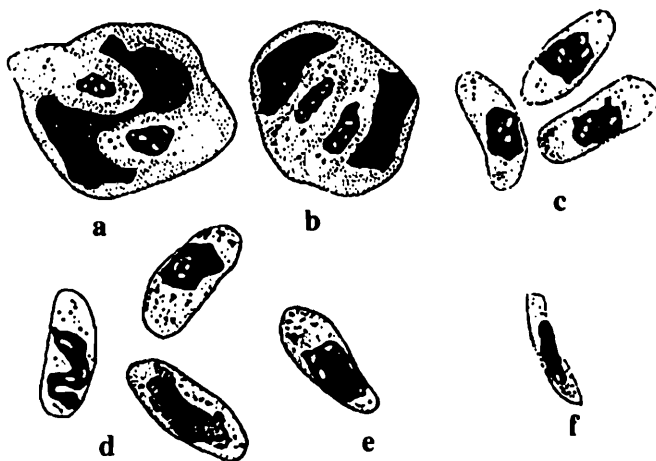
Remarks : Pawar and Gatne (2005) reported this species from this state.

216. *Hepatozoon funambuli* (Patton, 1908)
(Fig. 98a-f)

1908. *Hepatozoon funambuli* Patton, *Sci. Mem.*, **24**, Off. Med., Govt. of India.

1988. *Hepatozoon funambuli* : Levine, *The Protozoan Phylum Apicomplexa*, Vol. 1, CRC Press, Inc., Florida, p. 131.

Diagnosis : Gametocyte elongate oval, 10 μm $\times$ 5 μm , with one end larger and rounder than the other; no capsule round the parasite; free forms,

Fig. 98a-f. *Hepatozoon funambuli*

13-14 μm $\times$ 3-4 μm , elongated and spindle-shaped; nucleus large, irregularly quadrilateral, lying about the centre, staining deeply but not uniformly.

Host : *Funambulus pennanti* Wroughton; site of infection : blood.

Distribution : India : Maharashtra (Bombay : Kathiawar).

Remarks : This species is reported from *Funambulus pennanti* Wroughton from this state (vide Bhatia, 1938).

Suborder EIMERINA

Family AGGREGATIDAE

Diagnosis : Anisogamy resulting in production of zygotes which transforming into many spores, each with two to thirty sporozoites; in schizogony cytomeres first appeared and then merozoites; alternation of generations and parasites of marine annelid, mollusc and crustacean hosts.

Genus *Aggregata* Frenzel, 1885

1885. *Aggregata* Frenzel, *Arch. Mikr. Anat.*, **24** : 545.

1988. *Aggregata* : Levine, *The Protozoan Phylum Apicomplexa*, Vol. 1, CRC Press, Inc., Florida, p. 135.

Diagnosis : Oocysts large, with many sporocysts, each with 3-28 sporozoites; heteroxenous, with merogony in decapod crustacean and gamogony in a cephalopod host.

217. *Aggregata* sp

Diagnosis : Schizonts spherical or oval, 193-246 μm in diameter, enclosed in a cyst; merozoites curved and spindle-shaped, 11-16 μm , with a broad central portion and pointed ends; cyst having 6-7 pear-shaped apertures for escape of merozoites.

Host : *Parapeneopsis sculptilis*; site of infection : intestine.

Distribution : India : Maharashtra (Mumbai district).

Remarks : Setna and Bhatia (1934) reported this unnamed species from this state.

Family EIMERIIDAE

Diagnosis : Monoxenous; schizogony and gametogony within host cells, and sporogony

ordinarily occurring outside the host's body; oocysts and schizonts lack attachment organ; oocysts containing 0, 1, 2, 4, or many sporocysts, each containing one or more sporozoites.

Key to the genera

- 1(2) Four sporocysts, each with two sporozoites *Eimeria*
 2(1) Two sporocysts, each with four sporozoites *Isospora*

Genus *Eimeria* Schneider, 1875

1875. *Eimeria* Schneider, Arch. Zool. Exp. Gen., 4 : 473.

1988. *Eimeria* : Levine, *The Protozoan Phylum Apicomplexa*, Vol. 1, CRC Press, Inc., Florida, p. 139.

Diagnosis : Each oocyst with 4 sporocysts, each sporocyst with two sporozoites; merogony intracellular; parasitic in vertebrates and only in a few invertebrates.

A. *Eimeria* in fishes

218. *Eimeria harpodoni* Setna and Bana, 1935 (Fig. 99a-b)

1935. *Eimeria harpodoni* Setna and Bana, J. R. Microsc. Soc., 55 : 165-169.

1987. *Eimeria harpodoni* : Mandal : *Fauna of India : Protozoa : Sporozoa : Eucoccidiida : Eimeriidae*, Zoological Survey of India, Calcutta, p. 132.

1988. *Eimeria harpodoni* : Levine, *The Protozoan Phylum Apicomplexa*, Vol. 1, CRC Press, Inc., Florida, p. 153.

Diagnosis : Oocyst spherical, 12-17 μm in diameter; two-layered; without micropyle but oocystic residuum present; sporocyst elliptical, 8.5-10.8 μm $\times$ 3.6-5.7 μm , with a long protuberance

at one end, the edge of protuberance having a broad inverted V-shaped appendage, sporocystic residuum compact; sporozoites elongated, 7.3 μm in length, with one end pointed and having a nucleus located at the broader end.

Host : *Harpodon nehereus* (Ham.); site of infection : intestine.

Distribution : India : Maharashtra (Mumbai) and West Bengal.

Remarks : Setna and Bana (1935) reported this species from this state.

219. *Eimeria southwelli* Halwani, 1930

1930. *Eimeria southwelli* Setna and Bana, Ann. Trop. Ed. Parasit., 24 : 1.

1987. *Eimeria southwelli* : Mandal : *Fauna of India : Protozoa : Sporozoa : Eucoccidiida : Eimeriidae*, Zoological Survey of India, Calcutta, p. 135.

1988. *Eimeria harpodoni* : Levine, *The Protozoan Phylum Apicomplexa*, Vol. 1, CRC Press, Inc., Florida, p. 172.

Diagnosis : Oocyst cylindrical or sausage-shaped, 30.5-53.5 (39.5) μm $\times$ 10.5-15.4 (13.1) μm , with a single transparent outer wall; sporocyst oval, 10-12 μm $\times$ 6.5 μm ; sporocystic residuum absent; sporozoites sausage-shaped, 10.1 μm in length and arranged irregularly.

Host : *Aetobatis narinari*; site of infection : embryo spiral valve.

Distribution : India : Maharashtra (Mumbai) and West Bengal.

Remarks : Halwani (1930) reported this species from this state.

220. *Eimeria* sp.

Host : *Trichiurus savala*; site of infection : intestine.

Distribution : India : Maharashtra.

Remarks : Setna and Bana (1935) reported this unnamed species from this state.

221. *Eimeria* sp.

Host : *Batrachus grunniens*; site of infection : intestine.

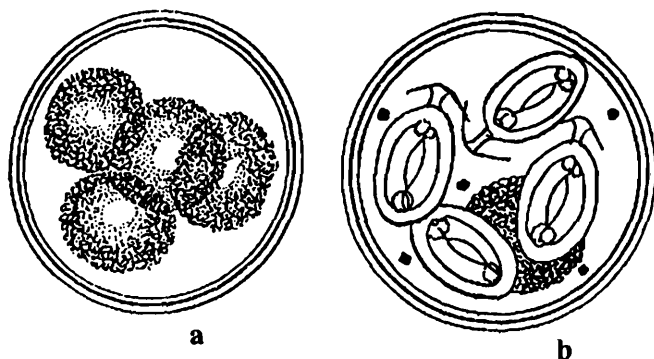


Fig. 99a-b. *Eimeria harpodoni*

Distribution : India : Maharashtra.

Remarks : Setna and Bana (1935) reported this unnamed species from this state.

222. *Eimeria* sp.

Host : *Epinehalus tauvina*; site of infection : intestine.

Distribution : India : Maharashtra.

Remarks : Setna and Bana (1935) reported this unnamed species from this state.

223. *Eimeria* sp.

Host : *Epinephalus diacanthus*; site of infection : intestine

Distribution : India : Maharashtra.

Remarks : Setna and Bana (1935) reported this unnamed species from this state.

224. *Eimeria* sp.

Host : *Engraulus mystax*; site of infection : intestine.

Distribution : India : Maharashtra.

Remarks : Setna and Bana (1935) reported this unnamed species from this state.

225. *Eimeria* sp.

Host : *Otolithes ruber*; site of infection : intestine.

Distribution : India : Maharashtra.

Remarks : Setna and Bana (1935) reported this unnamed species from this state.

226. *Eimeria* sp.

Host : *Sillago sihama*; site of infection : intestine.

Distribution : India : Maharashtra.

Remarks : Setna and Bana (1935) reported this unnamed species from this state.

227. *Eimeria* sp.

Host : *Plotossus canius*; site of infection : intestine.

Distribution : India : Maharashtra.

Remarks : Setna and Bana (1935) reported this unnamed species from this state.

228. *Eimeria* sp.

Host : *Coilia dussumieri*; site of infection : intestine.

Distribution : India : Maharashtra.

Remarks : Setna and Bana (1935) reported this unnamed species from this state.

B. *Eimeria* of reptiles

Key to the species

1(2) Oocyst elliptical, 18.5-35.4 (25.5) μm $\times$ 12.5 μm *E. flaviviridis*

2(1) Oocyst not elliptical, measuring less than 20 μm in length

(a) Oocyst lemon-shaped *E. hemidactyli*

(b) Oocyst ovoid *E. knowlesi*

229. *Eimeria flaviviridis* Setna and Bana, 1935
(Fig. 100a-b)

1935. *Eimeria harpodoni* Setna and Bana, *J. R. Microsc. Soc.*, 55 : 256-260.

1987. *Eimeria harpodoni* : Mandal : *Fauna of India : Protozoa : Sporozoa : Eucoccidiida : Eimeriidae*, Zoological Survey of India, Calcutta, p. 146.

Diagnosis : Oocyst elliptical, colourless, 18.5-35.4 (25.5) μm $\times$ 12.5 μm , shape index 2.0, micropyle and oocystic residuum absent; sporocyst ovoid, 6.5-9.4 (8.3) μm $\times$ 5.3-8.3 (6.9) μm , shape index 1.2, sporocystic residuum granular situated

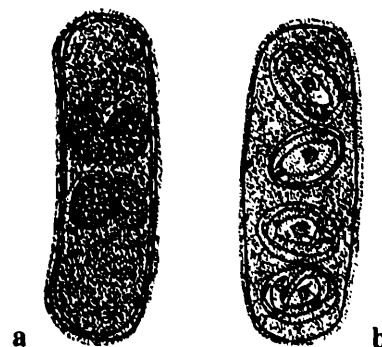


Fig. 100a-b *Eimeria flaviviridis*

in the middle; sporozoites elongated and bent at the middle, $9.5\ \mu\text{m} \times 1.0\ \mu\text{m}$, with a nucleus located close to the anterior end.

Host : *Hemidactylus flaviviridis* (Ruppell); site of infection : intestine.

Distribution : India : Maharashtra (Mumbai) and West Bengal.

Remarks : Setna and Bana (1935) reported this species from this state.

230. *Eimeria hemidactyli* Knowles and Das Gupta, 1935
(Fig. 101a-b)

1935. *Eimeria hemidactyli* Knowles and Das Gupta, *Indian J. med. Res.*, **22** : 701.

1987. *Eimeria hemidactyli* : Mandal : *Fauna of India : Protozoa : Sporozoa : Eucoccidiida : Eimeriidae*, Zoological Survey of India, Calcutta, p. 148.

1988. *Eimeria hemidactyli* : Levine, *The Protozoan Phylum Apicomplexa*, Vol. 1, CRC Press, Inc., Florida, p. 155.

Material examined : Sev. exs., Ratnagiri, Nov., 2006, R. Nandi.

Diagnosis : Oocyst lemon-shaped, two-layered, $16-22\ (18.5)\ \mu\text{m} \times 12-16\ (14)\ \mu\text{m}$, shape index 1.3, micropyle and oocystic residuum absent; sporocyst ovoid, $9-11\ (10)\ \mu\text{m} \times 8.0\ \mu\text{m}$, shape index 1.4, sporocystic residuum granular scattered inside; sporozoites elongated and pointed at one end, $6.5\ \mu\text{m} \times 1.5\ \mu\text{m}$, with a nucleus located at the posterior end.

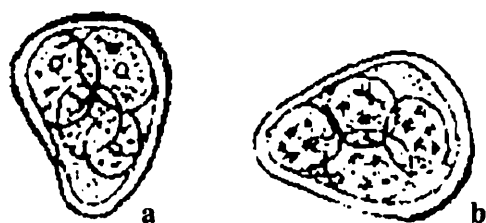


Fig. 101a-b. *Eimeria hemidactyli*

Host : *Hemidactylus flaviviridis* (Ruppell); site of infection : intestine.

Distribution : India : Maharashtra (Ratnagiri district).

Remarks : This species is reported herein for the first time from this state.

231. *Eimeria knowlesi* Bhatia, 1936
(Fig. 102a-b)

1936. *Eimeria knowlesi* Bhatia, *Curr. Sci.*, **5** : 177.

1987. *Eimeria knowlesi* : Mandal : *Fauna of India : Protozoa : Sporozoa : Eucoccidiida : Eimeriidae*, Zoological Survey of India, Calcutta, p. 151.

1988. *Eimeria knowlesi* : Levine, *The Protozoan Phylum Apicomplexa*, Vol. 1, CRC Press, Inc., Florida, p. 156.

Material examined : Sev. exs., Nasik, Dec., 2005, R. Nandi.

Diagnosis : Oocysts spherical or oval, double-layered, without any micropyle and residuum, $16-20\ (18)\ \mu\text{m} \times 14-18\ (16)\ \mu\text{m}$; sporocysts ovoid, $9.0-11.0\ (10.0)\ \mu\text{m} \times 7.5-8.5\ (7.8)\ \mu\text{m}$, sporocystic residual mass located in between the sporozoites; sporozoite elongated, $7.0\ \mu\text{m}$ in length.

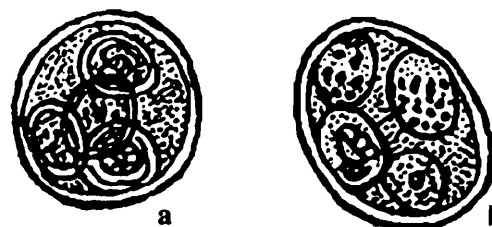


Fig. 102a-b. *Eimeria knowlesi*

Host : House Lizard *Hemidactylus flaviviridis* (Ruppell); site of infection : intestine.

Distribution : India : Maharashtra (Nasik district), Andhra Pradesh and West Bengal.

Remarks : This species is reported herein for the first time from this state.

C. *Eimeria* in birds

Key to the species of *Eimeria* of birds

- 1(2) Oocyst large sized, usually more than $30\ \mu\text{m}$ in diameter *E. maxima*
- 2(1) Oocyst usually less than $30\ \mu\text{m}$ in diameter
- 3(4) Oocyst wall striated, micropyle present
..... *E. tenella*
- 4(3) Oocyst wall smooth
- 5(6) Oocyst spherical or approximately spherical *E. mitis*

6(5) Oocyst elongated

7(8) Oocystic residuum present

(a) Oocyst oval or ovoid, above 25 μm in length
..... *E. columbae*

8(7) Oocystic residuum absent

(a) Oocyst elliptical, about 20 μm in length,
micropyle indistinct *E. praecox*

(b) Oocyst egg-shaped, less than 20 μm in length
..... *E. acervulina*

(c) Oocyst broad ovoid, about 20 μm in length,
pathogenic *E. necatrix*

(d) Oocyst broadly ovoid, about 20 μm in length,
non-pathogenic *E. hagini*

232. *Eimeria acervulina* Tyzzer, 1929
(Fig. 103)

1929. *Eimeria acervulina* Tyzzer, *Am. J. Hyg.*, **10** : 269.

1987. *Eimeria acervulina* : Mandal : *Fauna of India* :
Protozoa : *Sporozoa* : *Eucoccidiida* : *Eimeriidae*,
Zoological Survey of India, Calcutta, p. 161.

1988. *Eimeria acervulina* : Levine, *The Protozoan Phylum*
Apicomplexa, Vol. 1, CRC Press, Inc., Florida, p. 140.

Diagnosis : Oocyst egg-shaped or oval, 18-20 $\mu\text{m} \times 14 \mu\text{m}$, smooth walled, uniformly thick, excepting thin anterior end, yellowish in colour; micropyle at the narrower end, no oocystic residuum even in unsporulated oocyst but a polar granule present in most sporulated oocyst.

Host : *Gallus domesticus*; site of infection : intestine.

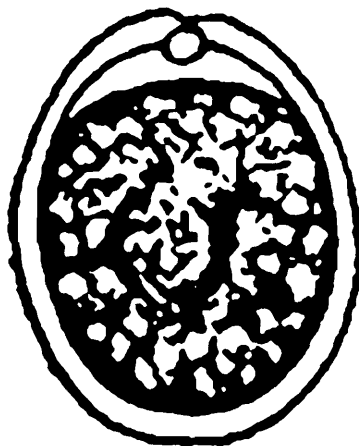


Fig. 103. *Eimeria acervulina*

Distribution : India : Maharashtra (Mumbai), Uttar Pradesh, Orissa, Madhya Pradesh and Tamil Nadu (Mandal, 1987).

Remarks : Gill (1959) reported this species from this state.

233. *Eimeria columbae* Mitra and Das gupta, 1937
(Fig. 104)

1937. *Eimeria columbae* Mitra and Das Gupta, *Proc. Indian Sci. Congr.*, p. 291.

1987. *Eimeria columbae* : Mandal : *Fauna of India* :
Protozoa : *Sporozoa* : *Eucoccidiida* : *Eimeriidae*,
Zoological Survey of India, Calcutta, p. 176.

1988. *Eimeria columbae* : Levine, *The Protozoan Phylum*
Apicomplexa, Vol. 1, CRC Press, Inc., Florida, p. 147.

Material examined : Few. exs., Jalgaon, Sept., 2007, R. Nandi.

Diagnosis : Oocyst subspherical, double walled, outer wall thinner and membranous, 14-18 (16) $\mu\text{m} \times 13-15$ (14) μm , shape index 1.2, micropyle absent, oocystic residuum present; sporocyst ellipsoidal without any knob, 6.5-8.5 (7.2) $\mu\text{m} \times 3.5-5.8$ (4.5) μm , shape index 1.6, sporocystic residuum present as scattered mass; sporozoites curved with one end pointed and the other end rounded.

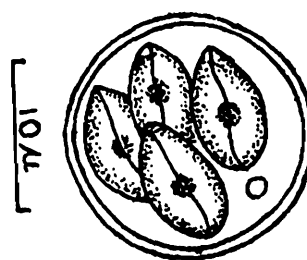


Fig. 104. *Eimeria columbae*

Host : Domestic Pigeon, *Columba livia intermedia* Strickland; site of infection : intestine.

Distribution : India : Maharashtra (Jalgaon), Andhra Pradesh, Orissa and West Bengal.

Remarks : This species is reported herein for the first time from this state.

234. *Eimeria hagini* Levine, 1938

1938. *Eimeria hagini* Levine, *Cornell Vet.*, **28** : 263.

1987. *Eimeria hagini* : Mandal : *Fauna of India : Protozoa : Sporozoa : Eucoccidiida : Eimeriidae*, Zoological Survey of India, Calcutta, p. 188.

1988. *Eimeria hagini* : Levine, *The Protozoan Phylum Apicomplexa*, Vol. 1, CRC Press, Inc., Florida, p. 153.

Diagnosis : Oocyst broadly ovoid, 16-21 μm $\times$ 14-19 μm ; wall double contoured with smooth surface; micropyle absent; polar granule present in mature oocyst after sporulation.

Host : *Gallus domesticus*; site of infection : faecal contents.

Distribution : India : Maharashtra (Mumbai), Uttar Pradesh, Orissa and Madhya Pradesh.

Remarks : Gill (1954) reported this species from this state.

235. *Eimeria maxima* Tyzzer, 1929
(Fig. 105)

1929. *Eimeria maxima* Tyzzer, *Am. J. Hyg.*, 10 : 269.

1988. *Eimeria maxima* : Levine, *The Protozoan Phylum Apicomplexa*, Vol. 1, CRC Press, Inc., Florida, p.160.

Diagnosis : Oocysts egg-shaped, double-layered, rough-walled, with light yellowish-brown tint and a micropyle at the narrower end, measuring 21-42 (29) μm $\times$ 16-30 (23) μm ; sporont spherical and granular in structure; polar granule present; oocystic residuum absent; sporocysts ovoid, 18.8 μm $\times$ 8.7 μm , with a prominent stieda body on the more pointed end; sporozoites 19 μm $\times$ 4 μm with a large refractile globule on the broader and a small granule on the narrower end.

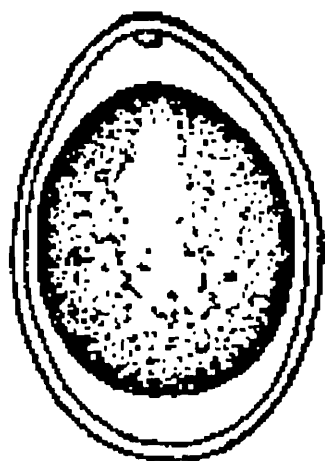


Fig. 105. *Eimeria maxima*

Host : *Gallus domesticus*; site of infection : faecal content.

Distribution : India : Maharashtra (Mumbai, Aurangabad), Madhya Pradesh, Orissa, Uttar Pradesh, Tamil Nadu.

Remarks : Gill (1954) reported this species from this state.

236. *Eimeria mitis* Tyzzer, 1929
(Fig. 106)

1929. *Eimeria maxima* Tyzzer, *Am. J. Hyg.*, 10 : 269.

1988. *Eimeria mitis* : Levine, *The Protozoan Phylum Apicomplexa*, Vol. 1, CRC Press, Inc., Florida, p.161.

Diagnosis : Oocysts apparently spherical, 11-19 μm $\times$ 10-17 μm , yellowish-tinged and smooth walled; shape index 1.1; polar granules present but oocystic residuum and micropyle absent; sporocyst 9-10 μm $\times$ 6.5 μm ; stieda body prominent; sporocystic residuum granular and centrally located.

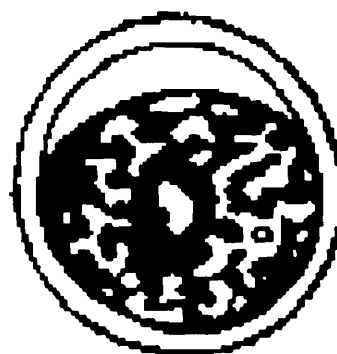


Fig. 106. *Eimeria mitis*

Host : *Gallus domesticus*; site of infection : faecal contents.

Distribution : India : Maharashtra (Mumbai), Madhya Pradesh, Uttar Pradesh, Orissa and Tamil Nadu.

Remarks : Gill (1954) reported this species from this state.

237. *Eimeria necatrix* Johnson, 1930
(Fig. 107)

1930. *Eimeria necatrix* Johnson, *Ore. Agric. Expt. St.*, p. 119.

1987. *Eimeria necatrix* : Mandal : *Fauna of India : Protozoa : Sporozoa : Eucoccidiida : Eimeriidae*, Zoological Survey of India, Calcutta, p. 203.

1988. *Eimeria necatrix* : Levine, *The Protozoan Phylum Apicomplexa*, Vol. 1, CRC Press, Inc., Florida, p.162.

Material examined : Sev. exs., Amaravati district, Sept. 2007, R. Nandi.

Diagnosis : Oocyst broad ovoid in shape, one end less pointed, measuring 15.3-23.3 (20.5) μm $\times$ 13.6-20.2 (16.8) μm ; shape index 1.0-1.6 (1.26); oocyst wall smooth and double contoured; micropyle and oocystic residuum absent; sporocysts elongated, each measuring 10 μm in length and 6 μm in width; a polar body present.

Host : Domestic Fowl, *Gallus domesticus*; site of infection : intestine.

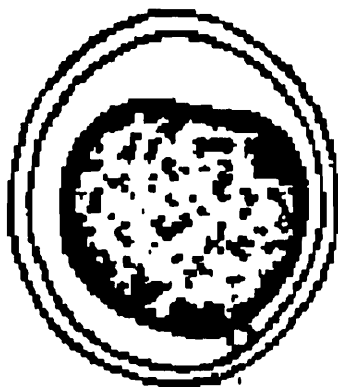


Fig. 107. *Eimeria necatrix*

Distribution : India : Maharashtra (Aurangabad and Amaravati districts) Andhra Pradesh, Uttar Pradesh and Tamil Nadu.

Remarks : Gill (1961) studied the incidence of this species in Indian Poultry. This species is also encountered herein from Maharashtra state.

238. *Eimeria praecox* Johnson, 1930
(Fig. 108)

1930. *Eimeria praecox* Johnson, Director's Biennial Report for the Fiscal Year 1928-1930. Oregon Agricultural Experiment Station, p. 119.

1988. *Eimeria praecox* : Levine, *The Protozoan Phylum Apicomplexa*, Vol. 1, CRC Press, Inc., Florida, p. 167.

Diagnosis : Oocysts 17.7-24.4 (21.2) μm $\times$ 13.8-19.2 (15.6) μm , spherical to elliptical in

shape; oocyst wall smooth, yellowish in colour; micropyle indistinct; polar granule present; oocystic residuum absent; sporocyst elongated to ovoid in shape.

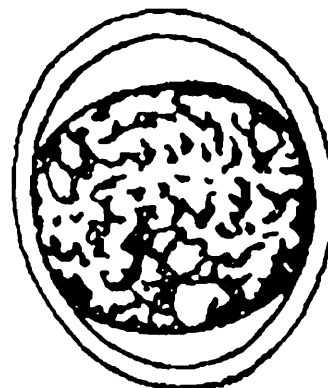


Fig. 108. *Eimeria praecox*

Host : *Gallus domesticus*; site of infection : intestine.

Distribution : India : Maharashtra (Mumbai), Madhya Pradesh, Uttar Pradesh.

Remarks : Gill (1957) reported this species from this state.

239. *Eimeria tenella* (Railliet and Lucet, 1891)
(Fig. 109)

1891. *Eimeria avium* auct., *Coccidium tenellum* Railliet and Lucet, *Bull. Soc. Zool. Fr.*, 16 : 246.

1987. *Eimeria tenella* : Mandal : *Fauna of India : Protozoa : Sporozoa : Eucoccidiida : Eimeriidae*, Zoological Survey of India, Calcutta, p. 213.

Diagnosis : Oocyst broad-ovoid, 19.2-26 μm $\times$ 16-22 μm , oocystic wall striated, micropyle present; sporocyst measuring 11 μm $\times$ 7 μm , stieda

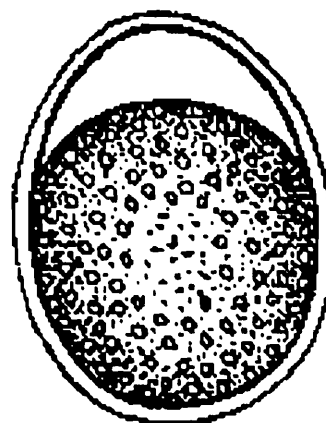


Fig. 109. *Eimeria tenella*

body present; sporozoites elongated banana-shaped, 5-8 μm in length; mature schizont 42.5 μm $\times$ 37.5 μm , merozoite 6.5 μm in length.

Host : Domestic Fowl, *Gallus domesticus*; site of infection : intestine.

Distribution : India : Maharashtra (Aurangabad), Andhra Pradesh, Uttar Pradesh, Madhya Pradesh, Tamil Nadu, West Bengal; elsewhere : cosmopolitan.

Remarks : This is the most pathogenic species of the chicken coccidia which is responsible for heavy losses in poultry farms. Gill and Ray (1957) reported this species from this state.

240. *Eimeria* sp.
(Fig. 110a-c)

Material examined : Sev. exs. Aurangabad district.

Diagnosis : Oocyst spherical, subspherical or ovoid, two layered, outer layer thick, transparent and bluish gray while inner one thin, membranous and opaque; micropylar cap and micropyle absent; unsporulated oocyst showing an oval sporoblast measuring 18.2 $\times$ 16.8 μm on an average; sporulated oocyst pyriform, conical stieda body, sporocystic residuum scattered irregularly;

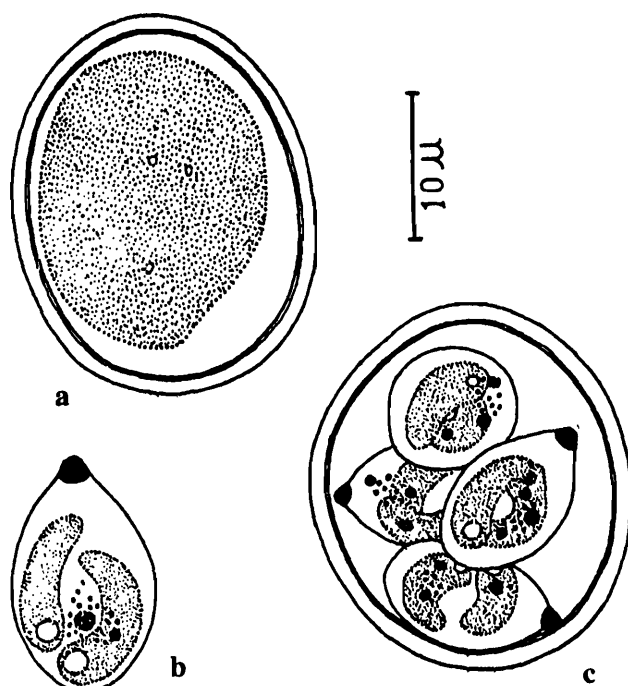


Fig. 110a-c. *Eimeria* sp. in *Alauda gulgula*

sporozoite elongated, 7.2 μm $\times$ 3.4 μm ; banana-shaped; carrying a medium sized refractile body at one end.

Host : *Alauda gulgula* (Franklin), Small skylark; site of infection : intestine.

Distribution : India : Maharashtra (Aurangabad district).

Remarks : In his unpublished work, V. M. Bhosale (1977) recorded this parasite as *Eimeria alaudae* n. sp. from this state (Pers. Com.). But, though observed and communicated by S. R. Nikam being unpublished it is treated herein as unnamed species.

241. *Eimeria* sp.
(Fig. 111a-c)

Material examined : Sev. exs. Aurangabad district.

Diagnosis : Oocyst subspherical to oval in shape, smooth, single layered, yellowish brown

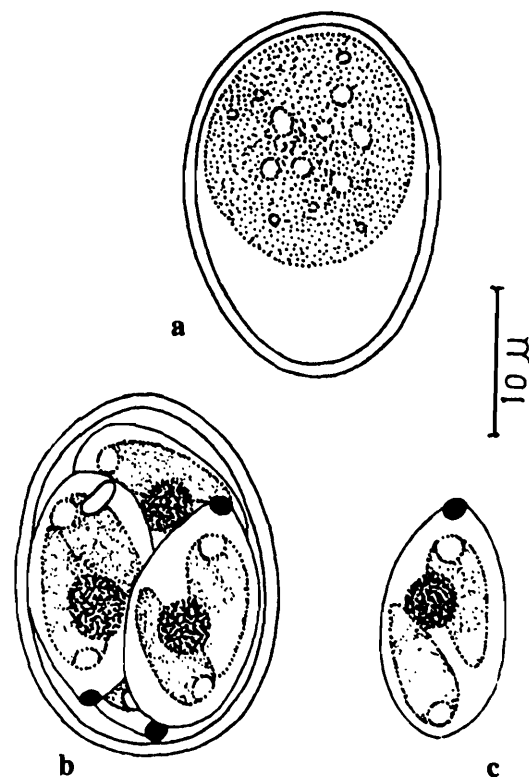


Fig. 111a-c. *Eimeria* sp. in *Columba livia intermedia*

colour, and 1.4 μm thick, with small elongated, rod-like polar granules; micropyle and oocystic residuum absent; unsporulated oocyst subspherical

measuring about $14.7 \mu\text{m} \times 13.5 \mu\text{m}$; sporocyst typically elongated almost twice as long as broad, average length / width ratio 1.8, almost filling the entire space inside oocyst, prominent button-like stieda body present at one end; sporocystic residuum spherical or oval granular mass measuring about $4.23\text{--}5 \mu\text{m}$; sporozoites elongated, fusiform, $6.1 \mu\text{m} \times 3.5 \mu\text{m}$, with one end broad and the other rounded end having a moderate size refractile granule.

Host : *Colmba livia intermedia* (Gmelin), Pigeon ; site of infecton : intestine.

Distribution : India : Maharashtra (Aurangabad district).

Remarks : In his unpublished work, V. M. Bhosale (1977) recorded this parasite as *Eimeria aurangabadensis* n. sp. from this state (Pers. Com.). But being unpublished and not studied the relevant recent literature critically it is treated herein as unnamed species as stated above.

242. *Eimeria* sp.
(Fig. 112a-c)

Material examined : Sev. exs. Aurangabad district.

Diagnosis : Oocyst oval, devoid of micropyle and micropylar cap; oocystic wall smooth

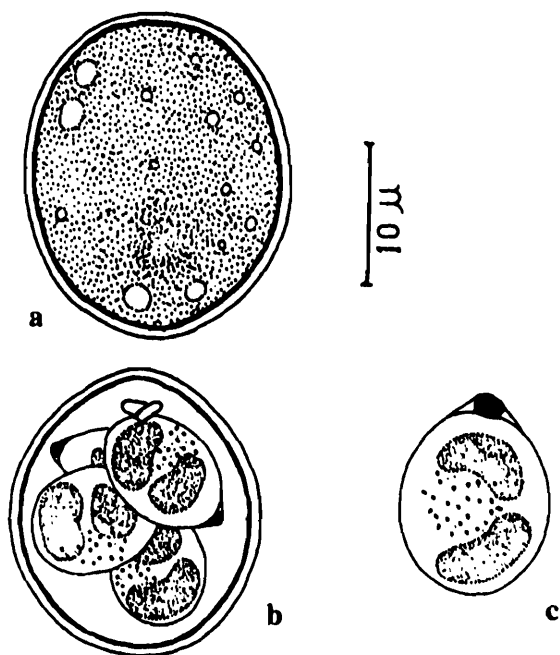


Fig. 112a-c *Eimeria* sp. in *Coturnix coturnix coturnix*

yellowish brown, $1.0 \mu\text{m}$ thick, two layered, outer thick and inner membranous; two elongated polar granules, each measuring $2.8 \mu\text{m} \times 2.1 \mu\text{m}$; oocyst residuum absent; unsporulated oocyst with sporoblast $17.5 \mu\text{m} \times 16.1 \mu\text{m}$, occupying entire space; sporocyst egg-shaped, with an average length width ratio 1.6, with prominent stieda body; sporocystic residuum present in the form of coarse granules of various sizes; sporozoites cucumber-shaped, $6.2 \mu\text{m} \times 3.5 \mu\text{m}$ and arranged transversly at opposite ends of the sporocyst.

Host : *Coturnix coturnix coturnix* (Linnaeus) (Gray quail); site of infection : intestine.

Distribution : India :Maharashtra (Aurangabad district).

Remarks : In his unpublished work, V. M. Bhosale (1977) recorded this parasite as *Eimeria chakravartyi* n. sp. from this state (Pers. Com.). But being unpublished it is treated herein as unnamed species as stated above.

243. *Eimeria* sp
(Fig. 113a-c)

Material examined : Sev. exs. Aurangabad district.

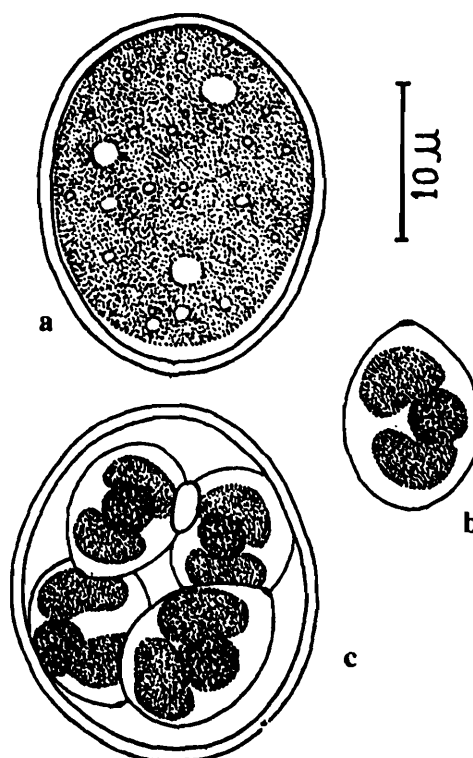


Fig. 113a-c. *Eimeria* sp. in *Francolinus francolinus*

Diagnosis : Oocyst spherical to ovoid in shape covered with smooth single layered dark yellowish wall of $1.0\ \mu\text{m}$ in thickness; elongated and rod-like prominent polar granules, measuring $2\text{--}8\ \mu\text{m} \times 1.4\ \mu\text{m}$ present; oocystic residuum absent; micropyle and micropylar cap absent; unsporulated oocyst with large granular sporoblast filling entire space; sporulated sporocyst typically oval or egg-shaped; steida body present, sporocystic residuum compact spherical mass of fine granules; sporozoites kidney-shaped, $4.8\ \mu\text{m} \times 3.5\ \mu\text{m}$, transversely or obliquely located in the sporocyst.

Host : Black partridge *Francolinus francolinus* (Gmelin) : site of infection : intestine.

Distribution : India : Maharashtra (Aurangabad).

Remarks : In his unpublished work, V. M. Bhosale (1977) recorded this parasite as *Eimeria francolini* n. sp. from this state (Pers. Com.). But being unpublished and not studied the relevant recent literature critically it is treated herein as unnamed species as stated above.

244. *Eimeria* sp.
(Fig. 114a-c)

Material examined : Sev. exs. Aurangabad district.

Diagnosis : Oocyst almost spherical or subspherical, single layered, smooth, transparent; micropyle and micropylar cap absent; unsporulated oocyst with sporoblast measuring $18.2\ \mu\text{m} \times 17.5\ \mu\text{m}$ on average; sporulated oocyst without oocystic residuum and polar granule; sporocyst elongated, pyriform, with a stieda body at one end; sporocystic residuum compact granular mass measuring $4.2\ \mu\text{m} \times 3.5\ \mu\text{m}$ in average; sporozoite pyriform, $5.3\ \mu\text{m} \times 3.8\ \mu\text{m}$, with one end broad and rounded and other conical and pointed and carrying moderate size refractile granules near the broader end.

Host : *Alauda gulgula* (Franklin), Small skylark : site of infection : intestine.

Distribution : India : Maharashtra (Aurangabad district).

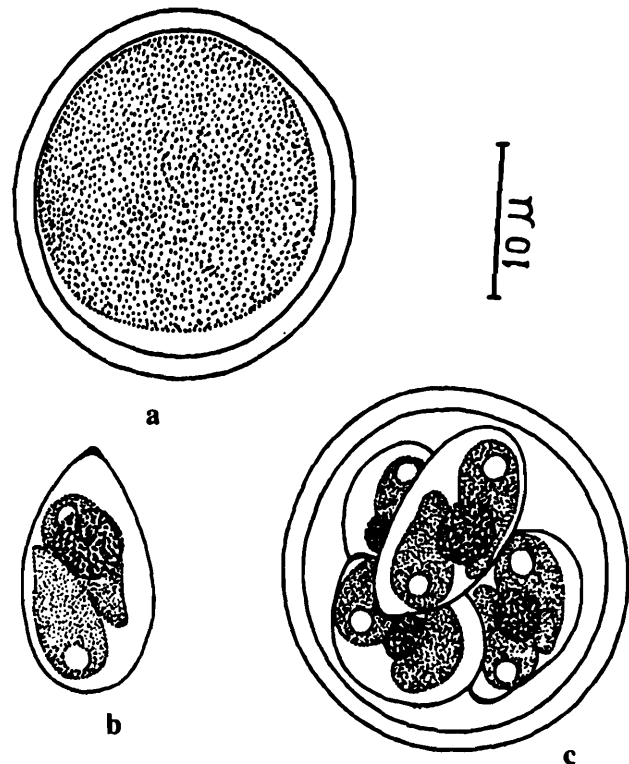


Fig. 114a-c. *Eimeria* sp. in *Alauda gulgula*

Remarks : In his unpublished work, V. M. Bhosale (1977) recorded this parasite as *Eimeria krishnamurthyi* n. sp. from this state (Pers. Com.). But being unpublished it is treated herein as unnamed species as stated above.

245. *Eimeria* sp.
(Fig. 115a-c)

Material examined : Sev. exs. Aurangabad district.

Diagnosis : Oocyst oval, smooth, single layered, yellowish brown in colour, micropyle and micropylar cap absent but with prominent polar granules; oocystic residuum absent; unsporulated oocyst oval or subspherical, $20.3\ \mu\text{m} \times 16.1\ \mu\text{m}$, with granular sporoblast; sporocyst typically elongated ovoid, with an average length / width ratio 1.7 and having very prominent conical steida body; sporocystic residuum compact granular, $6.5\ \mu\text{m} \times 5.6\ \mu\text{m}$ between two sporozoite; sporozoite short and stumpy, $5.3\ \mu\text{m} \times 3.1\ \mu\text{m}$ and placed transversely at two end of sporocyst separated by the residuum; refractile granules absent.

Host : *Perdica asiatica* (Latham), Jungle bush quail ; site of infection : intestine and caecum.

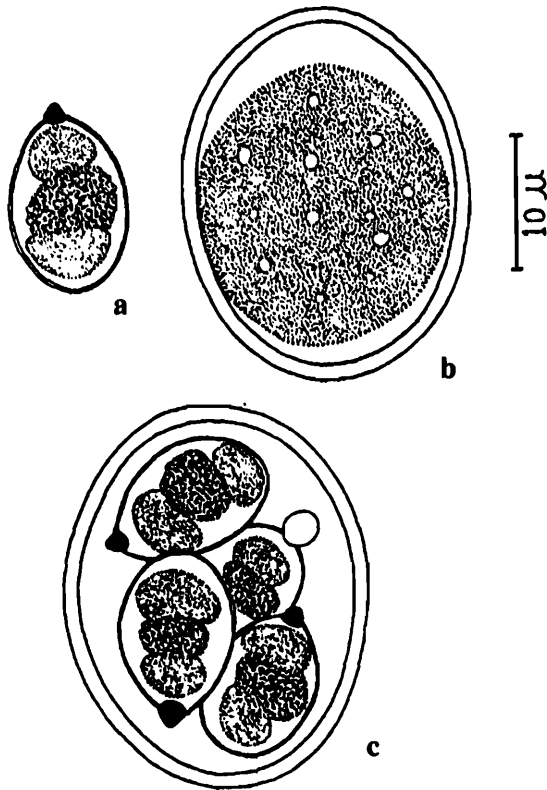


Fig. 1115a-c. *Eimeria* sp. in *Perdicula asiatica*

Distribution : India : Maharashtra (Aurangabad district).

Remarks : In his unpublished work, V. M. Bhosale (1977) recorded this parasite as *Eimeria perdiculae* n. sp. from this state (Pers. Com.). But being unpublished it is treated herein as unnamed species as stated above.

***E. Eimeria* in mammals**

Key to the species of *Eimeria* of mammals

A. Oocyst double-layered

1(2) Oocyst spherical to subspherical

- (a) Sporocyst egg-shaped, parasitic in rat *E. tuberculata*
- (b) Sporocyst ovoidal, parasitic in cattle and buffalo *E. zuernii*
- (c) Sporocyst elongated ovoid, parasitic in sheep and goat *E. ninakohlyakimovi*
- (d) Sporocyst spindle-shaped or elongated ovoid, parasitic in buffalo *E. subspherica*
- (e) Sporocyst round or ellipsoidal, parasitic in domestic sheep *E. punctata*

2(1) Oocyst not spherical or subspherical

3(4) Oocystic residuum present

- (a) Sporocyst small, ovoid, parasitic in rabbit ..
..... *E. perforans*
- (b) Sporocyst ovoid, parasitic in rabbit
..... *E. intestinalis*
- (c) Sporocyst elongated, parasitic in rabbit
..... *E. coccicola*
- (d) Sporocyst oval, parasitic in sheep and goat
..... *E. intricata*

4(3) Oocystic residuum absent

- (a) Sporocyst spindle-shaped, 16 $\mu\text{m} \times 7.5 \mu\text{m}$,
parasitic in cattle and buffalo
..... *E. canadensis*
- (b) Sporocyst spindle-shaped, 8-11 $\mu\text{m} \times 5-8 \mu\text{m}$,
parasitic in sheep and goat *E. crandallis*
- (c) Sporocyst oat-shaped, 15 $\mu\text{m} \times 5 \mu\text{m}$, parasitic
in rabbit *E. nagpurensis*
- (d) Sporocyst large, ellipsoidal, 15-17 $\mu\text{m} \times 8-10 \mu\text{m}$
parasitic in sheep and goat *E. faurei*
- (e) Sporocyst small, ellipsoidal, 10.2 $\mu\text{m} \times 5.0 \mu\text{m}$,
parasitic in sheep and goat *E. parva*
- (f) Sporocyst elongated, rounded at one end and
bluntly conical at other end; parasitic in sheep
..... *E. weybridgensis*
- (g) Sporocyst elongated, large (30-40 $\mu\text{m} \times 12-14 \mu\text{m}$),
parasitic in horse and donkey
..... *E. leuckarti*
- (f) Sporocyst elongated ovoid, 18 $\mu\text{m} \times 9 \mu\text{m}$,
with pointed anterior end, parasitic in rabbit
..... *E. irresidua*
- (g) Sporocyst elongated ovoid, below 15 μm in
length; with truncated anterior end, parasitic
in sheep and goat *E. arloingi*
- (h) Sporocyst elongated ovoid, above 15 μm in
length, with bluntly pointed anterior end,
parasitic in sheep and goat *E. ahsata*
- (i) Sporocyst elongate ovoid, with one end
broader than the other, oocyst elongated (27
 $\mu\text{m} \times 20 \mu\text{m}$), parasitic in sheep ... *E. ovina*

- (j) Sporocyst elongated ovoid, with bluntly pointed anterior end, oocyst averaging $28\ \mu\text{m} \times 21\ \mu\text{m}$, parasitic in cattle and buffalo *E. bovis*
- (k) Sporocyst elongate ovoid, with bluntly pointed anterior end, oocyst averaging $20\ \mu\text{m} \times 14\ \mu\text{m}$, parasitic in cattle and buffalo *E. ellipsoidalis*
- (l) Sporocyst elongated ovoid, with bluntly pointed anterior end, oocyst averaging $39\ \mu\text{m} \times 27\ \mu\text{m}$, parasitic in cattle and buffalo *E. brasiliensis*
- (m) Sporocyst elongated ovoid, or somewhat sub-cylindrical, oocyst measuring $22-43\ \mu\text{m} \times 24-30\ \mu\text{m}$, parasitic in cattle and buffalo *E. christensenii*
- (n) Sporocyst elongated ovoid, $14-18\ \mu\text{m} \times 6-8\ \mu\text{m}$, with both ends rounded, parasitic in cattle *E. pellita*
- (o) Sporocyst elongated ovoid, $11-16\ \mu\text{m} \times 5-6\ \mu\text{m}$ with parachute-shaped cap at the rounded end of developing sporocyst *E. alabamensis*
- (p) Sporocyst elongated ovoid, $13-16\ \mu\text{m} \times 6-7\ \mu\text{m}$ asymmetrical, parasitic in pigs *E. deblickei*
- (q) Sporocyst elongated with an ellipsoid in distinct stieda body *E. auburnensis*
- (r) Sporocyst ovoidal or elongate ovoid, $13-16\ \mu\text{m} \times 8-9\ \mu\text{m}$ with both ends rounded, parasitic in sheep and goat *E. granulosa*
- (s) Sporocyst oval or round, $9-15\ \mu\text{m} \times 4-6\ \mu\text{m}$ *E. cylindrica*
- (t) Sporocyst elliptical, $15-19\ \mu\text{m} \times 8-11\ \mu\text{m}$.. *E. bukidnonensis*
- (u) Sporocyst lemon-shaped, $15-18\ \mu\text{m} \times 7-8.5\ \mu\text{m}$ *E. bareillei*
- (v) Sporocyst pyriform with a knob-like structure at one end *E. canis*
- (w) Sporocyst pyriform with a butter-like stieda body *E. parbhaniensis*

B. Oocyst single layered

- 1. Oocyst ovoid, without oocystic residuum ... *E. levinei*

246. *Eimeria ahsata* Honess, 1942 (Fig. 116)

- 1942. *Eimeria ahsata* Honess, Univ. Wyo. Agric. Exp. Stn., 249 : 3.
- 1987. *Eimeria ahsatai* : Mandal : Fauna of India : Protozoa : Sporozoa : Eucoccidiida : Eimeriidae, Zoological Survey of India, Calcutta, p. 222.
- 1988. *Eimeria ahsata* : Levine, The Protozoan Phylum Apicomplexa, Vol. 1, CRC Press, Inc., Florida, p. 140.

Diagnosis : Oocyst ellipsoidal to ovoid, $37-45\ (39)\ \mu\text{m} \times 22-29\ (24)\ \mu\text{m}$, oocyst wall thick with a light yellowish green outer and yellowish brown inner layer, micropylar cap measuring $5-10(8)\ \mu\text{m} \times 1-3(2)\ \mu\text{m}$ present; more than one polar granules present, oocyst residuum absent; sporocyst elongate ovoid, $16-21\ \mu\text{m} \times 7-10\ \mu\text{m}$, stieda body absent, sporocyst residuum present as scattered granules; sporozoite banana-shaped, with one end broad and the other tapering and with two refractile globules, nucleus centrally placed.

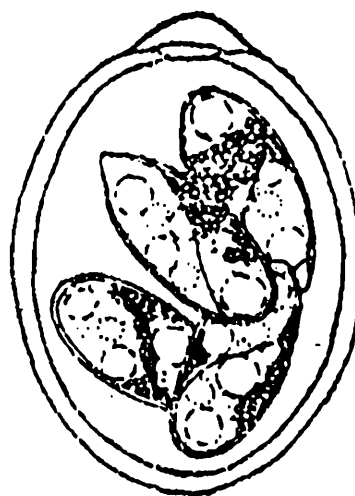


Fig. 116. *Eimeria ahsata*

Host : Domestic goat, *Capra hircus*; site of infection : intestine.

Distribution : India : Maharashtra (Aurangabad), Uttar Pradesh West Bengal.

Elsewhere : Sri Lanka.

Remarks : Krishnamurthy and his co-workers (1974-1981) as well as Nikam and her co-workers (1999-2001) studied this species from this state. Eleven species were recorded including this species.

247. *Eimeria alabamensis* Christensen, 1941
(Fig. 117)

1941. *Eimeria alabamensis* Christensen, *J. Parasit.*, **27**:303.
1987. *Eimeria alabamensis* : Mandal : *Fauna of India : Protozoa : Sporozoa : Eucoccidiida : Eimeriidae*, Zoological Survey of India, Calcutta, p. 225.
1988. *Eimeria alabamensis* : Levine, *The Protozoan Phylum Apicomplexa*, Vol. 1, CRC Press, Inc., Florida, p.140.

Diagnosis : Oocysts ovoid and pyriform, 17-24 μm $\times$ 12-16 μm ; without micropyle; wall about 1-1.3 μm thick, two layered, outer thicker than inner, residuum and polar granule absent; sporocyst elongated, having stieda body but without residuum; sporozoites lying head to tail and with 2 to 3 globules.

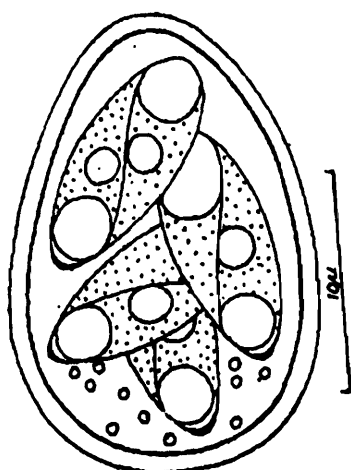


Fig. 117. *Eimeria alabamensis*

Host : Buffalo, *Bubalus bubalus*; site of infection : intestine.

Distribution : India : Maharashtra (Marathwada, Aurangabad district).

Remarks : In their unpublished work, V. D. Jadhav and S. R. Nikam (2002) studied this parasite from this state (Pers. Com.).

248. *Eimeria arloingi* Marotel (1905),
Martin (1909)
(Fig. 118)

1905. *Coccidium arloingi* Marotel, *Rec. Med. Vet.*, **33** : 243.
1987. *Eimeria arloingi* : Mandal : *Fauna of India : Protozoa : Sporozoa : Eucoccidiida : Eimeriidae*, Zoological Survey of India, Calcutta, p. 229.

1988. *Eimeria arloingi* : Levine, *The Protozoan Phylum Apicomplexa*, Vol. 1, CRC Press, Inc., Florida, p. 142.

Diagnosis : Oocyst elongate ellipsoidal, asymmetrical or slightly ovoid, 17-42 (27) μm $\times$ 13-27 (18) μm , oocyst wall transparent, double layered, micropyle with a crescent-shaped micropylar cap present, a polar granule present, oocyst residuum absent; sporocyst elongate ovoid, 11-17 μm $\times$ 6-10 μm , stieda body absent or vestigial, sporocyst residuum present; sporozoite elongated; oocyst from goat elongated ovoid, oocyst wall about 1.5 μm thick with two layers, outer one colourless smooth about 0.4 μm 0.5 μm thick, lined by thin membrane internally; micropyle 5-7 μm wide with micropylar flattened dome-shaped cap of 1 μm to 4 μm high and 4 μm to 9 μm wide; polar granules sometimes present; unsporulated oocyst spherical, sporoblast measuring 15-20 μm ; a small stieda body present; sporocystic residuum scattered in between two sporozoites, lying in head to tail in position and having a refractile body.

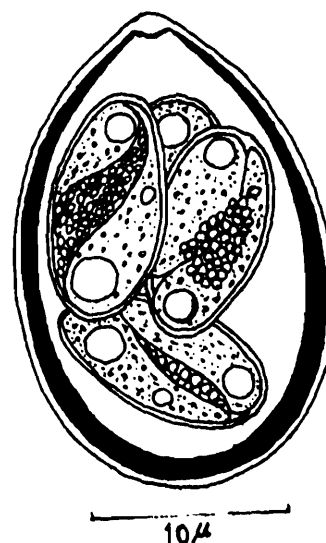


Fig. 118. *Eimeria arloingi*

Host : Goat, *Capra hircus*; site of infection : intestine.

Distribution : India : Maharashtra (Aurangabad district), Andhra Pradesh, Haryana, Uttar Pradesh, Bihar.

Elsewhere : cosmopolitan.

Remarks : S. R. Nikam (1983) in her

unpublished work studied this parasite from this state (Pers. Com.). Eleven species were recorded in goats from Marathwada region as mentioned above.

249. *Eimeria auburnensis* Christensen and Porter, 1939
(Fig. 119)

1939. *Eimeria auburnensis* Christensen and Porter, *Proc. Helminth. Soc. Washington*, 6 : 45.
1954. *Eimeria khurodensis* Rao and Hiregauder, *Bombay Vet. Coll. Mag.*, 4 : 24.
1954. *Eimeria bombayensis* Rao and Hiregauder, *Bombay Vet. Coll. Mag.*, 4 : 24.
1987. *Eimeria auburnensis* : Mandal : *Fauna of India : Protozoa : Sporozoa : Eucoccidiida : Eimeriidae*, Zoological Survey of India, Calcutta, p. 232.
1988. *Eimeria auburnensis* : Levine, *The Protozoan Phylum Apicomplexa*, Vol. 1, CRC Press, Inc., Florida, p.142.

Diagnosis : Oocysts ovoid to ellipsoid or pointed with micropyle, 2 to 3 polar granules but no oocystic residuum; wall about 1.0 to 1.7 μ m, two layered, outer colourless or pink orange while inner one orange green; sporocyst elongated with an ellipsoid and non-prominent stieda body; sporozoites arranged in head to tail, carrying 1 to 2 small globules.

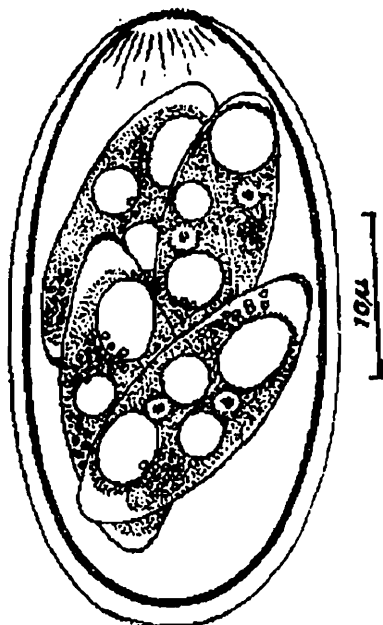


Fig. 119. *Eimeria auburnensis*

Host : Buffaloe, *Bubalus bubalus*; site of infection : intestine.

Distribution : India : Maharashtra (Marathwada, Aurangabad district).

Remarks : In their unpublished work, V. D. Jadhav and S. R. Nikam (2002) studied this parasite from this state (Pers. Com.).

250. *Eimeria bareillyi* Gill, Chhabra and Lall, 1963
(Fig. 120a-c)

1963. *Eimeria bareillyi* Gill, Chhabra and Lall, *Arch. Protistenk.*, 106 : 571.
1987. *Eimeria bareillyi* : Mandal : *Fauna of India : Protozoa : Sporozoa : Eucoccidiida : Eimeriidae*, Zoological Survey of India, Calcutta, p. 237.
1988. *Eimeria bareillyi* : Levine, *The Protozoan Phylum Apicomplexa*, Vol. 1, CRC Press, Inc., Florida, p. 143.

Diagnosis : Oocysts pyriform, 24-31 (28) μ m $\times$ 15-21 (19) μ m, shape index 1.4; wall double-layered, yellowish brown; anterior end narrower.

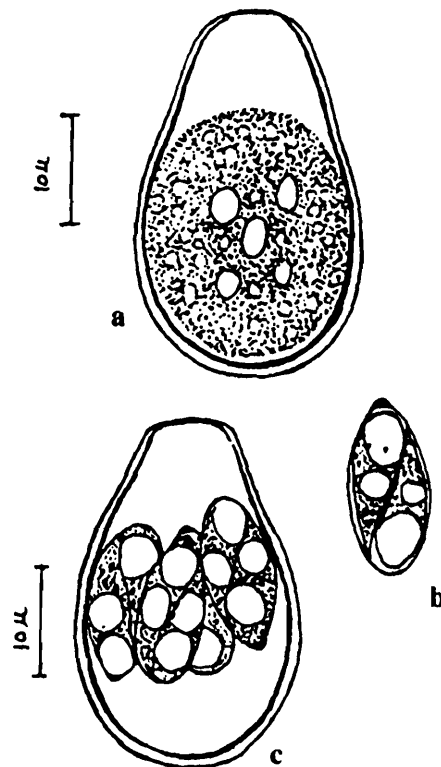


Fig. 120a-c. *Eimeria bareillyi*

truncated and slightly flattened; a small mass of a few granules located below the micropyle; residuum and polar granules absent; sporocysts

elongate-ovoid, 15-18 $\mu\text{m} \times 7.0$ -8.5 μm in size; one end broader than the other; stieda body and sporocystic residuum present; sporozoites elongated, somewhat banana-shaped, 12 $\mu\text{m} \times 4 \mu\text{m}$, with one end broader than the other and with one larger refractile globule at the broader end; the smaller refractile globule with the centrally placed nucleus at the anterior end.

Host : Buffalo, *Bubalus bubalis* Linn.; site of infection : intestine.

Distribution : India Maharashtra (Parbhani district), Uttar Pradesh.

Remarks : Shastri *et al.* (1973, 1974) and Shastri and Krishnamurthi (1975) reported this species from Maharashtra, while Shastri *et al.* (1973) reported its occurrence from various parts of India.

251. *Eimeria bovis* (Zublin, 1908)

Fiebiges 1912

(Fig. 121)

1908. *Coccidium bovis* Zublin (in partim), *Schweizer. Arch. Treiherk.*, 50 :123.

1987. *Eimeria bovis* : Mandal : *Fauna of India : Protozoa : Sporozoa : Eucoccidiida : Eimeriidae*, Zoological Survey of India, Calcutta, p. 239.

1988. *Eimeria bovis* : Levine, *The Protozoan Phylum Apicomplexa*, Vol. 1, CRC Press, Inc., Florida, p.144.

Diagnosis : Oocyst broadly ovoid, smooth walled, double layered, with a narrower micropylar end, measuring 23-33 (28) $\mu\text{m} \times 15$ -26 (21) μm in dimension; micropylar cap, polar granule and oocystic residuum absent; sporocyst elongate ovoid, 15-17 $\mu\text{m} \times 6$ -7 μm , stieda body and sporocystic residuum present; sporozoite elongated, banana-shaped, measuring 13 $\mu\text{m} \times 3 \mu\text{m}$, with two refractile granules. Oocyst from buffalo varying in shape, ovoid, short ovoid, asymmetrical or subellipsoidal and having an in conspicuous micropyle on the narrow end; wall smooth, homogenous, transparent, double layered and colourless, about 1.7 μm thick, outer rough than the inner; sporocyst elongated ovoid, 14-15 $\mu\text{m} \times 8 \mu\text{m}$ with an inconspicuous stieda body and residuum, one end of sporocyst tapering, and

a small stieda body present; sporozoites elongated bodies laying head to tail containing a clear sporozoites globules and two refractile bodies, a large one at posterior end and smaller round scattered granules present anteriorly.

Host : Buffaloe, *Bubulus bubalis*; site of infection : intestine.

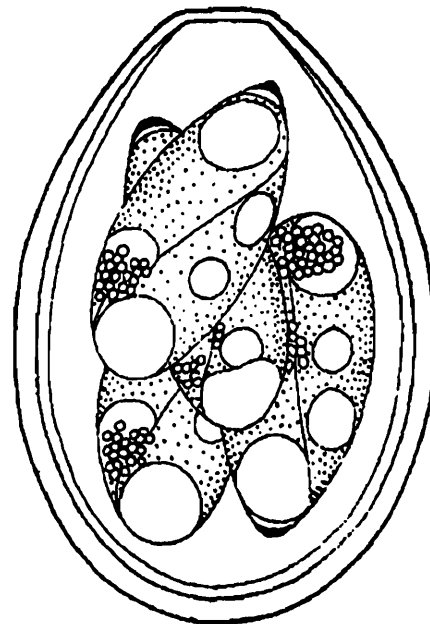


Fig. 121 *Eimeria bovis*

Distribution : India : Maharashtra (Marathwada, Aurangabad district), Andhra Pradesh, Haryana, Uttar Pradesh, Bihar.

Elsewhere : Cosmopolitan.

Remarks : Rao and Hiregander (1974) reported infection of this species with particular reference to outbreak at Aurey Mick colony in buffalo from Mumbai, Maharashtra state. However, in their unpublished work, V. D. Jadhav and S. R. Nikam (2002) studied this parasite from this state (Pers. Com.).

252. *Eimeria brasiliensis* Torres and

Ramos, 1939

(Fig 122)

1935. *Eimeria brasiliensis* Torres and Ramos, 1939, *Arg. Inst. Pesquisas. Agronom.*, 2 : 79.

1959. *Eimeria gokakai* Rao and Bhatawadekar, *Bombay vet. Coll. Mag.*, 8 : 23.

1987. *Eimeria brasiliensis* : Mandal : *Fauna of India : Protozoa : Sporozoa : Eucoccidiida : Eimeriidae*, Zoological Survey of India, Calcutta, p. 243.

1988. *Eimeria brasiliensis* : Levine, *The Protozoan Phylum Apicomplexa*, Vol. 1, CRC Press, Inc., Florida, p.144.

Diagnosis : Oocysts ellipsoidal or ovoidal, 31-44 μm $\times$ 20-29 μm , shape index 1.4, double-layered, colourless to slightly yellowish-brown; micropyle wide, micropylar cap present; a small protoplasmic body present below the micropyle; oocystic residuum and polar granule absent; sporocysts elongate-ovoid, 17-21 μm $\times$ 8-9 μm ; stieda body present as a fine cap at the narrower pole; sporocystic residuum present; sporozoites elongate, banana-shaped, one end broader than the other, a large refractile globule at the wider end.

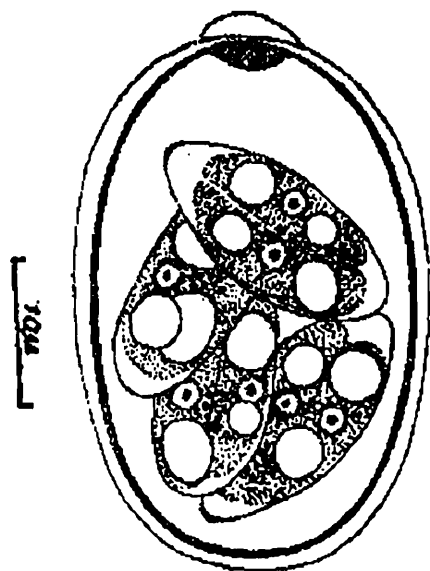


Fig. 122. *Eimeria brasiliensis*

Host : Cattle, *Bos indicus* : site of infection : intestine.

Distribution : India : Maharashtra (Mumbai), Haryana, Uttar Pradesh.

Remarks : Rao and Bhatawadekar (1959) recorded this species as *Eimeria gokaki* from this state, which is synonymised with this species (Mandal, 1987).

253. *Eimeria bukidnonensis* Tubangui, 1931
(Fig. 123)

1931. *Eimeria bukidnonensis* Tubangui, *Philip. J. Sci.*, **44** : 253.

1987. *Eimeria bukidnonensis* : Mandal : *Fauna of India : Protozoa : Sporozoa : Eucoccidiida : Eimeriidae*, Zoological Survey of India, Calcutta, p. 244.

1988. *Eimeria bukidnonensis* : Levine, *The Protozoan Phylum Apicomplexa*, Vol. 1, CRC Press, Inc., Florida, p. 144.

Diagnosis : Oocyst pyriform, with micropyle measuring about 4 μm wide; wall double layered of 3-4 μm in thickness, outer layer 2.9 μm thick, interrupted with dark protuberance while inner layer 1 μm thick; sporocyst elongated with stieda body; sporocyst residuum round mass centrally placed; sporozoites elongated and located head to tail with centrally placed nucleus and with a large clear globule at each end.

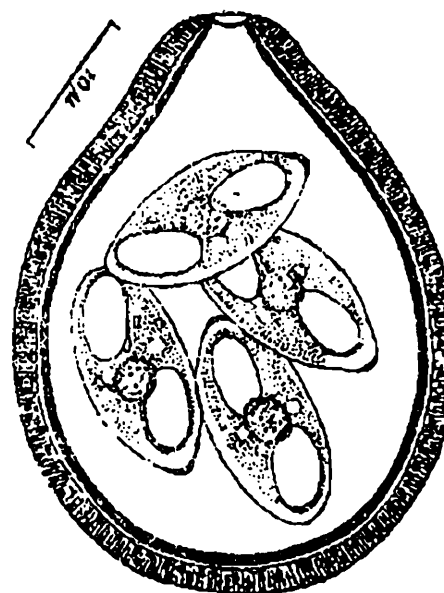


Fig. 123. *Eimeria bukidnonensis*

Host : Buffaloe, *Bubalus buballis*; site of infection : intestine.

Distribution : India : Maharashtra (Marathwada, Aurangabad district).

Remarks : In their unpublished work, V. D. Jadhav and S. R. Nikam (2002) studied this parasite from this state (Pers. Com.).

254. *Eimeria canadensis* Bruce 1921
(Fig. 124)

1935. *Eimeria canadensis* Bruce, *J. Am. Vetr. Med. Ass.*, **58** : 638.

1954. *Eimeria bombayensis* Rao and Hiregauder, *Bombay Vet. Coll. Mag.*, 4 : 24.

1987. *Eimeria canadensis* : Mandal : *Fauna of India : Protozoa : Sporozoa : Eucoccidiida : Eimeriidae*, Zoological Survey of India, Calcutta, p. 247.

1988. *Eimeria canadensis* : Levine, *The Protozoan Phylum Apicomplexa*, Vol. 1, CRC Press, Inc., Florida, p. 145.

Diagnosis : Oocyst ellipsoidal or ovoid with micropyle and without micropylar cap; wall about 1.2 μ m, double layered, outer thick and colourless or yellowish in colour, while inner thick yellowish layer, thin at the micropylar end; oocystic granules and polar granules absent; sporocysts elongated ovoid, stieda body present as a dark cap over the narrow end; sporozoites elongated banana-shaped, lying head to tail and carrying two-three clear globules.

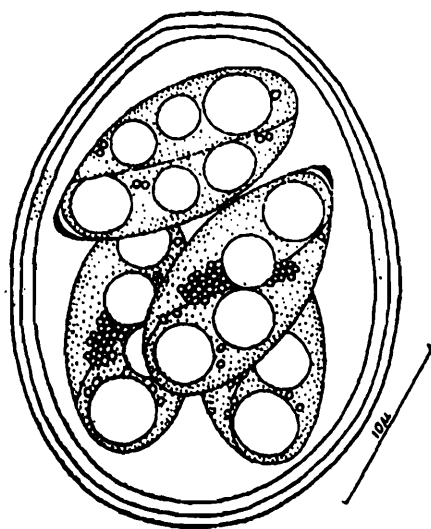


Fig. 124 *Eimeria canadensis*

Host : Buffalo, *Bubalus bubalis*; site of infection : intestine.

Distribution : India : Maharashtra (Marathwada, Aurangabad district).

Remarks : Rao and Hiregauder (1954) reported this species from this state. V. D. Jadhav and S. R. Nikam (2002) also studied this parasite from this state (Pers. Com.).

255. *Eimeria canis* Wenyon, 1923

1923. *Eimeria canis* Wenyon, *Am. Trop. Med. Parasit.*, 17 : 251.

1987. *Eimeria canis* : Mandal : *Fauna of India : Protozoa : Sporozoa : Eucoccidiida : Eimeriidae*, Zoological Survey of India, Calcutta, p. 248.

1988. *Eimeria canis* : Levine, *The Protozoan Phylum Apicomplexa*, Vol. 1, CRC Press, Inc., Florida, p. 145.

Diagnosis : Oocysts ovoid to elliptical, 18-45 μ m $\times$ 11-28 μ m in size; wall well developed, pink coloured, outermost layer distinct with a tendency to peel off; micropyle clearly visible through the uncovered anterior pole of the oocyst; sporoblasts initially quadrangular and clearly distinct from the sporonts; sporocyst with sporocystic residuum and with a knob-like structure at one end.

Host : Domestic cat, *Felis domestica* Linn. and Domestic dog, *Canis familiaris* Linn.; site of infection : intestine.

Distribution : India : Maharashtra (Mumbai).

Remarks : Rao and Hiregauder (1952) reported this species from the above-mentioned two hosts from this state.

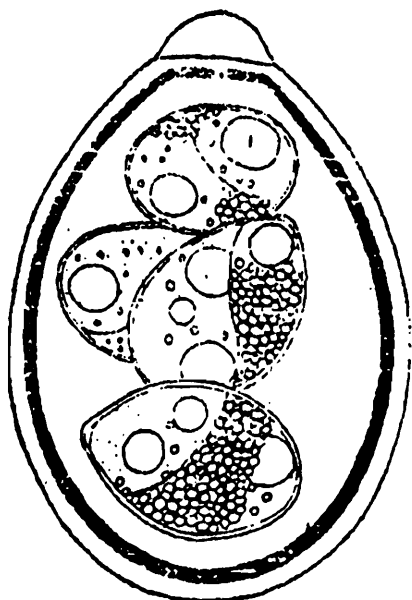
256. *Eimeria christenseni* Levine, Ivens and Fritz, 1962 (Fig. 125)

1962. *Eimeria christenseni* Levine, Ivens and Fritz, *J. Parasit.*, 48 : 255.

1987. *Eimeria christenseni* : Mandal : *Fauna of India : Protozoa : Sporozoa : Eucoccidiida : Eimeriidae*, Zoological Survey of India, Calcutta, p. 255.

1988. *Eimeria christenseni* : Levine, *The Protozoan Phylum Apicomplexa*, Vol. 1, CRC Press, Inc., Florida, p. 146.

Diagnosis : Oocyst ovoid, rarely ellipsoidal, 22-43 μ m $\times$ 24-30 μ m and slightly flattened at micropylar end; oocyst wall double layered, outer yellowish, inner brownish; micropyle 9.5-10 μ m wide and micropylar cap mound-shaped, colourless 1.5-4.5 μ m high and 3-11 μ m wide; with 1-4 polar granules but no oocystic residuum; unsporulated oocyst spherical, sporoblast 17-21 μ m diameter; sporocysts broadly ellipsoid with one end somewhat conical; stieda body absent, sporocystic residuum present; sporozoites arranged obliquely and enclosed large refractile globules at the broader end and a smaller one at narrower end.

Fig. 125 *Eimeria christenseni*

Host : Goat, *Capra hircus*; site of infection : intestine.

Distribution : India : Maharashtra (Aurangabad district), Uttar Pradesh and Madhya Pradesh.

Remarks : Jadhav *et al.* (2001) reported prevalence of this species in goats from Marathwada region. But, earlier S. R. Nikam (1983) in her unpublished work also studied this parasite from this state. (Pers. Com.).

257. *Eimeria coecicola* Kheissin 1947

1947. *Eimeria coecicola* Kheissin, *Dokl. Akad. Nauk SSSR*, 55 : 181.

1988. *Eimeria coecicola* : Levine, *The Protozoan Phylum Apicomplexa*, Vol. 1, CRC Press, Inc., Florida, p.147.

Diagnosis : Oocyst typically ovoid to elongated ovoid with micropyle of variable in diameter, 2.5 μm – 6 μm ; micropylar cap absent but oocystic residuum present; wall two layered, outer layer thick, inner membranous; unsporulated oocyst with spherical sporoblast, 20-21 μm in diameter; sporocyst elongated with prominent stieda body; sporocystic residuum prominent, coarsely granular and scattered; sporozoites elongated and lying head to tail, each having refractile body.

Host : Rabbit, *Oryctolagus cuniculus*; site of infection : intestine.

Distribution : India : Maharashtra (Aurangabad district).

Remarks : S. R. Nikam.(1983) in her unpublished work studied this parasite from this state. (Pers. Com.).

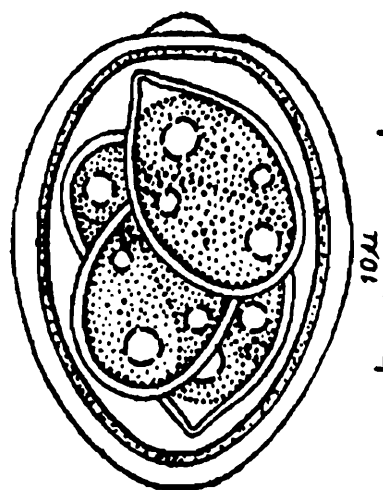
258. *Eimeria crandallis* Honess, 1942 (Fig. 126)

1942. *Eimeria crandallis* Honess, *Univ. Wyo. Agric. Expt. Sta.*, 249, p. 3.

1987. *Eimeria crandallis* : Mandal : *Fauna of India : Protozoa : Sporozoa : Eucoccidiida : Eimeriidae*, Zoological Survey of India, Calcutta, p. 258.

1988. *Eimeria crandallis* : Levine, *The Protozoan Phylum Apicomplexa*, Vol. 1, CRC Press, Inc., Florida, p.147.

Diagnosis : Oocyst usually light yellow in colour with a greenish tinge, spherical to broadly ellipsoidal to ovoid in shape, measuring 17-23 (21.9) μm $\times$ 17-22 (19.4) μm , a micropyle and micropylar cap present, oocyst residuum absent; sporocyst ovoid, 8-11 μm $\times$ 5-8 μm , with no stieda body, sporocyst residuum usually present; sporozoite with one or two clear globules.

Fig. 126. *Eimeria crandallis*

Host : Goat, *Capra hircus* and Domestic sheep, *Ovis aries*; site of infection : intestine.

Distribution : India : Maharashtra (Marathwada region), Kashmir, Haryana, Andhra Pradesh, Uttar Pradesh, Madhya Pradesh, Tamil Nadu, Bihar, Orissa, West Bengal.

Elsewhere : Syria, Turkey, Poland, U.K., U.S.A.

Remarks : Jadhav *et al.*, (2001) reported on the incidence of eleven species of coccidia in goats from Marathwada region including the present species. Nikam and her co-workers (1999-2001) studied this species from this state.

259. *Eimeria cylindrica* Wilson, 1931
(Fig. 127)

1935. *Eimeria cylindrica* Wilson, Va. Agri. Exp.. Stn. Tech. Bull., 42 : 1.
1987. *Eimeria cylindrica* : Mandal : *Fauna of India : Protozoa : Sporozoa : Eucoccidiida : Eimeriidae*, Zoological Survey of India, Calcutta, p. 260.
1988. *Eimeria cylindrica* : Levine, *The Protozoan Phylum Apicomplexa*, Vol. 1, CRC Press, Inc., Florida, p. 148.

Diagnosis : Oocysts cylindrical or somewhat sub-cylindrical, 20-34 μm $\times$ 12-17 μm ; without micropyle and micropylar cap, wall 1.3 μm thick and bilayered, colourless or straw-yellow coloured; oocystic residuum and polar granules absent; sporocyst elongated-ovoid; 9-13 μm $\times$ 4-6 μm in size, stieda body present as a light cap over the narrow end, sporocystic residuum consisting of diffuse granules; sporozoites elongate, banana-shaped, 7-9 μm $\times$ 2.0-2.6 μm , each with a large refractile globule at the wider end and the smaller globule located anterior to the centrally situated nucleus.

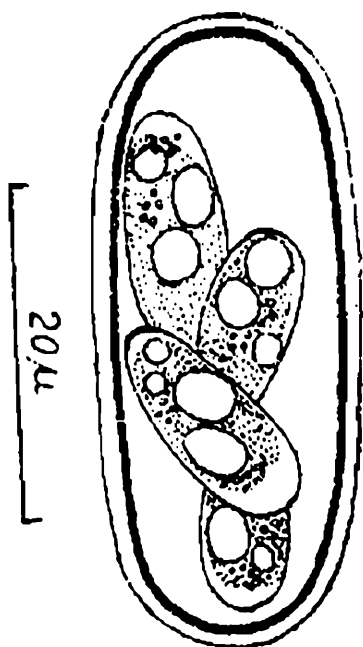


Fig. 127 *Eimeria cylindrica*

Host : Buffaloe, *Bubalus bubalis*; site of infection : intestine.

Distribution : India : Maharashtra (Marathwada, Aurangabad district), Haryana, Uttar Pradesh and Orissa.

Remarks : In their unpublished work, V. D. Jadhav and S. R. Nikam (2002) studied this parasite from this state (Pers. Com.).

260. *Eimeria debliecki* Douwes, 1921
(Fig. 128)

1921. *Eimeria debliecki* Douwes, *Bijdrage tot de kennis van enkele darmprotozoen der huisdieren in het bijzonder bij schaap en varken*, Diss., Utrecht, p. 62.
1987. *Eimeria debliecki* : Mandal : *Fauna of India : Protozoa : Sporozoa : Eucoccidiida : Eimeriidae*, Zoological Survey of India, Calcutta, p. 264.
1988. *Eimeria debliecki* : Levine, *The Protozoan Phylum Apicomplexa*, Vol. 1, CRC Press, Inc., Florida, p. 148.

Material examined : Sev. exs., Aurangabad, Amaravati, Dec., 2005 and Sept., 2007; R. Nandi.

Diagnosis : Oocyst ovoid to ellipsoidal or spherical, smooth walled, double layered, 13-29 μm $\times$ 13-19 μm ; shape index 1.4; micropyle, polar granule and oocystic residuum absent; sporocyst ellipsoidal or ovoid, 14-18 μm $\times$ 6-8 μm , stieda body and sporocystic residuum present; sporozoites elongated, lying length-wise, head to tail oriented and with two clear globules.

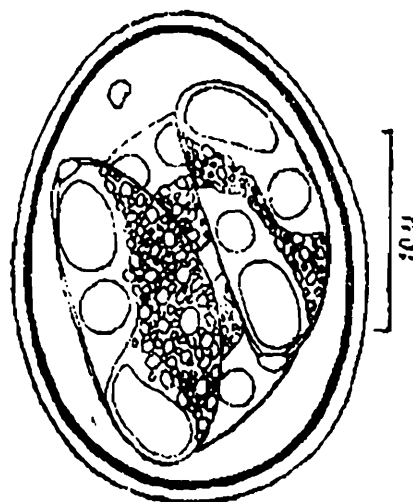


Fig. 128. *Eimeria debliecki*

Host : Domestic pig, *Sus scrofa*; site of infection : intestine.

Distribution : India : Maharashtra (Aurangabad and Amaravati districts), Haryana, Andhra Pradesh, Madhya Pradesh and Uttar Pradesh.

Remarks : This species is slightly pathogenic to adult pigs, but it may cause diarrhoea and even death of young pigs. This species is reported herein from the first time from this state.

261. *Eimeria ellipsoidal* Becker and Frye 1929
(Fig. 129)

1929. *Eimeria ellipsoidal* Becker and Frye, *J. Parasit.*, **15** : 175.

1987. *Eimeria ellipsoidal* : Mandal : *Fauna of India : Protozoa : Sporozoa : Eucoccidiida : Eimeriidae*, Zoological Survey of India, Calcutta, p. 267.

1988. *Eimeria ellipsoidal* : Levine, *The Protozoan Phylum Apicomplexa*, Vol. 1, CRC Press, Inc., Florida, p. 150.

Diagnosis : Oocysts ellipsoidal to slightly ovoid or cylindrical, 15-26 (20) μm $\times$ 12-16 (14) μm , with micropyle but micropylar cap absent; wall two layered, light yellowish green, smooth, and about 1.3 μm thick; oocystic residuum and polar granules absent; sporocyst elongated ovoid, 10-13 μm $\times$ 5-6 μm , with inconspicuous stieda body; sporozoites elongated, banana-shaped, 11 μm $\times$ 2.6 μm , one end broad and other blunt, and lying head to tail and having a large and smaller refractile globule.

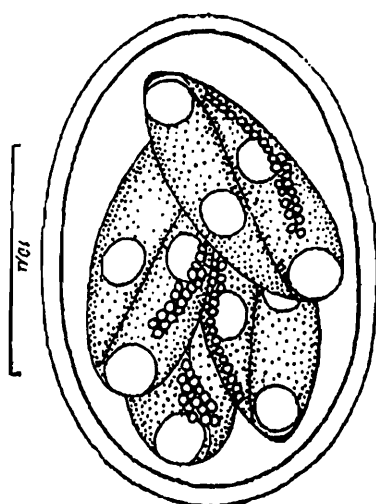


Fig. 129 *Eimeria ellipsoidal*

Host : Buffaloe, *Bubulus bubalis*; site of infection : intestine.

Distribution : India : Maharashtra (Marathwada region, Aurangabad district).

Remarks : In their unpublished work, V. D. Jadhav and S. R. Nikam (2002) studied this parasite from this state (Pers. Com.).

262. *Eimeria faurei* Moussu and Marotel
(1902), Martin (1909)
(Fig. 130)

1902. *Coccidium faurei* Moussu and Marotel, *Arch. Parasit.*, **6** : 82.

1987. *Eimeria ellipsoidal* : Mandal : *Fauna of India : Protozoa : Sporozoa : Eucoccidiida : Eimeriidae*, Zoological Survey of India, Calcutta, p. 267.

1988. *Eimeria faurei* : Levine, *The Protozoan Phylum Apicomplexa*, Vol. 1, CRC Press, Inc., Florida, p. 151.

Diagnosis : Oocyst from goat typically egg-shaped, 36-40 μm $\times$ 18-27 μm , with a conspicuous micropyle (2-3 μm wide) without micropylar cap, wall smooth single layered 1.0-1.5 μm thick, greenish to yellowish brown in colour; sporoblast of unsporulated oocyst spherical, 12-15 μm in diameter, sporulated oocyst ovoid to pyriform, stieda body small; sporocystic residuum absent; sporozoites elongated, occupying entire sporocyst, two refractile globules at each end.

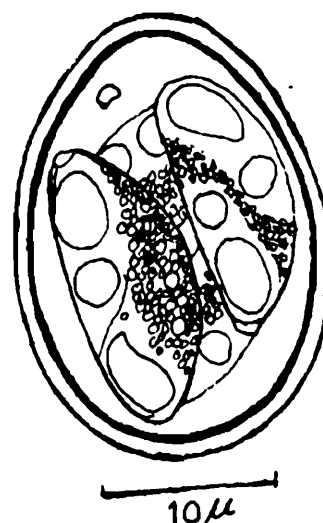


Fig. 130. *Eimeria faurei*

Oocyst from sheep similar but with slightly large micropyle of 2-5 μm wide, polar granules sometimes present; sporoblast 14-18 μm in diameter, stieda body small or absent.

Host : Goat, *Capra hircus*; Sheep, *Ovis aries*;
site of infection : intestine.

Distribution : India : Maharashtra (Aurangabad district), Andhra Pradesh, Punjab, Haryana Maharashtra, Madhya Pradesh, Uttar Pradesh, Orissa and West Bengal.

Remarks : This species is only mildly pathogenic. Krishnamurthy and Kshirsagar (1976) studied the incidence of this species as rare in goats of Marathwada region. S. R. Nikam and her co-workers (1999-2001) studied this parasite from this state.

263. *Eimeria granulosa* Christensen 1938
(Fig. 131)

1938. *Eimeria granulosa* Christensen, *J. Parasit.*, **24** : 453.

1987. *Eimeria granulosa* : Mandal : *Fauna of India : Protozoa : Sporozoa : Eucoccidiida : Eimeriidae*, Zoological Survey of India, Calcutta, p. 272.

1988. *Eimeria granulosa* : Levine, *The Protozoan Phylum Apicomplexa*, Vol. 1, CRC Press, Inc., Florida, p. 153.

Diagnosis : Oocyst from goat urn-shaped or ellipsoidal, 22-35 μm $\times$ 17-25 μm , with micropyle and micropylar cap, oocyst wall smooth two layered, outer pale yellow, 1.5 μm thick and inner brownish 0.8 μm thick. micropylar cap brown in colour, very prominent and having characteristic tunicated cone-shaped structure of 6-11 μm wide and 2-3 μm high, polar granules absent in some cases; unsporulated oocyst spherical 12-14 μm in diameter; sporocyst elongated to ovoid, 13-16 μm $\times$ 8-9 μm and devoid of a stieda body; sporozoites elongated, lying head to tail, each having 2-3 clear refractile globules.

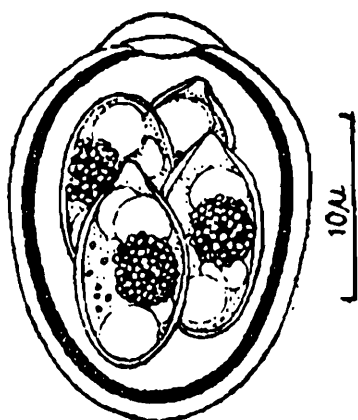


Fig. 131. *Eimeria granulosa*

Oocyst from sheep with smaller micropylar cap of 3-6 μm width and 2-3 μm in height; one-three polar granules present; distinct stieda body present.

Host : Goat, *Capra hircus*, Sheep, *Ovis aries*;
site of infection : intestine.

Distribution : India : Maharashtra (Aurangabad district), Haryana, Uttar Pradesh, Madhya Pradesh and Orissa.

Remarks : Krishnamurthy and Kshirsagar (1976) reported this species from this state. Jadhav *et al.* (2001) also studied this parasite in goats from Marathwada region.

264. *Eimeria intestinalis* Cheissin 1948
(Fig. 132)

1948. *Eimeria intestinalis* Cheissin, *Uch.Zap. Karelo-Finsk. Univ.*, **13** : 179.

1987. *Eimeria intestinalis* : Mandal : *Fauna of India : Protozoa : Sporozoa : Eucoccidiida : Eimeriidae*, Zoological Survey of India, Calcutta, p. 275.

1988. *Eimeria intestinalis* : Levine, *The Protozoan Phylum Apicomplexa*, Vol. 1, CRC Press, Inc., Florida, p. 155.

Diagnosis : Oocyst elongated oval or ellipsoidal, 25-30 μm $\times$ 17-20 μm , with micropyle and oocystic residuum but no micropylar cap; oocyst wall two layered and smooth 1.0-1.25 μm , outer light brownish thicker than inner membranous and dark brown layer; unsporulated oocyst having spherical sporoblast measuring

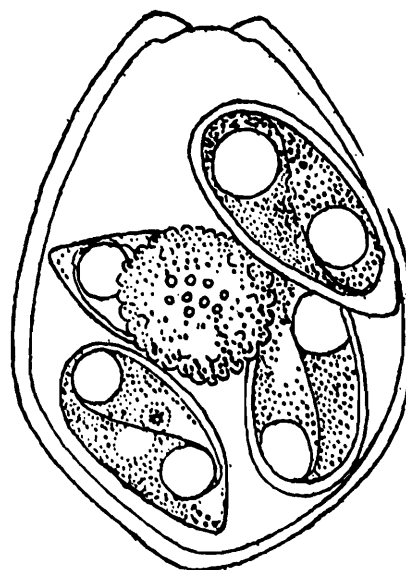


Fig. 132. *Eimeria intestinalis*

15-20 μm ; sporocyst ovoid, with a small stieda body at narrower end; sporocystic residuum present; sporozoites lying obliquely and with refractile granules at broader end.

Host : Rabbit, *Oryctolagus cuniculus*; site of infection : intestine.

Distribution : India : Maharashtra (Aurangabad district), Punjab and Uttar Pradesh.

Remarks : In her unpublished work, S. R. Nikam (1983) studied this parasite from this state (Pers. Com.).

265. *Eimeria intricata* Spiegel, 1925
(Fig. 133)

1925. *Eimeria intricata* Spiegel, Z. Infktkankh. U. Hyg. der Hasstiere., 28 : 42.

1987. *Eimeria intricata* : Mandal : Fauna of India : Protozoa : Sporozoa : Eucoccidiida : Eimeriidae, Zoological Survey of India, Calcutta, p. 277.

1988. *Eimeria intricata* : Levine., The Protozoan Phylum Apicomplexa, Vol. 1, CRC Press, Inc., Florida, p.155.

Diagnosis : Oocyst from goat ellipsoid or elongated ovoid and fairly large, 37-51 μm $\times$ 29-37 μm ; micropyle and micropylar cap present, thick-walled, double layered and rough outer layer 1.5-2 μm thick but thinner in micropylar region, yellowish brown in colour with transverse striations, inner layer thinner (0.5-1 μm), smooth and transparent; micropylar cap flattened, 5-12 μm wide and 2-6 μm high; polar granules either present or absent; spherical sporoblast in unsporulated oocyst

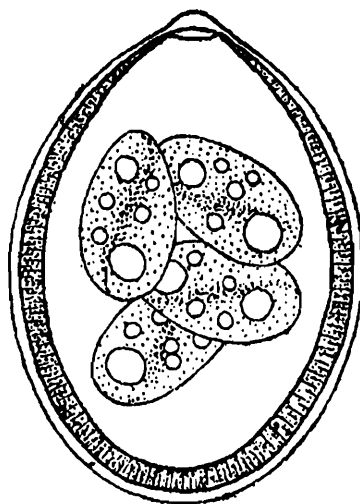


Fig. 133. *Eimeria intricata*

about 20-25 μm in diameter; sporocyst pointed at one end and rounded at other end, pointed end with conspicuous button-like stieda body; sporozoites fusiform, lying head to tail, each with two refractile globules; sporocystic residuum granular, scattered in middle region of sporocyst.

Oocyst collected from sheep almost similar but with wider micropyle of 5-13 μm wide and a micropylar cap, wider and shorter, measuring 6-15 μm $\times$ 2-4 μm .

Host : Goat, *Capra hircus*, Sheep, *Ovis aries*; site of infection : intestine.

Distribution : India : Maharashtra (Aurangabad district), Punjab, Uttar Pradesh, Madhya Pradesh, Bihar, Orissa and West Bengal.

Remarks : Rao and Hiregauder (1954) as well as Krishnamurthy and Kshirsagar (1976) earlier reported this species from this state. Jadhav *et al.* (2001) reported on the incidence of this species in goats from Marathwada region.

266. *Eimeria irresidua* Kossel and Jankiewicz 1931
(Fig. 134)

1931. *Eimeria irresidua* Kossel and Jankiewicz, Am. J. Hyg., 14 : 304.

1987. *Eimeria irresidua* : Mandal : Fauna of India : Protozoa : Sporozoa : Eucoccidiida : Eimeriidae, Zoological Survey of India, Calcutta, p. 279.

1988. *Eimeria irresidua* : Levine, The Protozoan Phylum Apicomplexa, Vol. 1, CRC Press, Inc., Florida, p. 155.

Diagnosis : Oocyst oval with conspicuous micropyle measuring 5.0-7.5 μm but no micropylar cap and oocystic residuum; oocyst wall smooth 1.5 μm thick and two layered, thicker around the micropyle, outer layer yellowish green while inner brownish, wrinkled around the micropylar region; unsporulated oocyst with a large and spherical to subspherical sporoblast, measuring 21-23 μm ; sporocyst large and ovoid and with 1-2 polar granules, sporocystic residuum and a stieda body; sporozoites fusiform and carry large refractile globules at the broader end, lying head to tail.

Host : Rabbit, *Oryctolagus cuniculus*; site of infection : intestine.

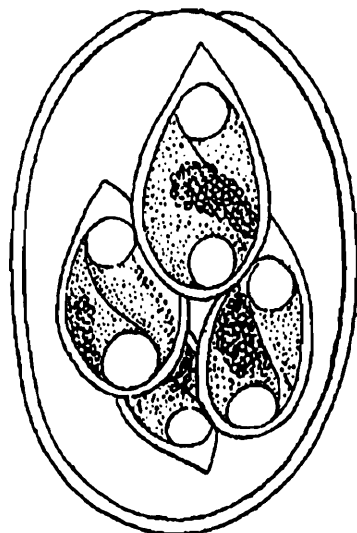


Fig. 134. *Eimeria irresidua*

Distribution : India : Maharashtra (Aurangabad district).

Remarks : In her unpublished work, S. R. Nikam (2002) studied this parasite from this state (Pers. Com.).

267. *Eimeria leuckarti* (Flesch, 1883)

1883. *Globidium leuckarti* Flesch, *Zool. Anz.*, 6 : 396.

1987. *Eimeria leuckarti* : Mandal : *Fauna of India : Protozoa : Sporozoa : Eucoccidiida : Eimeriidae*, Zoological Survey of India, Calcutta, p. 281

1988. *Eimeria leuckarti* : Levine, *The Protozoan Phylum Apicomplexa*, Vol. 1, CRC Press, Inc., Florida, p.158.

Diagnosis : Oocyst large, deep brown, bilayered, oval, $84\ \mu\text{m} \times 56\ \mu\text{m}$, with a distinct micropyle but without a polar cap; sporont $35\text{-}40\ \mu\text{m}$, circular; sporocyst elongated, $30\text{-}44\ \mu\text{m} \times 12\text{-}14\ \mu\text{m}$, lacking sporocystic residuum and polar granule; sporozoites spindle-shaped, $20\ \mu\text{m} \times 5\ \mu\text{m}$.

Host : Horse, *Equus caballus*; site of infection : intestine.

Distribution : Maharashtra (Mumbai).

Remarks : Hiregauder (1956b) and Gatme and Narsapur (1992) recorded this species from this state.

268. *Eimeria levinei* Krishnamurthy and Kshirsagar, 1980
(Fig. 135a-c)

1935. *Eimeria levinei* Krishnamurthy and Kshirsagar, *Arch. Protistenk.*, 123 : 215.

1987. *Eimeria levinei* : Mandal : *Fauna of India : Protozoa : Sporozoa : Eucoccidiida : Eimeriidae*, Zoological Survey of India, Calcutta, p. 283.

1988. *Eimeria levinei* : Levine, *The Protozoan Phylum Apicomplexa*, Vol. 1, CRC Press, Inc., Florida, p.158.

Diagnosis : Oocyst single layered, ovoid, $36\text{-}40\ \mu\text{m} \times 26\text{-}30\ \mu\text{m}$, oocystic residuum, micropyle and micropylar cap absent; sporocyst ovoid or elongated, $16\text{-}19\ \mu\text{m} \times 11\text{-}13\ \mu\text{m}$, with a very prominent spherical sporocystic residuum and a very small stieda body; sporozoites elongated or kidney-shaped, each with a refractile granule of moderate size at one end.

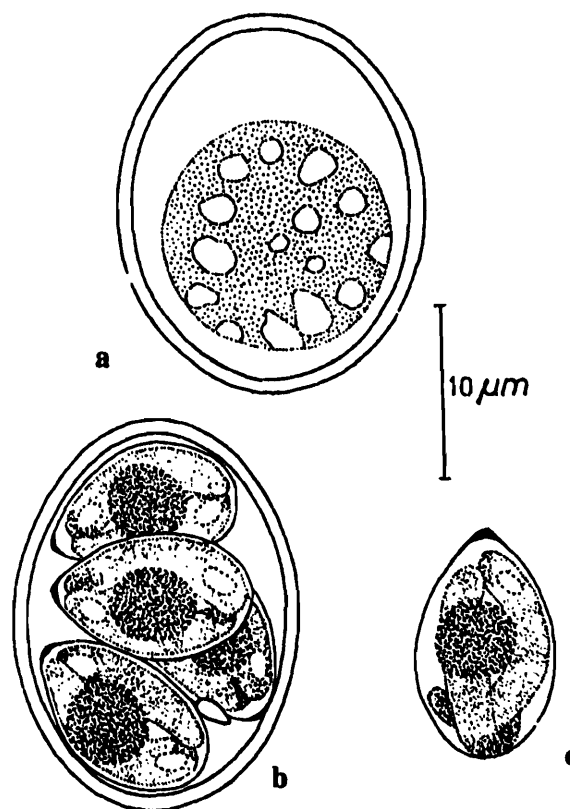


Fig. 135a-c. *Eimeria levinei*

Host : *Rattus rattus rattus*; site of infection : intestine.

Distribution : India : Maharashtra (Aurangabad).

Remarks : Krishnamurthy and Kshirsagar (1980) described this species as *Eimeria levinei*, which is preoccupied by *Eimeria levinei* earlier described by Bray (1958) as mentioned by Mandal (1987) and as such required to be reviewed and renamed.

269. *Eimeria nagpurensis* Gill and Ray, 1960
(Fig. 136)

1935. *Eimeria nagpurensis* Gill and Ray, *Proc. Zool. Soc. Calcutta*, 13 : 128.

1987. *Eimeria nagpurensis* : Mandal : *Fauna of India : Protozoa : Sporozoa : Eucoccidiida : Eimeriidae*, Zoological Survey of India, Calcutta, p. 292.

1988. *Eimeria levinei* : Levine, *The Protozoan Phylum Apicomplexa*, Vol. 1, CRC Press, Inc., Florida, p. 162.

Diagnosis : Oocyst barrel-shaped, 20-26 μm $\times$ 10-15 μm , micropyle absent; sporocyst oat-shaped, 15 μm $\times$ 5 μm , with anterior extremity sharply pointed, sporocystic residuum distinct, central and granular; sporozoites elongated, 12 μm $\times$ 2 μm , with a centrally placed nucleus and several refractile granules at the blunt end.

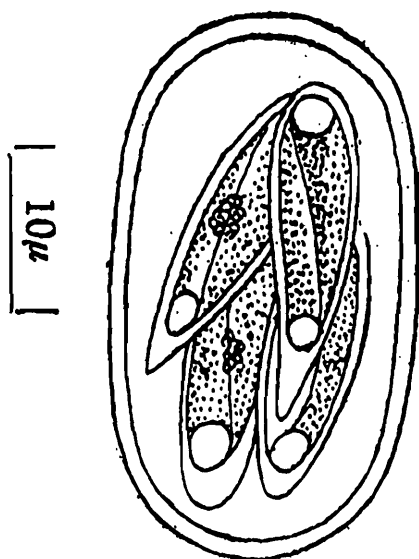


Fig. 136. *Eimeria nagpurensis*

Host : *Rattus rattus rattus*; site of infection : intestine.

Distribution : India : Maharashtra (Aurangabad).

Remarks : Gill and Ray (1960) recorded this species from this state.

270. *Eimeria ninakohlyakimovae* Yakimoff
and Rastegaieff, 1930
(Fig. 137)

1930. *Eimeria ninakohlyakimovae* Yakimoff and Rastegaieff, *Arch. Protistenk.*, 70, p. 185.

1987. *Eimeria ninakohlyakimovae* : Mandal : *Fauna of India : Protozoa : Sporozoa : Eucoccidiida : Eimeriidae*, Zoological Survey of India, Calcutta, p. 297.

1988. *Eimeria ninakohlyakimovae* : Levine, *The Protozoan Phylum Apicomplexa*, Vol. 1, CRC Press, Inc., Florida, p. 163.

Diagnosis : Oocyst from goat subspherical, micropyle seen in many cases but micropylar cap absent; oocyst wall two layered, smooth about 1.5 μm , outer layer 1 μm thick and yellowish brown in colour while inner 0.5 μm thinner and brownish; 1-4 polar granules present but oocystic residuum absent; sporoblast of unsporulated oocyst spherical and 14-20 μm in diameter; sporocyst elliptical to ovoid and with small stieda body; sporocystic residuum granular and near the center of sporocyst; sporozoites relatively shorter and situated transversely or obliquely, each with a conspicuous refractile globule.

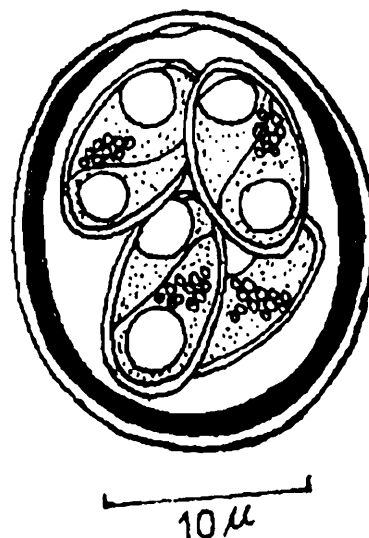


Fig. 137. *Eimeria ninakohlyakimovae*

Oocyst collected from sheep with more conspicuous micropyle and numerous polar granules, smaller sporoblast of 9-12 μm diameter, sporocystic residuum in compact group of 4-5 granules.

Host : Goat, *Capra hircus*, Sheep, *Ovis aries*; site of infection : intestine.

Distribution : India : Maharashtra (Aurangabad district), Andhra Pradesh; Punjab, Haryana, Madhya Pradesh, Uttar Pradesh, Orissa, West Bengal.

Elsewhere : Kazakhstan, Tunisia, Germany, United States.

Remarks : This is one of the most pathogenic species of coccidium in sheep. Rao and Hiregauder (1954) as well as S. R. Nikam and her co-workers (1999-2001) studied this species from this state.

271. *Eimeria ovina* Krylov, 1961
(Fig. 138)

1961. *Eimeria ovina* Krylov, *Trans. Inst. Zool. Parazitol. Akad. E. N. Pavlov. Tadazh. SSR*, 22 : 7.
1987. *Eimeria ovina* : Mandal : *Fauna of India : Protozoa : Sporozoa : Eucoccidiida : Eimeriidae*, Zoological Survey of India, Calcutta, p. 300.
1988. *Eimeria ovina* : Levine, *The Protozoan Phylum Apicomplexa*, Vol. 1, CRC Press, Inc., Florida, p. 164.

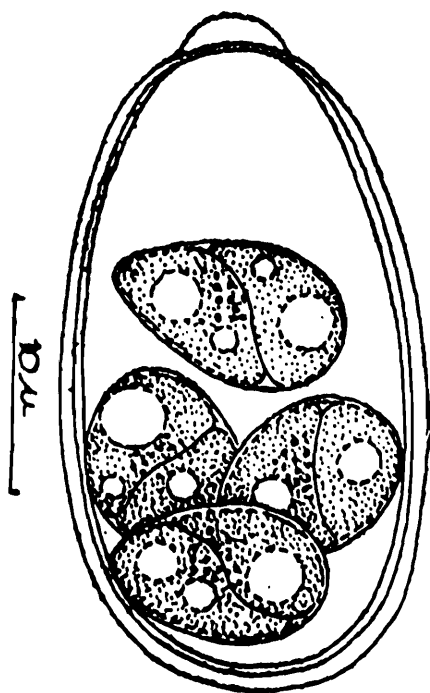


Fig. 138. *Eimeria ovina*

Diagnosis : Oocysts typically elongated, with two longitudinal sides almost parallel to one another, 23-36 (27) μm $\times$ 16-24 (20) μm , wall smooth and double layered; micropyle with a characteristic cone-shaped micropylar cap present; polar granule present but oocystic residuum absent; sporocyst elongate-ovoid, with one end broader than the other, 11-17 μm $\times$ 6-9 μm , stieda body absent or rudimentary; sporocystic residuum

present; sporozoite elongated, each with a large clear globule at one end and a smaller one at the other end.

Host : Sheep, *Ovis aries*; site of infection : intestine.

Distribution : India : Maharashtra (Aurangabad).

Remarks : Krishnamurthy and Bawazir (1981) studied the morphological variations (31.6-47.9 μm $\times$ 18.4-26.5 μm and 10.2-20.4 μm $\times$ 7.1-10.2 μm) of this species from this state.

272. *Eimeria parbhaniensis* Kshirsagar, 1976

1976. *Eimeria parbhaniensis* Kshirsagar, *Ph. D. Thesis*, Marathwada University.

Diagnosis : Oocyst obtained from goat large, egg-shaped or elongated with conspicuous micropyle and micropylar cap; wall thick, yellowish green colour, two layered, outer thicker than inner; micropyle 6.5-10.0 μm wide and covered by an inverted bowl-shaped, colourless and transparent micropylar cap, flattened at the apex, measuring 8.6-12 μm width and 3.5-4.5 μm in height; oocystic residuum absent; unsporulated oocyst having spherical sporoblast of about 18-20 μm in diameter; sporocysts pyriform bearing a button-like stieda body, sporocystic residuum in the form of two rows of spherical granules, lying in between the two sporozoites.

Host : Goat, *Capra hircus*; site of infection : intestine.

Distribution : India : Maharashtra (Parbhani, Aurangabad).

Remarks : Kshirsagar (1976) described this species from this state. S. R. Nikam. (1983) also in her unpublished work studied this species from this state. Even though this species was reported by Nikam (1999) and Jadhav *et al.* (2001), it needs to be reviewed and revalidated.

273. *Eimeria parva* Kotlan Mocsy and Vajda, 1929
(Fig. 139)

1929. *Eimeria parva* Koltan, Mocsy and Vajda, *Allatorv. Lapok.*, 2 : 304.

1987. *Eimeria parva* : Mandal : *Fauna of India : Protozoa : Sporozoa : Eucoccidiida : Eimeriidae*, Zoological Survey of India, Calcutta, p. 305.

1988. *Eimeria parva* : Levine, *The Protozoan Phylum Apicomplexa*, Vol. 1, CRC Press, Inc., Florida, p. 165.

Diagnosis : Oocyst collected from goat typically spherical to subspherical and devoid of a micropyle and micropylar cap, wall of oocyst about 1.0 μm thick and of two layers, outer smooth and brownish, while inner thin and membranous; polar granules present but oocystic residuum absent; spherical sporoblast in unsporulated oocyst 10-14 μm in diameter; sporocysts elongated and ovoid and with a steida body; sporocystic residuum scattered located and typically granular; sporozoites ovoid to pyriform and obliquely located, each with refractile globules.

Oocyst from sheep spherical or subspherical but smaller in size; micropyle and micropylar cap absent; oocystic wall smooth and two layered, but relatively thin, residuum absent; 1-2 polar granules present; unsporulated oocyst spherical with sporoblast measuring 5-11 μm ; sporocyst elongated ovoid with small steida body at narrower end; sporocystic residuum present; sporozoites arranged transversely.

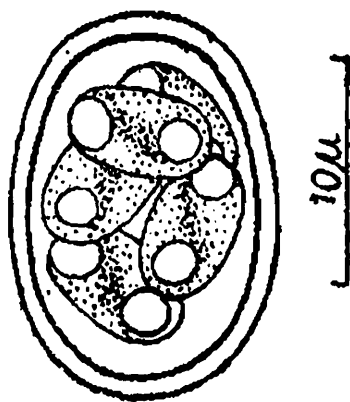


Fig. 139. *Eimeria parva*

Host : *Capra hircus*, *Ovis aries*; site of infection : intestine.

Distribution : India : Maharashtra (Aurangabad district).

Remarks : Rao and Hiregauder (1954) as well as S. R. Nikam and her co-workers (1999-2001) studied this parasite from this state.

274. *Eimeria pellita* Supperer, 1952 (Fig. 140)

1952. *Eimeria pellita* Supperer, *Osterreich. Zool. Zischr.*, 3 : 591.

1987. *Eimeria pellita* : Mandal : *Fauna of India : Protozoa : Sporozoa : Eucoccidiida : Eimeriidae*, Zoological Survey of India, Calcutta, p. 307.

1988. *Eimeria pellita* : Levine, *The Protozoan Phylum Apicomplexa*, Vol. 1, CRC Press, Inc., Florida, p. 166.

Diagnosis : Oocysts ovoid, 36-40 μm $\times$ 26-30 μm , wall of uniform thickness, dark brown in colour, with densely placed numerous protuberances, giving velvety appearance; with a micropyle on flattened narrower end; polar granule and oocystic residuum absent; sporocyst elongate-ovoid, 14-18 μm $\times$ 6-8 μm , usually with compact sporocystic residuum; sporozoite with two refractile globules.

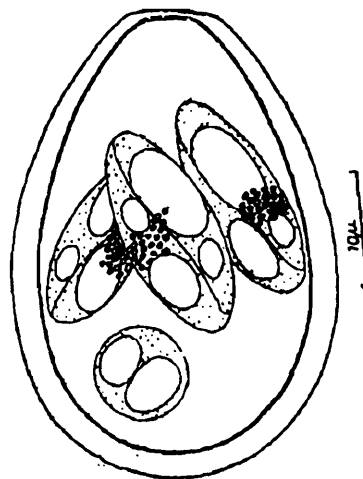


Fig. 140. *Eimeria pellita*

Host : Cattle, *Bos indicus*; site of infection : intestine.

Distribution : India : Maharashtra (Aurangabad) and Uttar Pradesh.

Remarks : Rao and Hiregauder (1954a, b) and Hiregauder and Rao (1966) reported this species from this state.

275. *Eimeria perforans* (Leuckart 1897) Sluiter and Swellengrabel, 1912 (Fig. 141)

1897. *Coccidium perforans* Leuckart, *Die Parasiten des Menschen*, 2nd ed., G. F. Winter.

1987. *Eimeria perforans* : Mandal : *Fauna of India : Protozoa : Sporozoa : Eucoccidiida : Eimeriidae*, Zoological Survey of India, Calcutta, p. 308.

1988. *Eimeria perforans* : Levine, *The Protozoan Phylum Apicomplexa*, Vol. 1, CRC Press, Inc., Florida, p. 166.

Diagnosis : Oocyst elongated ovoid and 3.0-5.5 μm in diameter, micropylar cap absent, oocyst wall smooth two layered and almost 1.5 μm thick. Outer layer greenish while inner one thinner and dark brown in appearance, oocyst residuum present in the form of a compact mass of granules about 5-7 μm in diameter; unsporulated oocyst oval, with sub-spherical sporoblast, 12-15 μm in diameter, elongated, showing wide variation, a small stieda body present, sporocystic residuum in the form of scattered granules near the middle of the sporocyst; sporozoites lying head to tail and with a prominent refractile body at the broader end.

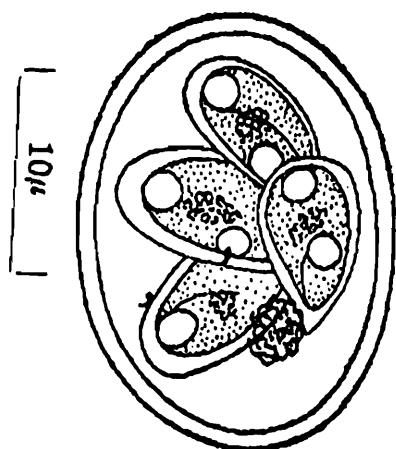


Fig. 141. *Eimeria perforans*

Host : Rabbit, *Oryctolagus cuniculus*; site of infection : intestine.

Distribution : India : Maharashtra (Aurangabad district).

Remarks : S. R. Nikam (1983) in her unpublished work studied this species from this state.

276. *Eimeria punctata* (Landers, 1952)

1952. *Eimeria honessi* Landers, *J. Parasitol.*, 38 : 569-570.

1988. *Eimeria punctata* : Levine, *The Protozoan Phylum Apicomplexa*, Vol. 1, CRC Press, Inc., Florida, p.168.

Diagnosis : Oocysts subspherical to spherical,

17.8-25.1 (21.2) μm $\times$ 16.2-21.1 (17.7) μm , with cone-shaped pits evenly distributed over the surface of the wall; outer layer colourless or pale yellow, inner wall with greenish tint; micropyle visible at the narrower pole carrying a squat cap; sporocysts round or oval, polar granule and primary residuum absent.

Host : *Ovis aries*; site of infection : intestine.

Distribution : India : Maharashtra (Arangabad district).

Remarks : S. R. Nikam and her co-workers (1999-2001) studied this parasite from this state.

277. *Eimeria subspherica* Christensen 1941 (Fig. 142)

1935. *Eimeria subspherica* Christensen *J. Parasit.*, 27 : 203.

1987. *Eimeria subspherica* : Mandal : *Fauna of India : Protozoa : Sporozoa : Eucoccidiida : Eimeriidae*, Zoological Survey of India, Calcutta, p. 328.

1988. *Eimeria subspherica* : Levine, *The Protozoan Phylum Apicomplexa*, Vol. 1, CRC Press, Inc., Florida, p.173.

Diagnosis : Oocysts spherical to sub spherical or round; micropyle absent; oocystic wall 0.7-1.0 μm thick, two layered, smooth, straw coloured, sometime pale yellowish; polar granules and oocystic residuum absent; sporocyst spindle-shaped or elongated ovoid with small stieda body; sporocyst residuum consisting of diffuse granules; sporozoites lying from head to tail and having clear globule at broader end.

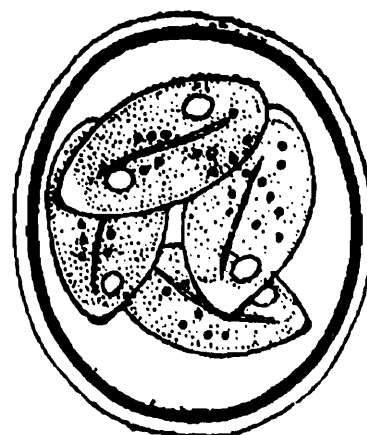


Fig. 142. *Eimeria subspherica*

Host : Buffalo, *Bubalus bubalis*; site of infection : intestine.

Distribution : India : Maharashtra (Aurangabad district).

Remarks : V. D. Jadhav and S. R. Nikam (2002) in their unpublished work studied this species from this state (Pers. Com.).

278. *Eimeria tuberculata* Krishnamurthy and Kshirsagar, 1980
(Fig. 143a-c)

1935. *Eimeria tuberculata* Krishnamurthy and Kshirsagar, 1980, *Arch. Protistenk.*, **123** : 215.

1987. *Eimeria tuberculata* : Mandal : *Fauna of India : Protozoa : Sporozoa : Eucoccidiida : Eimeriidae*, Zoological Survey of India, Calcutta, p. 334.

1988. *Eimeria tuberculata* : Levine, *The Protozoan Phylum Apicomplexa*, Vol. 1, CRC Press, Inc., Florida, p. 175.

Diagnosis : Oocyst subspherical, trilayered, 36-43 (40) μm $\times$ 32-38 (36) μm , shape index 1.1; micropyle, micropylar cap, polar granule and oocystic residuum absent; sporocyst oval or egg-shaped, with one rounded and the other end slightly pointed, 19-22 (20) μm $\times$ 12-14 (13) μm , shape index 1.6, sporocystic residuum present; sporozoite typically elongated, banna-shaped, with a fairly large refractile body at one end.

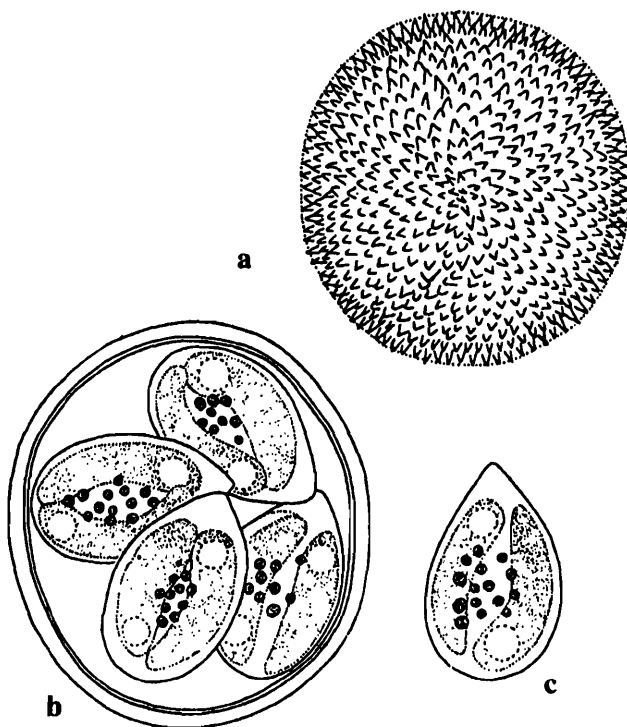


Fig. 143a-c. *Eimeria tuberculata*

Host : Rat, *Rattus rattus rattus*; site of infection : intestine.

Distribution : India : Maharashtra (Aurangabad).

Remarks : Krishnamurthy and Kshirsagar (1980) described this species from this state.

279. *Eimeria weybridgensis* Norton, Joyner and Catchpole 1974

1974. *Eimeria weybridgensis* Norton, Joyner and Catchpole, *Parasitology*, **69** : 87.

1988. *Eimeria weybridgensis* : Levine, *The Protozoan Phylum Apicomplexa*, Vol. 1, CRC Press, Inc., Florida, p. 177.

Diagnosis : Oocyst ellipsoid to ovoid with micropyle and micropylar cap, wall two layered, smooth, 1.5 μm thick, outer layer thicker, greenish while inner layer wrinkled near micropylar end; micropyle 4-6 μm wide, covered by broad flattened micropylar cap; polar granules and oocystic residuum absent; unsporulated oocyst relatively small; sporoblast 15-19 μm ; sporulated oocyst elongated, rounded at one end and bluntly conical at other end; stieda body absent; sporocystic residuum in the form of fine granules scattered between the sporozoite; sporozoites lying head to tail and carrying refractile body at broad end.

Host : Sheep, *Ovis aries*; site of infection : intestine.

Distribution : India : Maharashtra (Aurangabad district).

Remarks : Nikam and her co-workers (1999-2001) studied this species from this state.

280. *Eimeria zuernii* (Rivolta, 1878)
(Fig. 144)

1878. *Cryptosporidium zumii* Rivolta, *Geor. Anat. Fisiol. Patol. Anim.*, Pisa, **4** : 220.

1987. *Eimeria zuernii* : Mandal : *Fauna of India : Protozoa : Sporozoa : Eucoccidiida : Eimeriidae*, Zoological Survey of India, Calcutta, p. 338.

1988. *Eimeria zuernii* : Levine, *The Protozoan Phylum Apicomplexa*, Vol. 1, CRC Press, Inc., Florida, p. 177.

Material Examined : Sav. exs., Nasik, Dec., 2005, R. Nandi.

Diagnosis : Oocyst spherical, subspherical, bluntly ellipsoidal or ovoidal, smooth walled, double layered, $14-22$ (17) μm $\times$ $13-19$ (16) μm ; micropyle, micropylar cap, polar granule and oocystic residuum absent; sporocyst elongated ovoid, $8.0-10.5$ μm $\times$ $5.0-7.0$ μm , stieda body and sporocystic residuum present; sporozoite 9 μm $\times$ 3 μm , with a refractile granule.

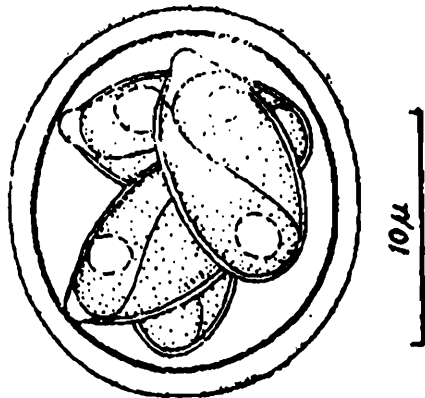


Fig. 144. *Eimeria zuernii*

Host : Cattle, *Bos indicus*; site of infection : intestine.

Distribution : India : Maharashtra (Nasik district), Andhra Pradesh, Orissa, Uttar Pradesh, Haryana.

Elsewhere : Cosmopolitan.

Remarks : This species is reported herein for the first time from this state.

281. *Eimeria* sp.
(Fig. 145a-c)

Diagnosis : Oocyst oval, both end rounded, micropyle and micropylar cap absent, wall smooth two layered about $1.0-1.25$ μm in thickness, outer layer thicker than inner, oocystic residuum typically granular and in the form of compact, spherical mass, about $4-5$ μm in diameter; unsporulated oocyst almost spherical, sporoblast measuring $13-15$ μm in diameter; sporocyst ovoid to elliptical with sporocystic residuum consisting of few fine granules scattered between sporozoites, stieda body at the slightly narrower end; sporozoites elongated, lying head to tail, occupying entire space in the sporocyst, each with a prominent refractile body at the broader end.

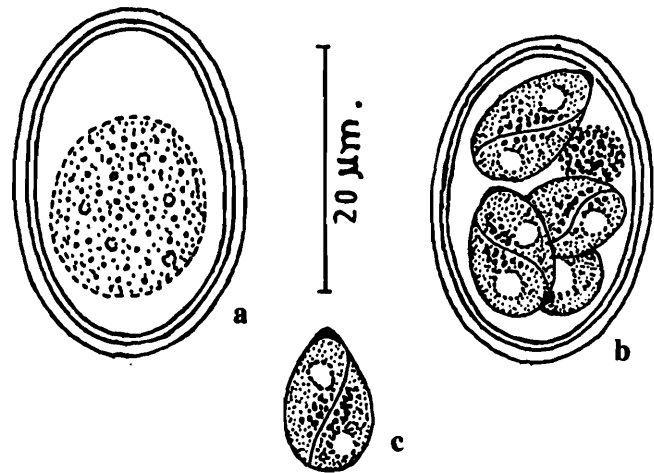


Fig. *Eimeria* sp. in *Oryctolagus cuniculus*

Host : Rabbit, *Oryctolagus cuniculus*; site of infection : intestine.

Distribution : India : Maharashtra (Aurangabad district).

Remarks : S. R. Nikam (1983) in her unpublished work recorded this species as *Eimeria trimurthyi* n. sp. from this state. Being unpublished and not thoroughly reviewed this species is reported herein as unnamed species.

282. *Eimeria* sp.

Host : *Capra hircus*; site of infection : intestine.

Distribution : India : Maharashtra (Aurangabad).

Remarks : Krishnamurthy and Kshirsagar (1976) recorded this unnamed species.

283. *Eimeria* sp.

Diagnosis : Oocysts typically single layered and of three forms, measuring 37.5 μm $\times$ 21.0 μm , 30.9 μm $\times$ 30.0 μm and 25.5 μm $\times$ 24.2 μm respectively.

Host : *Funambulus palmarum*; site of infection : intestine.

Distribution : India : Maharashtra.

Remarks : Kshirsagar and Krishnamurthy (1984) reported this unnamed species from this state.

Genus *Isospora* Schneider, 1881

1881. *Isospora* Schneider, *Arch. Zool. Exp. Gen.*, 9 : 389.
 1988. *Isospora* : Levine, *The Protozoan Phylum Apicomplexa*, Vol. 1, CRC Press, Inc., Florida, p. 180.

Diagnosis : Oocysts with two sporocysts, each sporocyst with four sporozoites; usually parasitic in vertebrates.

A. *Isospora* of reptiles284. *Isospora calotesi* Bhatia, 1938

1833. *Isospora* sp. Sitna, *Curr. Sci.*, 2 : 97.
 1938. *Isospora calotesi* Bhatia, *the fauna of British India, including Ceylon and Barma, Protozoa : Sporozoa*, Taylor and Francis, London, p. 167.
 1987. *Isospora calotesi* Bhatia : Mandal, *Fauna of India, Protozoa : Sporozoa : Eucoccidiida : Eimeridae*, Zoological Survey of India, Calcutta, p. 47.

Diagnosis : Oocysts spherical or subspherical, 25-37 (32.5) μm , double-layered, with a micropyle but without any oocystic residuum sporocysts elliptical, 12.5-17.5 (14.5) μm $\times$ 9.5-10.5 (9.8) μm , with a small knob (stieda body) at the anterior end and round posterior end or in some cases abruptly tapering to a blunt point; sporocystic residuum appeared aggregated irregular mass, shape index 1.5; sporozoites elongated, 12 μm $\times$ 2.5 μm , 12 μm $\times$ 2.5 μm , irregularly arranged with one end pointed and other rounded.

Host : *Calotes versicolor*; site of infection : intestine.

Distribution : India : Maharashtra (Mumbai), West Bengal.

Remarks : Setna (1933) observed this species and reported as unnamed from this state, which was given a new name by Bhatia (1938). Subsequently Chakravarty and Kar (1947) and Mandal (1976) studied this species from West Bengal state.

B. *Isospora* of birds285. *Isospora lacazei* Labbe 1893
(Fig. 146a-b)

1893. *Diplospora lackzei* Labbe, *C. r. hebl. Seanc Acad. Sci. Paris*, 117 : 407.

1987. *Isospora lacazei* : Mandal : *Fauna of India : Protozoa : Sporozoa : Eucoccidiida : Eimeriidae*, Zoological Survey of India, Calcutta, p. 69.

1988. *Eimeria lacazei* : Levine, *The Protozoan Phylum Apicomplexa*, Vol. 1, CRC Press, Inc., Florida, p. 184.

Diagnosis : In Weaver bird : Oocyst spherical to subspherical smooth, single layered about 2-1 μm thick, polar granules, oocystic residuum and micropyle absent, unsporulated oocyst subspherical, measuring 20.3 μm $\times$ 18.2 μm ; sporocysts pyriform to elongated ovoid with button like stieda body, sporocystic residuum small compact mass; sporozoites elongated, comma-shaped with refractile body.



Fig. 146a-b. *Isospora lacazei*

In House sparrow : Oocyst subspherical to ovoid, two layered, smooth, about 2.1 μm thick, outer layer thicker, transparent and creamish, inner layer thinner, opaque, polar granules, oocystic residuum and micropyle absent; unsporulated oocyst 17.5 μm $\times$ 16.1 μm ; sporocyst ellipsoid to pyriform, prominent stieda bodies with knob-like projections present, sporocystic residuum in the form of scattered granules; sporozoites 9.5 μm $\times$ 4.9 μm , comma-like, broader at one end and pointed at other.

Host : *Ploceus philippinus* (Linnaeus), common weaver bird and *Passer domesticus* (Linnaeus). House sparrow ; site of infection : intestine.

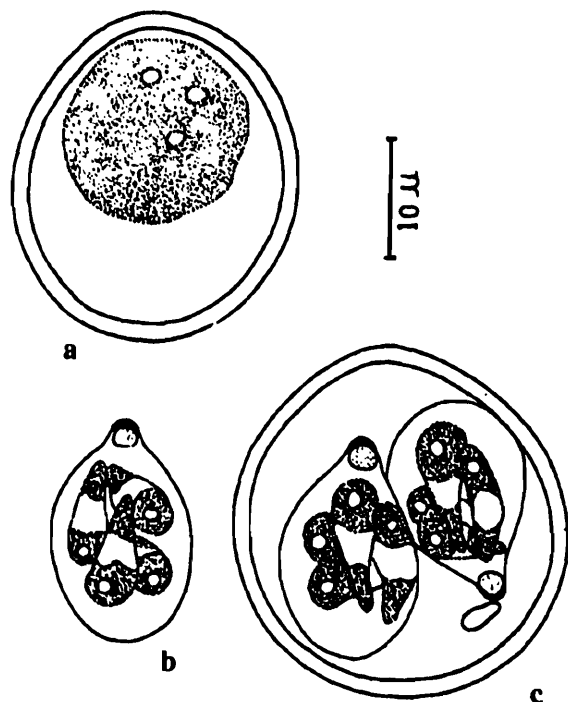
Distribution : India : Maharashtra (Aurangabad district).

Remarks : V. M. Bhosale (1977) in his unpublished work recorded this species from this state, which was also observed and communicated herein by S. R. Nikam.

286. *Isospora* sp.

(Fig. 147a-c)

Diagnosis : Oocyst subspherical or slightly pyriform with one half somewhat triangular and conical; wall smooth, brownish, single layered about $2.1\ \mu\text{m}$ thick; polar granules elongated about $2.8\ \mu\text{m} \times 2.1\ \mu\text{m}$; micropyle and residuum absent; unsporulated oocyst with very small sporoblast, spherical or subspherical, $15.4\ \mu\text{m} \times 14.7\ \mu\text{m}$ on average; sporocyst elongated-ovoid, flattened, stieda body as well as substieda body present; sporozoites elongated, club-shaped with one end broad and elongated, other narrow, tapering and pointed, $6.7\ \mu\text{m} \times 3.9\ \mu\text{m}$; refractile granules present.

Fig. 147a-c. *Isospora* sp. in *Alauda gulgula*

Host : *Alauda gulgula* (Franklin), Small skylark; site of infection : intestine.

Distribution : India : Maharashtra (Aurangabad district).

Remarks : V.M. Bhosale (1977) in his unpublished work recorded this species as *Isospora alaudae* n. sp. But this species, though observed and communicated by S. R. Nikam, is reported herein as unnamed species before critical review of this species.

287. *Isospora* sp.

Diagnosis : Oocyst subspherical, smooth, single layered about $1.4\ \mu\text{m}$ thick, $14.7\ \mu\text{m} \times 13.5\ \mu\text{m}$ on average, micropyle or polar granules absent, oocystic residuum having prominent stieda body; unsporulated oocyst showing spherical or oval sporoblast, sporocystic residuum absent; sporozoites short and stumpy, $5.9\ \mu\text{m} \times 3.2\ \mu\text{m}$ on average, with slight constriction near their middle and with fairly prominent refractile body at one end.

Host : *Turdoides somervillei* (Sykes), Jungle Babbler; site of infection : intestine.

Distribution : India : Maharashtra (Aurangabad district).

Remarks : V.M. Bhosale (1977) in his unpublished work recorded this unnamed species from this state as communicated by S. R. Nikam.

288. *Isospora* sp.

Diagnosis : Oocyst spherical to subspherical, smooth single layered, brownish yellow wall of about $1.4\ \mu\text{m}$ thick; micropyle, oocystic residuum and polar granules absent; unsporulated oocyst with fairly large sporoblast, measuring $18.5\ \mu\text{m} \times 16.1\ \mu\text{m}$ on an average; sporocyst somewhat ellipsoidal or pyriform having flattened stieda body; sporocystic residuum in the form of compact and granular mass; sporozoites short, stumpy, about $8.3\ \mu\text{m} \times 5.8\ \mu\text{m}$, all carry prominent refractile body at broader end.

Host : *Amandava amandava* (Linnaeus), Red munia; site of infection : intestine.

Distribution : India : Maharashtra (Aurangabad district).

Remarks : V.M. Bhosale (1977) in his unpublished work recorded this species as *Isospora amandavae* n. sp. But this species is reported herein as unnamed species being unpublished as stated earlier.

289. *Isospora* sp.¹
(Fig. 148a-c)

Diagnosis : Oocyst subspherical to oval, two layered, smooth and about 1.4 μm thick, outer layer relatively thicker, semitransparent, brownish while inner layer thinner and almost transparent; micropyle, polar granules and oocystic residuum absent; unsporulated oocyst oval and relatively small; sporocyst fairly large and elongated with two side almost parallel to each other, one end of sporocyst broader, thickened with stieda body and just behind it a fairly prominent, refractile sub stieda body, triangular in shape, sporocystic residuum compact, 4.9 μm $\times$ 4.2 μm in diameter; sporozoites elongated cucumber-shaped, 9.8 μm $\times$ 4.2 μm on average, with large refractile body at broader end and a smaller one at the other.

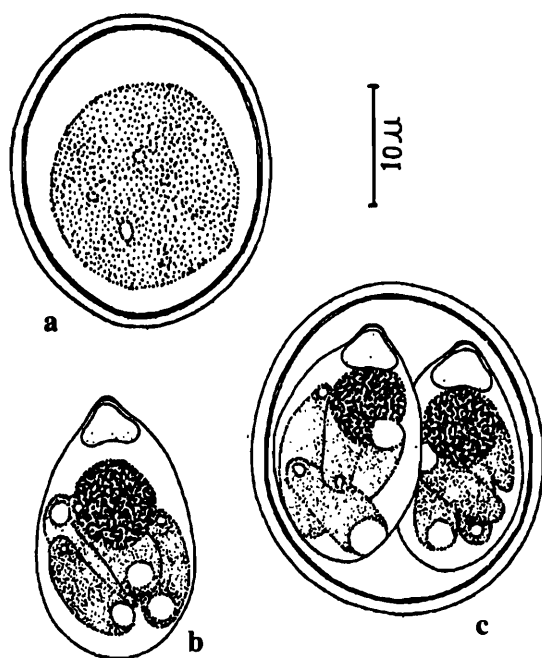


Fig. 148a-c *Isospora* sp. in *Molpastes cafer*

Host : *Molpastes cafer* (Linnaeus), Red-vented bulbul; site of infection : intestine.

Distribution : India : Maharashtra (Aurangabad district).

Remarks : V.M. Bhosale.(1977) in his unpublished work recorded this species as *Isospora lonavalensis* n. sp. But this species is reported herein as unnamed species as stated earlier.

290. *Isospora* sp.²
(Fig. 149a-c)

Diagnosis : Oocyst ellipsoid; with one half slightly broader than other, a characteristic constriction passing around the oocyst in the narrower half, a little distance away from the middle of the oocyst; wall smooth, two layered about 2.1 μm thick, outer layer thicker and transparent with grayish or greenish tinge, inner wall thin membranous, slightly opaque and closely attached to the outer wall; micropyle, polar granules or oocystic residuum absent; unsporulated oocyst about 27.3 μm $\times$ 24.5 μm , with large sporoblast occupying a greater part of the space in oocyst; sporocyst elongated, one end of the sporocyst drawn out into a knob-like projection but stieda body poorly developed, a large stieda body present in the form of a triangular hemispherical translucent mass occupying the entire space in the knob-like projection, sporocystic residuum in the form of compact spherical, granular mass about 6.3 μm $\times$ 5.6 μm ; sporozoites elongated with large refractile body about 16.4 μm $\times$ 6.3 μm on average.

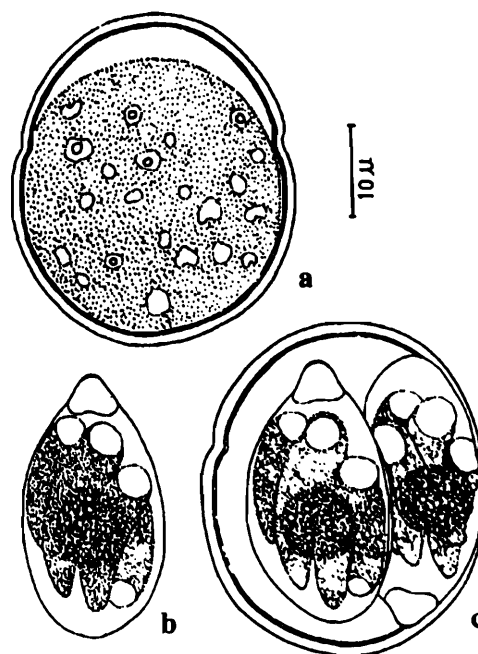


Fig. 149a-c. *Isospora* sp. in *Molpaster cafer*

Host : *Molpaster cafer* (Linnaeus), Redvented bulbul; site of infection : intestine.

Distribution : India : Maharashtra (Aurangabad district).

Remarks : V.M. Bhosale (1977) in his unpublished work recorded this species as *Isospora molpasti* n. sp. But this species is reported herein as unnamed species as stated earlier.

291. *Isospora* sp.
(Fig. 150a-c)

Diagnosis : Oocysts subspherical, smooth, two layered, about $1.4\ \mu\text{m}$, outer layer thicker, transparent and brownish, inner layer thinner and opaque, oocystic residuum absent but conspicuous polar granules present, about $3.5\ \mu\text{m} \times 2.8\ \mu\text{m}$; unsporulated oocyst oval or spherical measuring $25.0\ \mu\text{m} \times 23.5\ \mu\text{m}$ on average; sporocyst elongated ovoid with prominent knob-like stieda body at one end, prominent sub-stieda body also present, sporocystic residuum variable as a small compact mass or few scattered large granules; sporozoite moderately long, stumpy and pestle-shaped, $6.8\ \mu\text{m} \times 4.4\ \mu\text{m}$ on the average, prominent refractile body present.

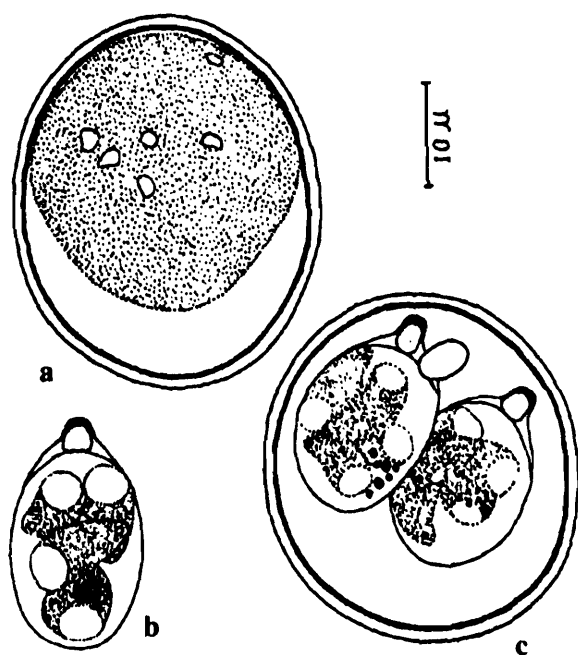


Fig. 150a-c. *Isospora* sp. in *Sylvia eurruca*

Host : *Sylvia eurruca*, Lesser white throat; site of infection : intestine.

Distribution : India : Maharashtra (Satara district).

Remarks : V.M. Bhosale (1977) in his unpublished work recorded this species as *Isospora mehdii* n. sp. But this species is reported herein as unnamed species as stated earlier.

292. *Isospora* sp.
(Fig. 151a-c)

Diagnosis : Oocyst elliptical, smooth single layered, yellowish brown, about $1.0\ \mu\text{m}$ thick; micropyle and oocystic residuum absent but a prominent refractile polar granule of about $2.8\ \mu\text{m} \times 2.1\ \mu\text{m}$ present; unsporulated oocyst with sporoblast measuring $21.0\ \mu\text{m} \times 18.9\ \mu\text{m}$; sporocyst elongated, oval with stieda body at one end, just below this body a large refractile substieda body present, sporocystic residuum in the form of 5-8 scattered granules; sporozoites typically elongated, banana-shaped, $8.7\ \mu\text{m} \times 4.3\ \mu\text{m}$, with moderate refractile body at one end.

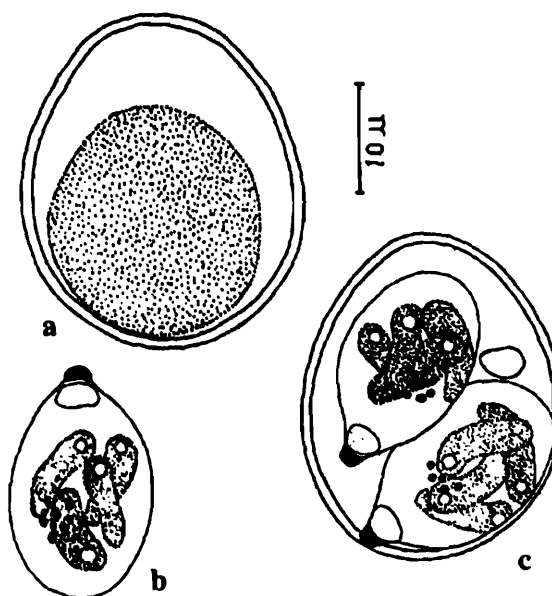


Fig. 151a-c. *Isospora* sp. in *Temenuchus pogodarum*

Host : *Temenuchus pogodarum* (Gmelin); site of infection : intestine.

Distribution : India : Maharashtra (Aurangabad district).

Remarks : V.M. Bhosale (1977) in his unpublished work recorded this species as *Isospora sulumarii* n. sp. (Pers. Com.). But this species is reported herein as unnamed species as stated earlier.

293. *Isospora* sp.

Diagnosis : Oocysts elliptical 26.6-36.4 μm $\times$ 20.3-27.3 μm , thin walled; sporocyst oval with a very prominent substieda body.

Host : *Micropus affinis*; site of infection : intestine.

Distribution : India : Maharashtra (Aurangabad).

Remarks : Krishnamurthy *et al.*, (1981) reported this unnamed species from this state.

B. *Isospora* of mammals

Key to the species of *Isospora* of mammals

- 1(4) Oocysts single layered
- 2(3) Oocysts large, spherical, subspherical or ovoid, more than 30 μm in dimension
 - (a) Oocysts 32-44 μm $\times$ 32-40 μm , sporozoites short and stumpy parasitic in rats *I. aurangabadensis*
 - (b) Oocysts 36-48 μm $\times$ 35-40 μm , sporozoites elongated, parasitic in rats *I. krishnamurthyi*
- 3(2) Oocysts less than 30 μm in dimension
 - (a) Oocyst spherical or short ellipsoidal, larger ones 18-20 μm $\times$ 14-16 μm , smaller ones 10-14 μm $\times$ 7-9 μm , parasitic in cats and dogs *I. bigemina*
- 4(1a) Oocysts bilayered, ovoid, 27-30 μm $\times$ 20-25 μm , parasitic in dogs *I. rivolta*
- 4(1b) Oocysts bilayered, elongated egg-shaped, 25-33 μm $\times$ 12.5-16.00 μm , parasitic in man *I. belli*
- 4(1c) Oocystic smooth, layer not reported, oocysts measuring 32-53 μm $\times$ 26-43 μm , parasitic in the family Felidae *I. felis*

294. *Isospora aurangabadensis*

Kshirsagar, 1980

(Fig. 152)

1980. *Isospora aurangabadensis* Kshirsagar, *Arch. Protistenk.*, 123 : 267.

1988. *Isospora aurangabadensis* : Mandal : *Fauna of India* : Protozoa : Sporozoa : Eucoccidiida : Eimeriidae, Zoological Survey of India, Calcutta, p. 92.

1988. *Eimeria aurangabadensis* : Levine, *The Protozoan Phylum Apicomplexa*, Vol. 1, CRC Press, Inc., Florida, p. 180.

Diagnosis : Oocysts single layered, yellowish brown, spherical or subspherical, with polar granule but without oocystic residuum; sporocysts oval, globose or elongated, 18-24 μm $\times$ 12-15 μm , stieda body and sporocystic residuum present; sporozoites short and stumpy, one end slightly broader than the other and with a large refractile body at the broader end.

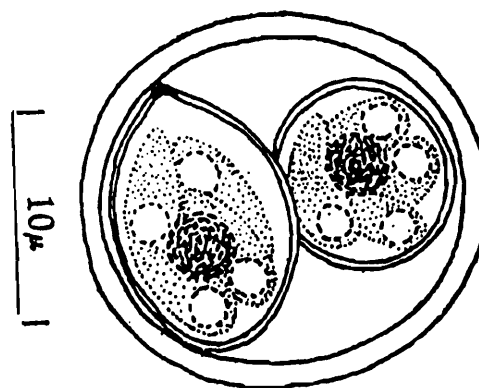


Fig. 152. *Isospora aurangabadensis*

Host : *Rattus rattus rattus* : site of infection : intestine.

Distribution : India : Maharashtra (Aurangabad).

Remarks : Kshirsagar (1980) described this species from this state.

295. *Isospora belli* Wenyon, 1923

1923. *Isospora belli* Wenyon, *Ann. trop. Med. Parasit.*, 17 : 231.

1987. *Isospora belli* Wenyon; Mandal : *Fauna of India*, Protozoa : Sporozoa : Eucoccidiida : Eimeriidae, Zoological Survey of India, Calcutta, p. 93.

Diagnosis : Oocyst elongated, egg-shaped, 25-33 (29) μm $\times$ 12.5-16.0 (14.2) μm , with one end more constricted than the other forming neck, wall double-layered; a micropyle at the narrower end; sporocysts 12-14 μm $\times$ 7-9 μm , with large spherical residual body; sporozoites elongated with rounded anterior and tapering posterior end.

Host : *Homo sapiens*; site of infection : intestine (faeces).

Distribution : India : Maharashtra (Mumbai), West Bengal.

Remarks : Cragg (1917) reported four cases from Mumbai (cited from Bhatia, 1938; Mandal 1987).

296. *Isospora bigemina* (Stiles, 1891)

1891. *Coccidium bigeminum* Stiles (partim), *Bull. Soc. Zool. Fr.*, **16** : 163.

1987. *Isospora bigemina* : Mandal : *Fauna of India* : Protozoa : Sporozoa : Eucoccidiida : Eimeriidae, Zoological Survey of India, Calcutta, p. 95.

Diagnosis : Oocyst spherical or ellipsoidal, thin walled, single layered, colourless, of two sizes : larger ones $18-20\ \mu\text{m} \times 14-16\ \mu\text{m}$, and the smaller, more common ones $10-14\ \mu\text{m} \times 7-9\ \mu\text{m}$, micropyle, polar granule and oocyst residuum absent; sporocyst ellipsoidal, $7.5-9.0\ \mu\text{m} \times 5-7\ \mu\text{m}$, without a stieda body, sporocystic residuum present.

Host : *Canis familiaris*; site of infection : intestine.

Distribution : India : Maharashtra (Mumbai), Orissa, Andhra Pradesh Tamil Nadu, Uttar Pradesh.

Remarks : Rao (1968) recorded this species from this state.

297. *Isospora felis* (Wasilewsky, 1904) (Fig. 153)

1904. *Diplospora bigemina* Wasielewsky (partim), *Stuien und Mikrophotogramme zur Kenntnis der pathogenen Protozoen*, Leipzig.

1923. *Isospora felis* Wenyon, *Ann. Trop. Med. Parasit.*, **17** : 231.

1987. *Isospora felis* : Mandal : *Fauna of India* : Protozoa : Sporozoa : Eucoccidiida : Eimeriidae, Zoological Survey of India, Calcutta, p. 82.

1988. *Isospora felis* : Levine, *The Protozoan Phylum Apicomplexa*, Vol. 1, CRC Press, Inc., Florida, p. 182.

Diagnosis : Oocyst ovoid, measuring $32-53\ (43)\ \mu\text{m} \times 26-43\ (33)\ \mu\text{m}$ in dimension, smooth

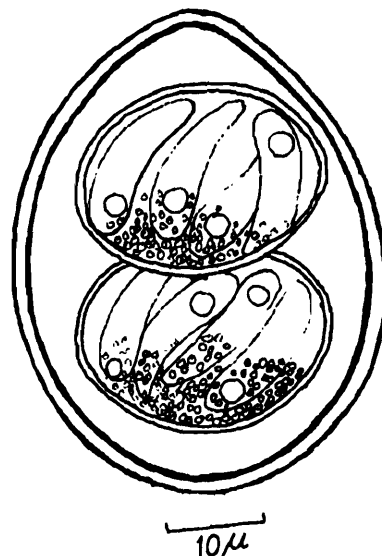


Fig. 153. *Isospora felis*

walled, colourless, without a micropyle, polar granule and oocystic residuum; sporocyst ellipsoidal, $20-27\ \mu\text{m} \times 18-21\ \mu\text{m}$, sporocystic residuum present; sporozoite $10-15\ \mu\text{m}$ long.

Host : *Felis domestica*; site of infection : intestine.

Distribution : India : Maharashtra (Mumbai), Tamil Nadu, Uttar Pradesh, Andhra Pradesh and West Bengal.

Remarks : Rao and Hiregauder (1952) recorded this species from this state.

298. *Isospora krishnamurthyi* Kshirsagar, 1980 (Fig. 154)

1980. *Isospora krishnamurthyi* Kshirsagar, *Arch. Protistenk.*, **123** : 267.

1987. *Isospora krishnamurthyi* : Mandal : *Fauna of India* : Protozoa : Sporozoa : Eucoccidiida : Eimeriidae, Zoological Survey of India, Calcutta, p. 104.

1988. *Eimeria krishnamurthyi* : Levine, *The Protozoan Phylum Apicomplexa*, Vol. 1, CRC Press, Inc., Florida, p. 184.

Diagnosis : Oocysts single layered, pale yellowish, spherical or slightly ovoid, $36-48\ \mu\text{m} \times 35-40\ \mu\text{m}$, a prominent polar granule always present but oocystic residuum absent; sporocysts elongated or ovoid, $20-26\ \mu\text{m} \times 17-21\ \mu\text{m}$, with a conspicuous stieda body and sporocystic residuum in the form of coarse granules; sporozoites elongated without any refractile body.

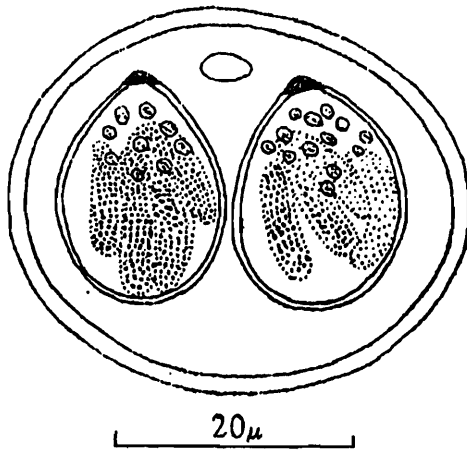


Fig. 154. *Isospora krishnamurthy*

Host : *Rattus rattus rattus* : site of infection : intestinal contents.

Distribution : India : Maharashtra (Aurangabad).

Remarks : Kshirsagar (1980) described this species from this state.

299. *Isospora rivolta* (Grassi, 1879)
(Fig. 155)

1879. *Coccidium rivolta* Grassi, (partim), *Gaz. Med. Ital.*, **39** : 445.

1987. *Isospora rivolta* : Mandal : *Fauna of India : Protozoa : Sporozoa : Eucoccidiida : Eimeriidae*, Zoological Survey of India, Calcutta, p. 111.

1988. *Isospora rivolta* : Levine, *The Protozoan Phylum Apicomplexa*, Vol. 1, CRC Press, Inc., Florida, p.186.

Diagnosis : Oocysts bilayered, yellowish to orange in colour, ovoid, 27-30 µm × 20-25 µm, without micropyle, polar granule and oocystic residuum; sporocyst ellipsoidal, 17-19 µm × 12-14 µm, stieda body absent, but sporocystic

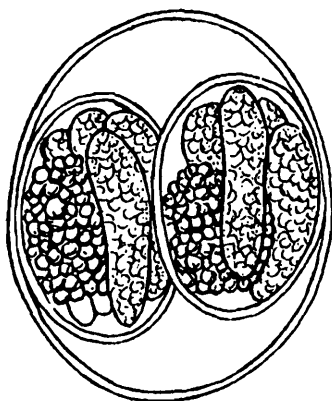


Fig. 155. *Isospora rivolta*

residuum present; sporozoites elongated, 13-15 µm × 2-3 µm, each with one pointed end.

Host : *Canis familiaris*; site of infection : intestine.

Distribution : India : Maharashtra (Mumbai), Tamil Nadu, Uttar Pradesh and West Bengal.

Remarks : Rao and Hiregauder (1952) recorded this species from this state.

Family LANKESTERELLIDAE

Genus *Lankesterella* Labbe, 1899

1899. *Lankesterella* Labbe, *Sporozoa*, in *Tierreich Eine Zuusammengstellung und Reizen Tierformen*. Vol. 5, F. E. Schulze and O. Butschli eds., Friedlader & Sohn, Berlin.

1988. *Lankesterella* : Levine, *The Protozoan Phylum Apicomplexa*, Vol. 1, CRC Press, Inc., Florida, p.195.

Diagnosis : Heteroxenous; oocysts with 32 or more sporozoites; known invertebrate host leeches; sporozoites in vertebrate erythrocytes, with about 30 subpellicular microtubules; in amphibians and reptiles.

300. *Lankesterella minima* (Chaussat, 1850)
(Syn. *Lankesterella monilis*)

1850. *Anguillula minima* Chaussat, *Reserches Microscopique Apliquees a la Pathologie des Hematozoaires*, M. D. Thesis, Paris.

1938. *Lankesterella monilis* : Bhatia : *The Fauna of British India, including Ceylon and Burma. Protozoa : Sporozoa*. Taylor and Francis, London.

1988. *Lankesterella minima* : Levine, *The Protozoan Phylum Apicomplexa*, Vol. 1, CRC Press, Inc., Florida, p. 195

Diagnosis : Sporozoites 10-15 µm in length, grown into a schizont, producing a large number of mēsozoites to infect blood and other endothelial cells; oocysts directly forming sporozoites without the formation of sporoplasts and sporocysts; sporozoites parasitic in red blood cells.

Host : *Rana tigrina*; site of infection : blood.

Distribution : India : Maharashtra (Mumbai).

Remarks : Berestneff (1903) reported this species from this state.

Family SARCOCYSTIDAE Poche, 1913

Subfamily SARCOCYSTINAE

Genus *Sarcocystis* Lankester, 1882

1882. *Sarcocystis* Lankester, *Quant. J. Microsc. sci.*, 22 : p. 54.

Diagnosis : Obligatorily heteroxenous; last generation meronts ("sarcocysts") typically in striated muscles; merozoites elongate.

301. *Sarcocystis capracanis* Fischer, 1979

1979. *Sarcocystis capracanis* Fischer, Die Entwicklung von *Sarcocystis capracanis* n. spec. in der Zeige, Inaug. Dissertation Tierärztliche, Frein University, Berlin.
1988. *Sarcocystis capracanis* : Levine, *The Protozoan Phylum Apicomplexa*, Vol. 1, CRC Press, Inc., Florida, p. 195.

Diagnosis : Parasites from musculature other than heart, measuring $1003.7 \mu\text{m} \times 69.7 \mu\text{m}$; wall radially striated, about $3.6 \mu\text{m}$ in thickness; parasites from heart shorter and thicker, measuring $247.1 \mu\text{m} \times 78.4 \mu\text{m}$, with comparatively thin but striated wall.

Host : *Capra hircus*; site of infection : muscle.

Distribution : India : Maharashtra (Parbhani district).

Elsewhere : Germany.

Remarks : Shastri (1990) reported this species from this state.

302. *Sarcocystis* sp.

Host : *Capra hircus*; site of infection : muscle.

Distribution : India : Maharashtra (Augangabad).

Remarks : Shastri (1990) reported this unnamed species from this state.

303. *Sarcocystis* sp.

Host : *Canis familiaris*; site of infection : muscle.

Distribution : India : Maharashtra (Parbhani).

Remarks : Deshpande *et al.*, (1981) reported this species from this state.

Subfamily TOXOPLASMOTINAE

Genus *Toxoplasma* Nicolle and Manceaux, 1909

Diagnosis : Meronts in many types of cell; host cell nucleus outside meront wall.

304. *Toxoplasma gondii* (Nicolle and Manceaux, 1908)
(Fig. 156)

1908. *Toxoplasma gondii* Nicolle and Manceaux, *C.R. Acad. Sci.*, 147, p. 763.

1967. *Toxoplasma gondii* : Levine : *Protozoan Parasites Of Domesticated Animals and Man*. Burgess Publishing Company, Minnesota, p. 325.

Diagnosis : Trophozoites crescentic or banana-shaped, $4-5 \mu\text{m} \times 2-4 \mu\text{m}$, occurring singly or in groups, with one end pointed and the other end rounded; trophozoite nucleus central and vesicular; schizont growing up to $20 \mu\text{m}$ in diameter, producing 20-30 nuclei by internal budding known as endodyogeny and this process continued until the daughter cello released from the destroyed parent cell.



Fig. 156. *Toxoplasma gondii*

Host : *Felis catus*; site of infection : blood.

Distribution : India : Maharashtra (Parbhani district).

Remarks : Shastri and Ratnaparkhi (1992) reported this species from this state.

305. *Toxoplasma hammondi* (Frenkel, 1974)

1974. *Hammondia hammondi* Frenkel, *Z. Parasitenk.*, 46 : 3.

1988. *Toxoplasma hammondi* : Levine, *The Protozoan Phylum Apicomplexa*, Vol. II, CRC Press, Inc., Florida, p. 9

Diagnosis : Not available.

Host : *Felis catus*; site of infection : blood.

Distribution : India : Maharashtra (Parbhani district), cosmopolitan.

Remarks : Shastri and Ratnaparkhi (1992) reported this species from this state.

306. *Toxoplasma* sp.

Host : *Felis domestica*; site of infection : blood.

Distribution : India : Maharashtra (Parbhani).

Remarks : Shastri and Ratnaparkhi (1992) reported this unnamed species from this state.

307. *Toxoplasma* sp.

Host : *Homo sapiens*, *Ovis aries*, *Capra hircus*; site of infection : blood.

Distribution : India : Maharashtra (Marathwada region).

Remarks : Ali *et al.*, (1981) reported prevalence of this species from this state using the indirect haemagglutination test.

Suborder HAEMOSPORINA

Family PLASMODIIDAE

Diagnosis : Pigmented gametocytes in mature erythrocytes; asexual cycles in blood cells and tissues of the vertebrate host; sexual phase in mosquito.

Genus *Plasmodium* Marchiafava and Celli, 1885

Diagnosis : Asexual stages (trophozoites, schizonts, etc.) and gametocytes, round or elongated, forming haemozoin pigment; exoerythrocytic schizogony in various internal organs; sexual reproduction in Culicidae.

Remarks : Key to the species of human malaria may also be consulted from earlier State Fauna Series (Das *et al.*, 1993; Nandi *et al.*, 2004), while most of the other plasmodial species require review/further study. However, *Plasmodium* species may be consulted from Garnham (1966), Greiner *et al.* (1975) and Bennett *et al.* (1993) for more information.

A. Key to the species of *Plasmodium* from birds

- 1(2) Elongate gametocytes with inner border much crinkled, with schizont of 4-8 merozoites *P. vaughani*
- 2(1) Round gametocytes without crinkled margin, with schizont of 8-32 merozoites *P. relictum*

B. Key to the species of *Plasmodium* from man

- 1(2) Full grown schizonts rounded, nearly filling erythrocytes, 6-12 merozoites, typically arranged in circle, schizogony in 72 hours *P. malariae*
- 2(1) Full grown schizonts irregular in form, filling half to two-third the erythrocyte and irregularly arranged, schizogony in about 48 hours 3
- 3(4) Gametocytes crescent-shaped, infected erythrocytes normal or atrophied *P. falciparum*
- 4(3) Gametocytes rounded or oval, infected erythrocytes hypertrophied *P. vivax*

A. *Plasmodium* of birds

308. *Plasmodium relictum* (Grassi and Felletti, 1891) (Fig. 156a-j)

1891. *Haemaphysalis relictus* Grassi and Felletti, *Bull. mens. Acad. gioania Sci. nat. Catania*, 16 : 16.

1966. *Plasmodium relictum* (Grassi and Felletti) : Garnham : *Malaria Parasites and other Haemosporidia*, Blackwell Scientific Publications, Oxford, p. 522.

Materials examined : Sev. exs., Dighod, Nasik, September, 1973, N. C. Nandi.

Diagnosis : Trophozoite slightly amoeboid, with black pigment granules; schizont spherical or oval in shape located near the host cell nucleus often displacing it, pigment grains clumped one or two foci, producing 8-32 merozoites; gametocytes round or oval, with relatively fine dot-like pigment granules, mature forms markedly displaced or expelled the host cell nucleus.

Host : Woodpecker, *Picoides m. mahrattensis*; site of infection : blood.

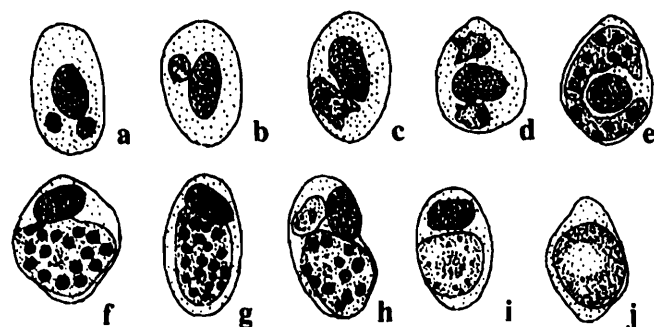


Fig. 157a-j. *Plasmodium relictum*

Distribution : India : Maharashtra, West Bengal, Andhra Pradesh, etc.

Elsewhere : Cosmopolitan species occurring throughout the globe.

Remarks : It occurs in a wide range of hosts. Nandi (1976) recorded this species in Woodpecker, *Picoides m. mahrattensis* from this state.

309. *Plasmodium vauhani* Novy and MacNeal, 1904

1904. *Plasmodium vauhani* Novy and MacNeal, *Am. Med.*, 8 : 932-934.

Materials examined : Sev. exs., Deola, Nasik, September, 1973, N. C. Nandi.

Diagnosis : Trophozoites very small, amoeboid, no typical ring forms, with 2-3 pigment granules; schizont irregular with 4-8 merozoites, lying in any part of the erythrocyte without displacing the host cell nucleus; gametocytes elongate bodies, having an irregular outline and much crinkled inner border, and with a much vacuolated cytoplasm, lying alongside the nucleus of the host cell, and often stretching from one end to the other without curving round the nucleus, pigment granules varying from strain to strain.

Host : Common Myna, *Acridotheres t. tristis* : site of infection : blood.

Distribution : India : Maharashtra and Andhra Pradesh.

Remarks : It occurs in a large number of hosts. Nandi (1976) recorded this species in Common Myna, *Acridotheres t. tristis* from this state.

310. *Plasmodium* sp.

Host : *Pitta brachyura*; site of infection : blood.

Distribution : India : Maharashtra (exact locality not mentioned).

Remarks : McClure *et al.*, (1978) reported this unnamed species from this state.

311. *Plasmodium* sp.

Host : *Hypsipetes madagascariensis*; site of infection : blood.

Distribution : India : Maharashtra (exact locality not mentioned).

Remarks : McClure *et al.*, (1978) reported this unnamed species from this state.

312. *Plasmodium* sp.

Host : *Pycnonotus cafer*; site of infection : blood.

Distribution : India : Maharashtra (exact locality not mentioned).

Remarks : McClure *et al.*, (1978) reported this unnamed species from this state.

313. *Plasmodium* sp.

Host : *Prinia socialis*; site of infection : blood.

Distribution : India : Maharashtra (exact locality not mentioned).

Remarks : McClure *et al.*, (1978) reported this unnamed species from this state.

314. *Plasmodium* sp.

Host : *Rhipidura albogularis*; site of infection : blood.

Distribution : India : Maharashtra (exact locality not mentioned).

Remarks : McClure *et al.*, (1978) reported this unnamed species from this state.

315. *Plasmodium* sp.

Host : *Lanius schach*; site of infection : blood.

Distribution : India : Maharashtra (exact locality not mentioned).

Remarks : McClure *et al.*, (1978) reported this unnamed species from this state.

316. *Plasmodium* sp.

Host : *Nectarina asiatica*; site of infection : blood.

Distribution : India : Maharashtra (exact locality not mentioned).

Remarks : McClure *et al.*, (1978) reported this unnamed species from this state.

317. *Plasmodium* sp.

Host : *Ploceus philippinus*; site of infection : blood.

Distribution : India : Maharashtra (exact locality not mentioned).

Remarks : McClure *et al.*, (1978) reported this unnamed species from this state.

B. *Plasmodium* in Mammals318. *Plasmodium bubalis* Sheather, 1919

1919. *Plasmodium bubalis* Sheather, *Bull. Agri. Res. Inst. Pusa*, 32 : 223.

Diagnosis : Larger parasites round or oval, 6 μ m in size, with regular outline and having a central vacuole; chromatin peripheral, single or double; pigment scattered or in clumps; slight hypertrophy of infected red blood corpuscle; schizont producing 7-14 merozoites, characterized by pigment aggregated in a single clump.

Host : *Bubalus bubalis*; site of infection : blood.

Distribution : India : Maharashtra (Marathwada region) and Uttar Pradesh.

Remarks : Shastri *et al.*, (1981) reported this species in two buffaloes showing fever and haemoglobinuria from this state.

319. *Plasmodium ratufoe* Donovan, 1920

1920. *Plasmodium ratufoe* Donovan, *Indian J. Med. Res.*, 8 : 717-721.

Diagnosis : Gametocytes predominated, otherwise very similar to *Plasmodium vivax* in man.

Host : *Ratufa indica*; site of infection : blood.

Distribution : India : Maharashtra.

Remarks : Donovan (1920) reported this species from the Bombay Presidency.

C. *Plasmodium* in man320. *Plasmodium falciparum* (Welch, 1897)
(Fig. 158a-c)

1897. *Haematozoon falciparum* Welch, *Syst. Pract. Med.*, 1 : 17.

1961. *Plasmodium falciparum* (Grassi and Feletti) : Garnham : *Malaria Parasites and other Haemosporidia*, Blackwell Scientific Publications, Oxford, p. 357.

Diagnosis : Ring forms small with double dots of chromatin; usually with crescentic gametocytes, macrogametocyte 12-14 μ m long; trophozoite compact, rarely seen in peripheral blood; schizont irregular in form, 5 μ m in diameter, 8-32 merozoites, irregularly arranged filling half to two-third the erythrocyte, with early clumping of coarse dark pigments, rarely occurring in peripheral circulation; host erythrocyte not hypertrophied, but accompanied by reddish clefts known as Maurer's clefts; erythrocytic schizogony at 48 hours interval; paroxysms of chills and fever occur every other day.

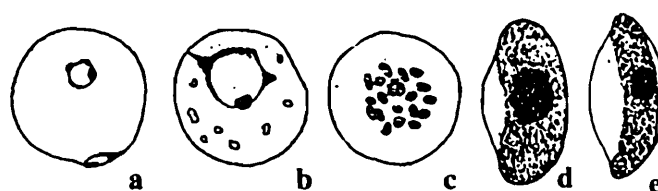


Fig 158a-e. *Plasmodium falciparum*

Host : *Homo sapiens*; site of infection : blood.

Distribution : India : Maharashtra (possibly all districts) and in almost all over India (Knowles, Senior White and Das Gupta, 1930; Bhatia, 1938). This species is mainly distributed in tropics and subtropics.

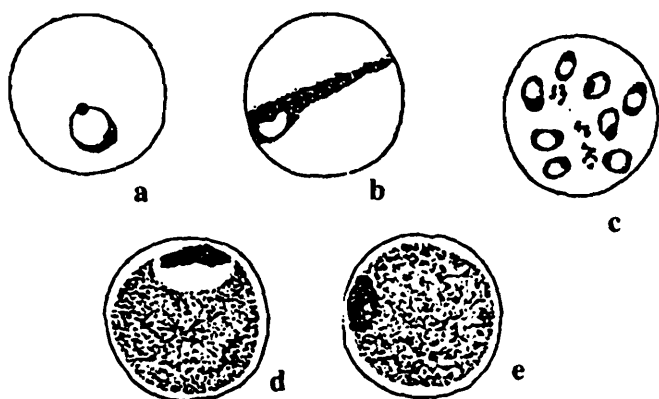
Remarks : This species causes malignant tertian malaria and is the greatest killer of human race over most parts of Africa and elsewhere in the tropics (Garnham, 1966).

321. *Plasmodium malariae* (Grassi and Feletti, 1892)
(Fig. 159a-e)

1892. *Haemamoeba malariae* Grassi and Feletti, *Atti. Acad. Zioenia Sci. nat. Catania, Memoir*, 5, pp. 1-80.

1966. *Plasmodium malariae* (Grassi and Feletti) : Garnham : *Malaria Parasites and other Haemosporidia*, Blackwell Scientific Publications, Oxford, p. 257.

Diagnosis : 'Ring' form about one-third diameter of erythrocyte, one in each red cells; trophozoite compact, often band-like, schizont rounded, 7 μ m in diameter, nearly filling the erythrocyte, 6-12 merozoites, typically arranged in circle; schizogony in 72 hours; gametocyte round or ovoid, 9 μ m in diameter, with brown-black pigments; host erythrocyte not enlarged, very faint stippling (Ziemann's) after prolonged staining; only paroxysms occurring every 3 days.



159a-e *Plasmodium malariae*

Host : *Homo sapiens*; site of infection : blood.

Distribution : India : Maharashtra (possibly all districts) and all over India (Bhatia, 1938).

Remarks : This species causes quartan malaria in man. It is not very pathogenic, but chronic infection may lead to a lethal kidney condition.

322. *Plasmodium vivax* (Grassi and Feletti, 1890)
(Fig. 160 a-e)

1890. *Haemoeba vivax* Grassi and Feletti, *Arch. ital. Biol.*, 13 : 297.

1966. *Plasmodium relictum* (Grassi and Feletti) : Garnham : *Malaria Parasites and other Haemosporidia*, Blackwell Scientific Publications, Oxford, p. 116.

Diagnosis : Ring forms relatively large, about one-third diameter of erythrocyte, round or oval, usually one in each red cells, a round chromatin dot in thin part of ring; trophozoite amoeboid; schizont irregular, filling half to two-third the erythrocyte; schizogony usually at interval of 48 hours, 12-24 merozoites in irregular grape-like cluster, with small brown pigment granules usually collected in a single mass; gametocyte large, round or ovoid, 10 μ m in diameter; host erythrocyte enlarged, stippled with red dots known as Schüffner's dots; all erythrocytic stages occurring in peripheral blood, multiple infection in R.B.C. not uncommon; paroxysms at every other day as in *falciparum* malaria.

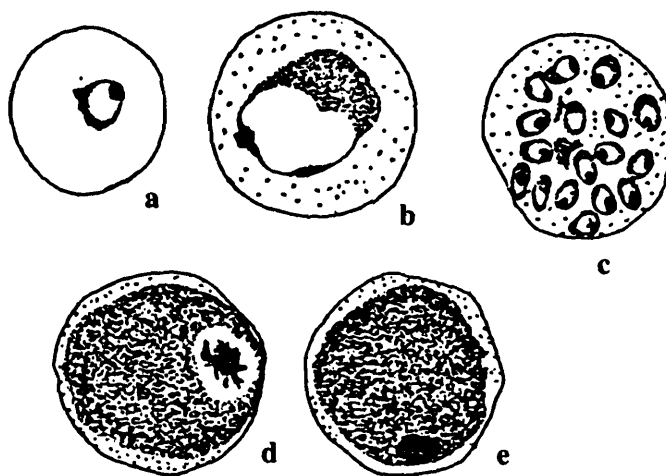


Fig. 160a-e *Plasmodium vivax*

Host : *Homo sapiens*; site of infection : blood.

Distribution : India : Maharashtra (all districts) and all over India. This species is worldwide in distribution, occurring mainly in tropics, subtropics and warmer temperate regions (Knowles *et al.*, 1930; Garnham, 1966).

Remarks : This species causes benign tertian malaria in man and is the commonest and the most widely distributed species.

Family HAEMOPROTEIDAE

Diagnosis : Pigmented gametocytes in erythrocytes of the circulating blood, asexual cycle in tissue cells of the vertebrate host; sexual phase in insects other than mosquitoes.

Genus *Haemoproteus* Kruse, 1890

Diagnosis : Pigmented gametocytes in erythrocytes, usually halter-shaped, partly encircling the host cell nucleus; schizogony in the internal organs, lung, liver, kidney capillary endothelium etc.; sporogony in Hippoboscidae and Ceratopogonidae; oocysts either large with more than 500 short sporozoites or small with less than 50 relatively large sporozoites.

Remarks : Key to the species of *Haemoproteus* is given below, which can be used along with related checklist (Bennett *et al.*, 1994) and host-parasite catalogues (Nandi, 1984; Nandi and Bennett, 1997; Bennett and Bishop, 1992; Bennett *et al.*, 1982).

Key to the species of *Haemoproteus* in birds

- 1(18) Parasites normally circumnuclear or halteridial
 - 2(3) Parasites circumnuclear, with outline entire and 16-34 pigment granules, occurring in the avian family Picidae *H. velans*
 - 3(2) Parasites not circumnuclear, but halteridial
 - 4(7) Halteridial parasites, with marked displacement of host cell nucleus
 - 5(6) Parasites occupying 70% or more of the host cell-parasite complex
 - (a) Pigment granules 10 in number, parasitic in the avian family Estrildidae ... *H. manwelli*
 - (b) Pigment granules averaging 16 in number, parasitic in the avian family Irenidae *H. aegithinae*
 - (c) Pigment granules averaging 14 in number, parasitic in the avian family Cuculidae *H. centropi*
 - (d) Pigment granules averaging 12 in number, occurring in the avian family Laniidae *H. lanii*
 - (e) Pigment granules averaging 45 in number, parasitic in the avian family Threshkiornithidae *H. plataleae*
 - 6(5) Parasites occupying about 50-70% of the host cell-parasite complex,
 - (a) Pigment granules 6-9 in number, occurring in the avian family Sturnidae *H. pastoris*
 - 7(4) Halteridial parasites, without marked displacement of host cell nucleus
 - 8(15) Parasites with outline entire
 - 9(10) Halteridial or broadly sausage-shaped parasites, occupying about 75% or more of the host cell-parasite complex
 - (a) Pigments averaging 31 granules per parasite, parasitic in the avian family Capitonidae *H. thereicerycis*
 - (b) Pigments averaging 11 granules per parasite, parasitic in the avian family Motacillidae *H. anthi*
 - (c) Pigments averaging 12 granules per parasite, parasitic in the avian family Picidae *H. borgesii*
 - (d) Pigments averaging 23 granules per parasite, parasitic in the avian family Falconidae ... *H. tinnunculi*
 - 10(9) Parasites not broadly sausage-shaped, occupying less than 75% of the host cell-parasite complex
 - 11(14) Parasites occupying 65-75% of the host cell parasite complex
 - 12(13) Parasites with inner lateral margins invaginated to form a pair of "horns"
 - (a) Pigments small, scattered, averaging 28 in number per parasite, parasitic in the avian family Capitonidae *H. cornuata*
 - 13(12) Parasites without any 'horns'
 - (a) Pigments averaging 15 granules per parasite, parasitic in the avian family Zosteropidae *H. zosteropis*
 - 14(11) Parasites occupying about 50-65% of the host cell parasite complex
 - (a) Pigments averaging 19 granules per parasite, parasitic in the avian family Capitonidae *H. xantholaemae*

- (b) Pigments averaging 30 granules per parasite, parasitic in the avian family Columbidae *H. columbae*

15(8) Parasites with amoeboid or entire outline

- 16(17) Immature parasite amoeboid, mature entire, about 8 pigment granules per parasite, parasitic in the avian family Coraciidae *H. coraciae*

- 17(16) Parasites usually entire, sometimes amoeboid, averaging 14 pigment granules per parasite, parasitic in the avian family Meropidae *H. meropis*

18(1) Parasites microhalteridial,

- (a) Parasites small, clearly centrally constricted and somewhat bilobed, parasitic in the avian family Pycnonotidae *H. philippinensis*

323. *Haemoproteus aegithinae* De Mello, 1937

1937. *Haemoproteus aegithinae* De Mello, C. R. 12th Int. Congr. Zool., 2 : 1391-1445.

1990. *Haemoproteus aegithinae* : Bennett and Peirce, J. nat. Hist., 24 : 939-947.

Diagnosis : Macrogametocytes halteridial, medium-sized, 15.1 (1.3) μm $\times$ 2.7 (1.6) μm and 45.4 (4.2) μm^2 in area, occupying 60-70% of host erythrocyte; margins entire; frequently appearing dumbbell-shaped due to narrowing of the portion of parasite adjacent to the erythrocyte nucleus; cytoplasm finely granular; parasite nucleus compact, central to sub-central in location and frequently appressed to the outer wall of the parasite; host erythrocyte hypertrophy less than 10%; little lateral displacement of host erythrocyte nucleus; pigment granules averaging 16 per parasite, scattered randomly throughout the parasite; volutin granules absent.

Host : *Aegithina tiphia*; site of infection : blood.

Distribution : India : Goa and Maharashtra.

Elsewhere : Thailand and throughout the distributional range of the avian family Irenidae.

Remarks : Bennett and Peirce (1990) designated neohapantotype from the type host from

Maharashtra (*Neohapantotype* : Blood film No. 37408 from *Aegithina tiphia* (Linnaeus), Coll. H. E. McClure, 24.vii.1969, Maharashtra, close to the original type locality).

324. *Haemoproteus anthi* De Mello, 1935

1935. *Haemoproteus anthi* de Mello, Proc. Indian Acad. Sci., 2B : 349-358.

1990. *Haemoproteus anthi* : Bennett and Peirce, J. nat. Hist., 24 : 939-947.

Diagnosis : Macrogametocytes broadly halteridial and highly pleomorphic, medium to large-sized, 15.6 (2.0) μm $\times$ 3.2 (0.5) μm and 49.4 (8.5) μm^2 in area, occupying 70-80% of host erythrocyte; margins entire; frequently appearing dumbbell-shaped due to narrowing of the portion of parasite adjacent to the erythrocyte nucleus; cytoplasm finely granular; parasite nucleus compact, usually central to sub-central in location and normally appressed to the outer margin of the parasite; host erythrocyte hypertrophied in area and a variable amount of lateral displacement of host erythrocyte nucleus; pigment granules large, averaging 10 per parasite, scattered usually randomly throughout the parasite, but occasionally clumped near the poles; volutin granules absent.

Type host : *Anthus hodgsoni* (Richmond).

Distribution : India : Maharashtra and Goa.

Elsewhere : South Korea, South Africa and Philippine Islands and throughout the Old World distribution of the avian family Motacillidae.

Remarks : Bennett and Peirce (1990) designated neohapantotype from the type host from Maharashtra (*Neohapantotype* : Blood film No. 11337 from *Anthus hodgsoni* (Richmond), Coll. H. E. McClure, 19. iv. 1968, Maharashtra, India).

325. *Haemoproteus borgesii* Tendeiro, 1947

1947. *Haemoproteus borgesii* Tendeiro, Rev. Med. Vet. (Lisbon), 42 : 285-350.

1978. *Haemoproteus borgesii* Tendeiro : Greiner, Mandal and Nandi : J. Parasitol., 63 : 651-656.

Materials examined : Sev. exs., Nasik, September, 1973, N. C. Nandi.

Diagnosis : Macrogametocyte broadly sausage-shaped to slightly halteridial, measuring $13.2\ \mu\text{m} \times 4.0\ \mu\text{m}$ and $51.5\ \mu\text{m}^2$ in area, occupying more than 80% of the host cell-parasite complex; margin entire, not amoeboid; parasite lateral to erythrocyte nucleus, pigment granules discrete, yellow-brown, scattered, and averaging 12 granules per parasite; volutin granules present; parasite nucleus submedian, oval to round, $3.0 \times 2.3\ \mu\text{m}$ and $5.1\ \mu\text{m}^2$ in area; erythrocyte nucleus displaced laterally; Nuclear Displacement Ratio (NDR) = 0.04; host cell hypertrophied slightly in length (4%) and in area (8%), but slightly atrophied in width (5%); and host cell nucleus atrophied (18%).

Host : *Picoides mahrattensis mahrattensis* (Family Picidae); site of infection : blood.

Distribution : India : Maharashtra (Nasik district), Assam, Andhra Pradesh and Jammu & Kashmir.

Elsewhere : Portuguese Guinea and Malaysia.

Remarks : Nandi (1976) recorded this species in Woodpecker, *Picoides mahrattensis mahrattensis* from this state.

326. *Haemoproteus centropi* de Mello, 1935 (Fig. 161a-e)

1935. *Haemoproteus centropi* de Mello, *Proc. Indian Acad. Sci.*, **2B** : 469-475.

1977. *Haemoproteus centropi* : Peirce : *E. Afr. Wildl. J.*, **15** : 57-60.

Diagnosis : Macrogametocytes halteridial, $16.2\ (1.7)\ \mu\text{m} \times 2.9\ (0.3)\ \mu\text{m}$ and $52.6\ (6.1)\ \mu\text{m}^2$ in area; margin entire, not amoeboid; parasite lateral to erythrocyte nucleus, measuring $13.2\ \mu\text{m} \times 4.0\ \mu\text{m}$ and $51.5\ \mu\text{m}^2$ in area, occupying more than 80% of the host cell-parasite complex; cytoplasm slightly granular, with small vacuoles; pigments yellow-brown, in the form of granules or rodlets, discrete scattered as well as in small cluster, and averaging 14.5 (3.2) granules per parasite; devoid of volutin granules; parasite nucleus median to submedian, compact, round to oval, staining pale pink; erythrocyte nucleus only slightly displaced laterally; host cell hypertrophied in length (9.1%), width (8.7%) and in area (16.0%); and host cell nucleus atrophied (32.1%) in area.

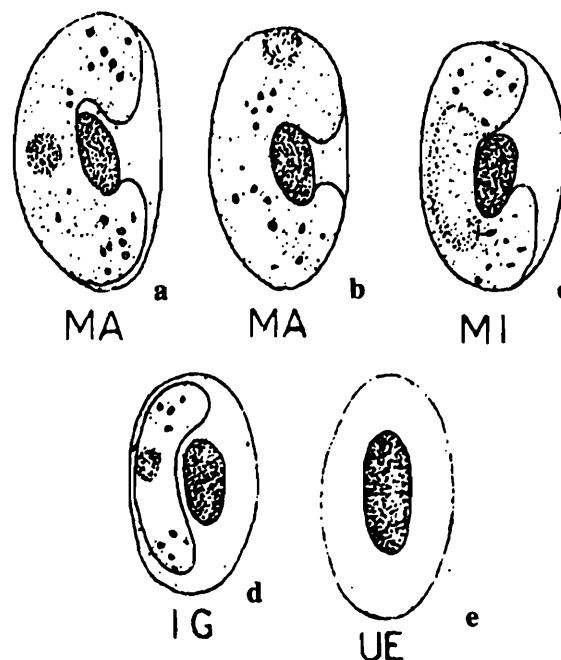


Fig. 161a-e. *Haemoproteus centropi*

Hosts : *Centropus sinensis* and *Clamator jacobinus*; site of infection : blood.

Distribution : India : Maharashtra and Goa.

Elsewhere : Portuguese Guinea and Kenya.

Remarks : McClure *et al.*, (1978) collected this species from this state.

327. *Haemoproteus columbae* Kruse, 1890 (Fig. 162a-d)

1890. *Haemoproteus columbae* Kruse, *Arch. Pathol. Anat.*, **120** : 359.

1990. *Haemoproteus columbae* : Bennett and Peirce, *J. Nat. Hist.*, **24** : 311-325.

Materials examined : Sev. exs., Trimbak, Nasik, September, 1973, N. C. Nandi.

Diagnosis : Macrogametocyte halteridial, $12.6\ \mu\text{m} \times 3.4\ \mu\text{m}$ and $34.3\ \mu\text{m}^2$ in area, occupying about 60% of the host cell-parasite complex; inner and polar margin amoeboid, outer margin entire, pigment yellowish-black, discrete, round, scattered, about 30 granules per parasite; nucleus round-oval, median to submedian, $2.5\ \mu\text{m} \times 1.8\ \mu\text{m}$ and $3.2\ \mu\text{m}^2$ in area; host cell relatively unchanged, host cell nucleus atrophied 25.8% in area.

Host : *Columba livia intermedia*; site of infection : blood.

Distribution : India : Maharashtra (Nasik district), Andhra Pradesh, Delhi, Goa, Rajasthan, West Bengal, etc.

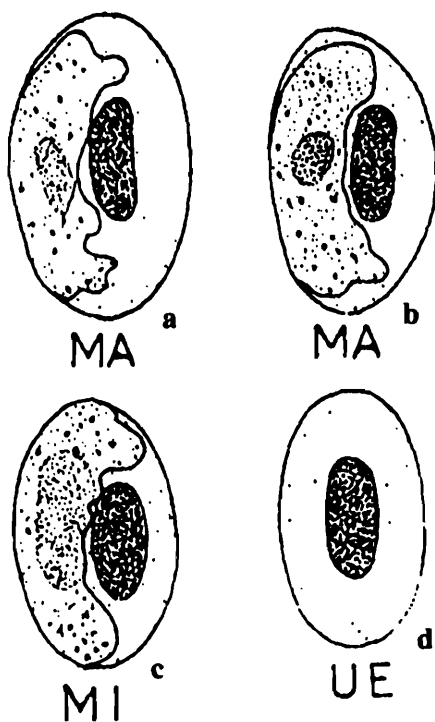


Fig. 162a-d. *Haemoproteus columbae*

Elsewhere : A cosmopolitan species with worldwide distribution.

Remarks : *Haemoproteus columbae* is commonly occurring in pigeons and other birds belonging to the family Columbidae. Nandi (1976) recorded this species in domestic pigeon, *Columba livia intermedia*, from this state.

328. *Haemoproteus coraciae* De Mello and Afonso, 1935
(Fig. 163)

1935. *Haemoproteus coraciae* De Mello and Afonso, *Proc. Indian Acad. Sci.(B)*, 2 : 67-73.

1986. *Haemoproteus coraciae* De Mello and Afonso : Bishop and Bennett : *Can. J. Zool.*, 64 : 1860-1863.

Materials examined : Sev. exs., Trimbak, Nasik, September, 1973, N. C. Nandi.

Diagnosis : Macrogametocyte moderate in size, measuring $15.0\ \mu\text{m} \times 2.6\ \mu\text{m}$ and $48.5\ \mu\text{m}^2$ in area, occupying more than 50% of the erythrocyte-parasite complex; usually halteridial in shape; margins entire but occasionally amoeboid; pigment

granules large deep brown-yellow and scattered throughout the cytoplasm but occasionally grouped in one or more clumps; parasite nucleus small, dense, round or ovoid and situated centrally.

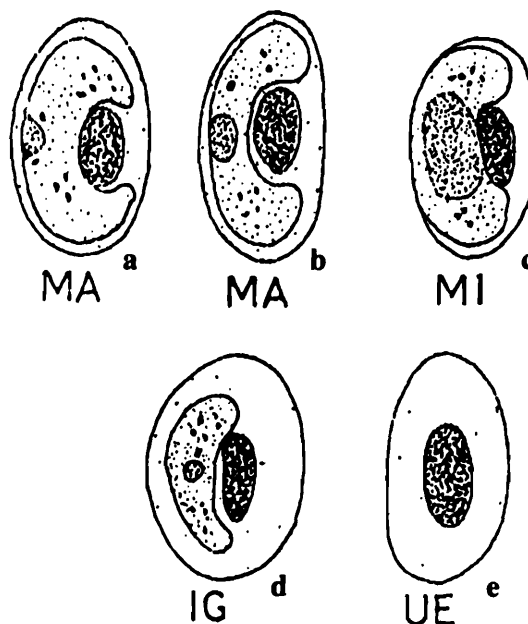


Fig. 163a-e. *Haemoproteus columbae*

Host : *Coracias b. benghalensis* (Family Coraciidae); site of infection : blood.

Distribution : India : Maharashtra, (Nasik district), Andhra Pradesh, Goa.

Elsewhere : Africa, Asia east to the Philippine Islands.

Remarks : Nandi (1976) recorded this species in Blue Jay, *Coracias b. benghalensis* from this state.

329. *Haemoproteus cornuata* Bennet and Nandi, 1981
(Fig. 164a-d)

1981. *Haemoproteus cornuata* Bennett and Nandi, *Can. J. Zool.*, 59 : 2064-2071.

Diagnosis : Macrogametocytes large, broadly sausage-shaped and halteridial, $21.9\ (2.3)\ \mu\text{m} \times 4.3\ (0.6)\ \mu\text{m}$ and $73.1\ (9.1)\ \mu\text{m}^2$ in area constituting 68% of the host cell parasite complex; with ends reflexing to form a deep invagination at the inner lateral margins adjacent to erythrocyte nucleus, thus forming a pair of 'horns'; margins entire except at terminalia; cytoplasm coarsely granular, staining

deep blue; nucleus small, compact, ovoid, usually median or submedian, representing 9% of the parasite area; pigment granules small, usually randomly scattered throughout, averaging 28.2 (6.4) per parasite; erythrocyte hypertrophied in length (11%), width (3.6%) and in area (19.7%); erythrocyte nucleus atrophied (11.5% in area) and displaced laterally.

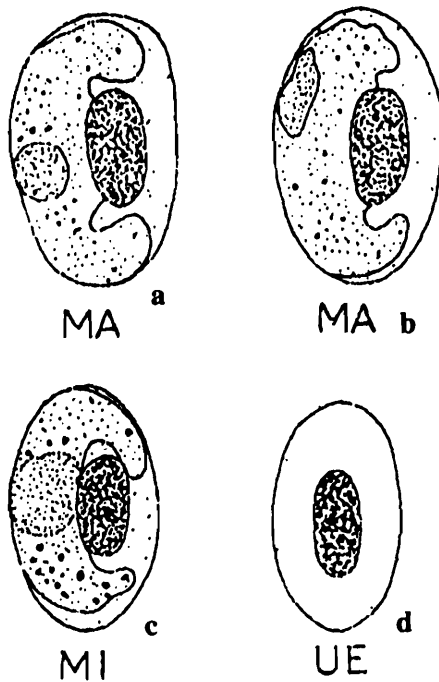


Fig. 164a-d. *Haemoproteus cornuata*

Host : *Megalaima viridis*; site of infection : blood.

Distribution : India : Maharashtra, Goa.

Elsewhere : Bhutan and Thailand.

Remarks : Bennett and Nandi (1981) recorded this species (*Paratype* : Blood film No. 37118 from *Megalaima viridis*, Coll. H. E. McClure, Maharashtra, 26.iv.1969) from this state.

330. *Haemoproteus lanii* de Mello, 1937 (Fig. 165a-d)

1937. *Haemoproteus lanii* de Mello, C. R. 12th Int. Congr. Zool., 2 : 1391-1445.

1990. *Haemoproteus lanii* : Bennett, Peirce and Earle, S. Afr. J. Zool., 25(3) : 194-198.

Diagnosis : Macrogametocytes medium-sized, halteridial, measuring 15.4 (1.7) μm $\times$ 3.5 (0.6)

μm and 54.0 (6.5) μm^2 in area and occupying about 75% of the infected erythrocyte, usually causing little hypertrophy or distortion of the host erythrocyte; cytoplasm coarsely granular; parasite nucleus small, dense, median to submedian in location and staining deep red with Giemsa's; erythrocyte nucleus only slightly displaced laterally; pigments yellow-brown, rod-like to broadly ovoid in shape, normally scattered randomly throughout the cytoplasm, averaging 12 granules per parasite; volutin granules rare in occurrence.

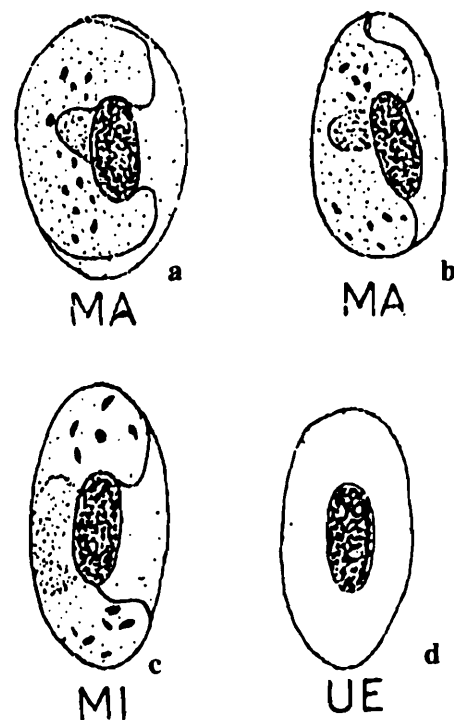


Fig. 165a-d. *Haemoproteus lanii*

Host : *Lanius schach* Linnaeus and *Lanius tigrinus* Drapiez; site of infection : blood.

Additional hosts : A number of species belonging to the genus *Lanius* from Europe, Africa and Asia (*vide* Bennett *et al.*, 1990).

Distribution : India : Maharashtra, Goa, Gujarat, and Orissa.

Elsewhere : Europe, Africa and Asia and presumably throughout the distributional range of of the subfamily Laniinae (*vide* Bennett *et al.*, 1990).

Remarks : Nandi (1976) and Bennett *et al.* (1990) reported this parasite from this state.

Bennett *et al.* (1990) designated blood film No. 41831 from *Lanius trigrinus* Drapiez, as Parahapantotype collected by H. E. McClure on 30 July, 1968 from Maharashtra, presently deposited in the Queensland Museum, Australia.

331. *Haemoproteus manwelli* Bennett, 1978

1978. *Haemoproteus manwelli* Bennett, *Can. J. Zool.*, 56 : 1721-1725.

Diagnosis : Macrogametocytes broadly ovoid, $12.5\ \mu\text{m} \times 4.4\ \mu\text{m}$ and $49\ \mu\text{m}^2$ in area, constituting 80% or more of the host cell parasite complex, slightly halteridial, with ends slightly enclosing poles of the erythrocyte nucleus; outline entire; pigment granules prominent, scattered, averaging 10 granules per parasite; parasite nucleus median, broadly ovoid, $4.1\ \mu\text{m}^2$ in area; host cell nucleus markedly displaced laterally; NDR = 0.1.

Host : *Merops orientalis* Latham; site of infection : blood.

Distribution : India : Maharashtra (exact locality not mentioned).

Elsewhere : Malaysia, Thailand, presumably throughout the distributional range of the avian family Meropidae in Asia.

Remarks : Bennett (1978) reported this species from this state designating the blood film No. 371777 as syntype, collected by McClure on February 26, 1969 from Maharashtra, presently deposited in the Queensland Museum, Australia.

332. *Haemoproteus meropis* (Zargar, 1945)
(Fig. 166a-d)

1945. *Haemoproteus meropi* Zargar, *Proc. Indian Acad. Sci.(B)*, 21 : 124-127.

1978. *Haemoproteus meropis* (Zargar) : Bennett : *Can. J. Zool.*, 56 : 1721-1725.

Diagnosis : Macrogametocytes broadly sausage-shaped to halteridial, measuring $13.9\ \mu\text{m} \times 3.2\ \mu\text{m}$ and $44.5\ \mu\text{m}^2$ in area, constituting 65% or more of the host cell-parasite complex; outline usually entire, somewhat amoeboid; pigment granules prominent, randomly distributed throughout parasite, averaging 14 granules per

parasite; parasite occasionally with large, deep purple-staining volutin granules; parasite nucleus median, round to broadly ovoid, occupying about $3.3\ \mu\text{m}^2$ in area; host cell hypertrophied 15% in length, 3% in width, and 18% in area; host cell nucleus slightly displaced laterally; Nuclear Displacement Ratio (NDR) = 0.7.

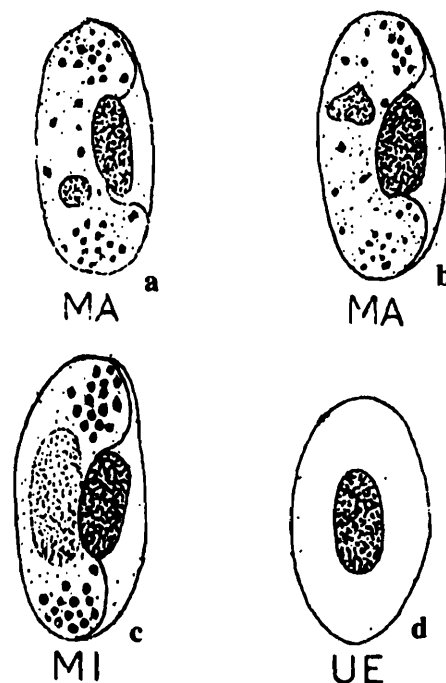


Fig. 166a-d. *Haemoproteus meropis*

Host : *Merops orientalis* (Family Meropidae); site of infection : blood.

Distribution : India : Maharashtra; Goa, Andhra Pradesh, and Orissa.

Elsewhere : Malaysia, Philippines, Thailand and Africa.

Remarks : Zargar (1945) reported this species from this state.

333. *Haemoproteus pastoris* de Mello, 1935
(Syn. *Haemoproteus sturni* de Mello, 1935,
H. morneti Tendeiro, 1947 and *H. morneti*
orientalis Travassos Santos Dias, 1953 as cited
from Bishop and Bennett, 1990)
(Fig. 167a-d)

1935. *Haemoproteus pastoris* de Mello, *Proc. Indian Acad. Sci. (B)*, 2 : 469-475.

1935. *Haemoproteus sturni* de Mello, *Proc. Indian Acad. Sci. (B)*, 2 : 469-475.

1987. *Haemoproteus pastoris* : Bishop and Bennett, *Can. J. Zool.*, **68** : 2251-2256.

Materials examined : Sev. exs., Deola, Nasik, September, 1973, N. C. Nandi.

Diagnosis : Macrogametocyte halteridial, medium-sized, $11.0-12.5\ \mu\text{m} \times 2.4-3.0\ \mu\text{m}$, margins usually entire, sometimes amoeboid occupying about 50% of the host cell-parasite complex; nucleus round to ovoid, sub-medial; pigment granules small, scattered, 6-9 yellowish-brown granules; host cell hypertrophy less than 15% in area; host cell nuclear atrophy about 5% in area without marked displacement to the periphery.

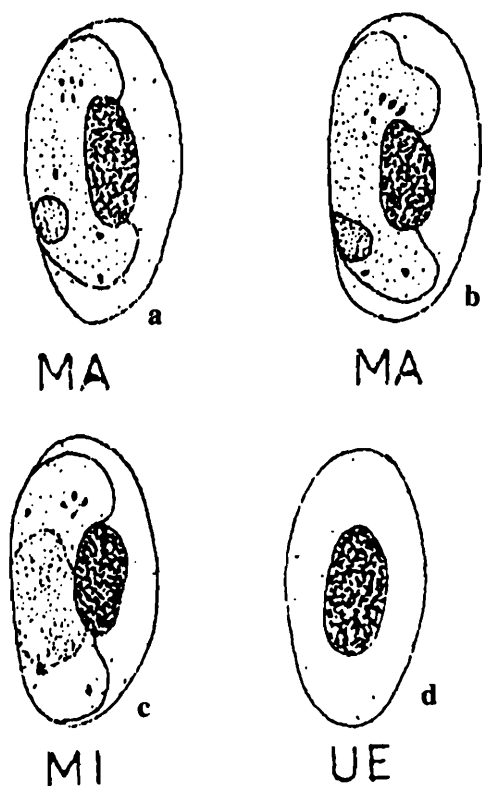


Fig. 167a-d. *Haemoproteus pastoris*

Host : Common Myna, *Acridotheres tristis* (Linnaeus) and Blackheaded Myna, *Sturnus pagodarum* (Gmelin); site of infection : blood.

Distribution : India : Maharashtra (Nasik district) Andhra Pradesh, Goa, and West Bengal; Elsewhere : Africa, Indonesia, Thailand and Philippine Islands.

Remarks : Nandi (1976) recorded this species from two above mentioned hosts from this state.

334. *Haemoproteus philippinensis* Rahal, Bishop and Bennett, 1987
(Fig. 168a-d)

1987. *Haemoproteus philippinensis* Rahal, Bishop and Bennett, *Can J. Zool.*, **65** : 322-328.

Diagnosis : Macrogametocytes measuring $13.6\ \mu\text{m} \times 1.4\ \mu\text{m}$ and $26.6\ \mu\text{m}^2$ in area, occupying 35.9% erythrocyte-parasite complex, with marked, central, clear constriction, closely appressed and lateral to host cell nucleus, and causing slight host cell nuclear displacement; margin entire; parasite nucleus subterminal, ovoid, staining pink; pigment granules, yellow-brown, discrete, randomly distributed, 7.6 (2.4) per parasite; host cell hypertrophied in length and area and atrophied in width; host cell nucleus atrophied in both length and area; NDR = 0.83.

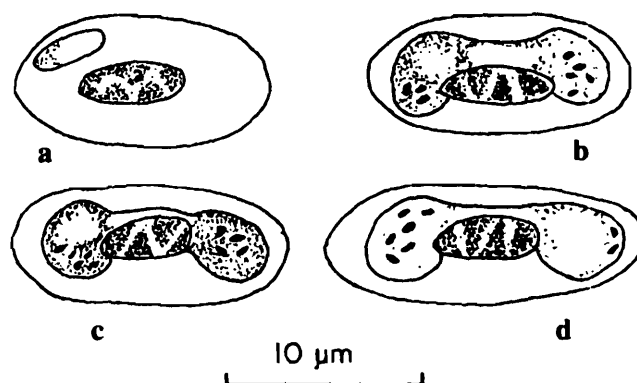


Fig. 168a-d. *Haemoproteus philippinensis*

Host : *Hypsipetes madagascariensis* (P. L. S. Muller); site of infection : blood.

Distribution : India : Maharashtra.

Elsewhere : Philippines, Japan, Taiwan, Malaysia, Thailand and Uganda.

Remarks : Rahal *et al.* (1987) reported this parasite from Maharashtra state designating the blood film No. 42126, collected on april 11, 1971 from the above cited host. The gametocytes of this species are categorized under microhalteridial form (Bennett and Peirce, 1988).

335. *Haemoproteus plataleae* de Mello, 1935
(Fig. 169a-f)

1935. *Haemoproteus plataleae* de Mello, *Proc. Indian Acad. Sci. (B)*, **2** : 469-475.

1975. *Haemoproteus plataleae* : Bennett, Greiner and Campbell, *Can J. Zool.*, **53** : 634-638.

Materials examined : Sev. Exs. Saval Vahir, Ahmednagar, October, 1973, N. C. Nandi.

Diagnosis : Macrogametocytes halteridial, $12-14\ \mu\text{m} \times 3.8-4.2\ \mu\text{m}$ and $72\ \mu\text{m}^2$ in area, occupying 96% or more of the host cell parasite complex; margins entire; cytoplasm deep blue, coarsely granular; nucleus subterminal to central, discrete, large, staining pink; pigment granules yellow-brown, randomly distributed either singly or in small clumps, averaging 45 per parasite; host cell hypertrophied, in length (10%), breadth (5%) and in area (20%) erythrocyte nucleus slightly atrophied in length (11%); in width (10%) and in area (20%); host cell nucleus displaced laterally to periphery of host cell.

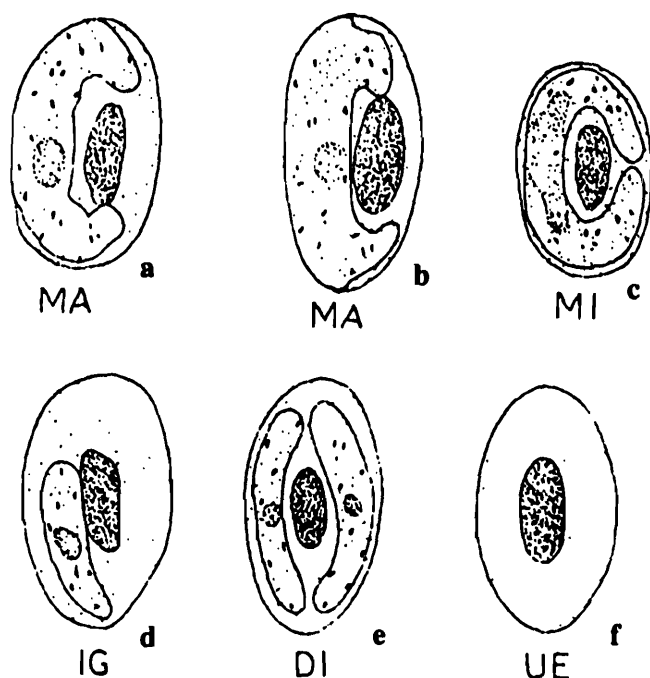


Fig. 169a-f. *Haemoproteus plataleae*

Host : *Pseudibis p. papillosa* (Temminck); site of infection : blood.

Distribution : India : Maharashtra (Ahmednagar district), Goa.

Elsewhere : Asia, Australasia, North America; probably cosmopolitan.

Remarks : Nandi (1976) recorded this species from the above mentioned host from this state.

336. *Haemoproteus thereicerycis* de Mello, 1935 (Fig. 170a-d)

1935. *Haemoproteus thereicerycis* de Mello, *Proc. Indian acad. Sci.*, **2B** : 469-475.

1981. *Haemoproteus thereicerycis* : Bennett and Nandi, *Can. J. Zool.*, **59** : 2064-2071.

Diagnosis : Macrogametocytes broadly sausage-shaped to halteridial, $16.3\ (1.8)\ \mu\text{m} \times 4.9\ (0.9)\ \mu\text{m}$ and $80.2\ \mu\text{m}^2$ in area, constituting 75% of the host cell parasite complex; margins entire; cytoplasm granular staining deep blue; nucleus medium size, compact, dense, ovoid, usually median or submedian, representing 11% of the parasite area; pigment granules small, usually scattered throughout the parasite, averaging 31.3 (2.9) per parasite; parasitized erythrocyte hypertrophied in length (12%), width (6.3%) and in area (20%); parasitized erythrocyte nucleus atrophied in area (4%) and markedly displaced laterally, sometimes enucleated or displaced to pole.

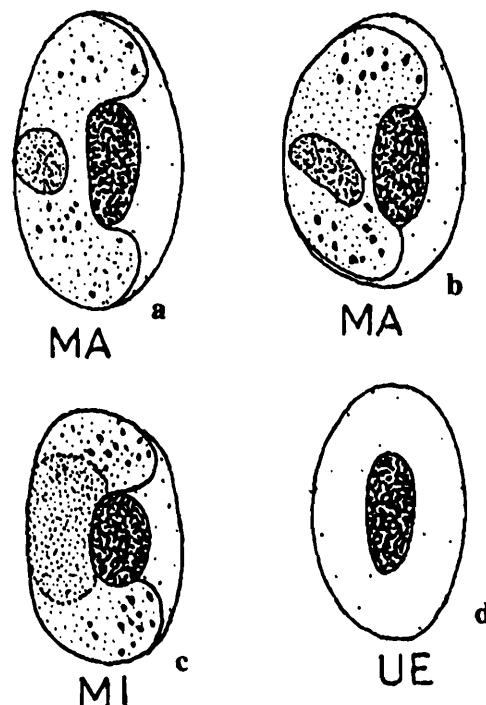


Fig. 170a-d. *Haemoproteus thereicerycis*

Host : *Megalaima viridis*; site of infection : blood.

Distribution : India : Maharashtra, Goa, Andhra Pradesh.

Elsewhere : throughout the distributional range of the Capitonidae.

Remarks : Bennett and Nandi (1981) redescribed it designating type materials, which were then deposited in the collection of the International Reference Centre for Avian Haematozoa (IRCAH), Canada, now located at Queensland Museum, Australia. McClure *et al.* (1978) collected this parasite in *Megalaima viridis* from Maharashtra state.

337. *Haemoproteus tinnunculi* (Wasielewski and Wulker, 1918)

(Syn. *Haemoproteus danilewski* var. *tinnunculi* Wasielewski and Wulker, 1918)

(Fig. 171a-d)

1918. *Haemoproteus danilewski* var. *tinunculi* Wasielewski and Wulker, *Arch. Schiffs-und Tropenhyg.*, **22** : 1-100.

1990. *Haemoproteus tinnunculi* Peirce, Bennett and Bishop, *J. Nat. Hist.*, **24** : 1091-1100.

Materials examined : Sev. exs., Trimbak, Nasik, September, 1973, N. C. Nandi.

Diagnosis : Macrogametocyte halteridial, moderate-sized, $16.1 (1.2) \mu\text{m} \times 4.1 (0.7) \mu\text{m}$ and $56.6 \mu\text{m}^2$ in area, occupying about 75% of the host cell-parasite complex; nucleus round to ovoid, median to sub-median; pigment granules small, round, scattered, averaging 23 yellowish-brown

granules per parasite; little host cell hypertrophy; erythrocyte nucleus somewhat laterally displaced.

Host : *Falco tinnunculus tinnunculus*; site of infection : blood.

Distribution : India : Maharashtra (Nasik district).

Elsewhere : North America, Europe, Asia, Africa, and probably throughout the distributional range of the avian family Falconidae.

Remarks : Nandi (1976) recorded this species from from this state.

338. *Haemoproteus velans* Coatney and Roudabush, 1937

1936. *Haemoproteus velans* Coatney and Roudabush, *Am. Midl. Nat.*, **18** : 1005-1030.

1977. *Haemoproteus velans* Coatney and Roudabush : Greiner, Mandal and Nandi : *J. Parasitol.*, **63** : 651-656.

Materials examined : Sev. exs., Dighod, Nasik district, Sept., 1973, N.C. Nandi.

Diagnosis : Macrogametocyte completely encircling host cell nucleus, measuring $24.4 \mu\text{m} \times 2.9 \mu\text{m}$ and $66.5 \mu\text{m}^2$ in area, occupying 75-80% of the host cell parasite complex; pigment variable, yellow-brown, averaging 18 granules per parasite; volutin granules present, scattered; parasite nucleus median, oval to round, $3.0 \mu\text{m} \times 2.3 \mu\text{m}$ and $5.8 \mu\text{m}^2$ in area; erythrocyte nucleus partially displaced laterally; NDR = 0.68; host cell hypertrophied in length (10.8%) and in area (21.0%); host cell nucleus atrophied (19.1%) in area.

Host : *Picoides m. mahrattensis* (Family Picidae); site of infection : blood.

Distribution : India : Maharashtra (Nasik district) Andhra Pradesh, Assam, and Rajasthan.

Elsewhere : Nearctic and oriental.

Remarks : Nandi (1976) reported this species from this state.

339. *Haemoproteus xantholaemae* (Zargar, 1945)

1945. *Haemoproteus xantholaemae* Zargar, *Proc. Indian Acad. Sci.*, **21B** : 124-127.

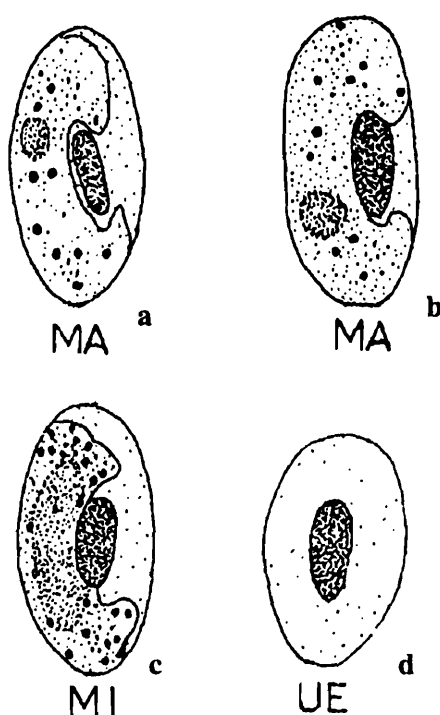


Fig. 171a-d. *Haemoproteus tinnunculi*

1981. *Haemoproteus xantholaemae* : Bennett and Nandi, *Can. J. Zool.*, **59** : 2064-2071.

Diagnosis : Macrogametocytes of medium size, narrow, sausage-shaped, slightly halteridial, measuring $13.7 (2.6) \mu\text{m} \times 3.6 (0.6) \mu\text{m}$ and $52.0 (8.2) \mu\text{m}^2$ in area, occupying 54% of the host cell-parasite complex; margins entire; pigment granules small, usually randomly scattered, dense, ovoid, usually median or submedian in position, $7.3 (2.1) \mu\text{m}^2$ in area; host cell nucleus not markedly displaced laterally, NDR = 0.57; parasitized host erythrocyte hypertrophied in length (8.8%), width (6.5%) and area (12.2%); host erythrocyte nucleus atrophied 6% in area.

Host : *Megalaima haemacephala* and *M. viridis*; site of infection : blood.

Distribution : India : Maharashtra (Nagpur, etc.).

Elsewhere : Southeast Asia to Thailand.

Remarks : Zargar (1945) described this species from Telinkhery, Nagpur, Maharashtra. Bennett and Nandi (1981) redescribed this species designating the blood film No. 37102 as neotype, collected by McClure on July 24, 1969 from this state from the type host *Megalaima haemacephala*, and also designated blood film No. 37126 as paraneotype, also collected by McClure on April 10, 1971 from *Megalaima viridis* from this state. These types were deposited in the collection of the International Reference Centre for Avian Haematozoa (IRCAH), Canada, presently housed at Queensland Museum, Australia.

340. *Haemoproteus zosteropis* Chakravarty and Kar, 1945

1945. *Haemoproteus zosteropis* Chakravarty and Kar, *Proc. Indian Acad. Sci.*, **22B** : 63-69.

1981. *Haemoproteus zosteropis* : Bennett and Peirce, *Can. J. Zool.*, **59** : 1155-1160.

Diagnosis : Macrogametocytes of medium size, usually halteridial, measuring $15.8 \mu\text{m} \times 3.0 \mu\text{m}$ and $50.5 (7.9) \mu\text{m}^2$ in area, constituting 68% of the host-parasite complex; margins entire; pigment granules usually scattered, averaging 15 granules

per parasite; parasite nucleus small, compact, dense, ovoid, usually median or sub-median in position, averaging $2.7 \mu\text{m}^2$ in area, representing 5.3% of the parasite area; host nucleus slightly displaced laterally, NDR = 0.80; host cell hypertrophy 12% in area and host cell nucleus atrophy 25% in area.

Host : *Zosterops palpebrosa*; site of infection : blood.

Distribution : India : Maharashtra, Tamil Nadu, West Bengal.

Elsewhere : Presumably throughout the old world distributional range of the Zosteropidae.

Remarks : Bennett and Peirce (1981) described this species based on blood films collected from India including Maharashtra (Blood film No. 37244, from *Zosterops palpebrosa*, collected by McClure on August 1, 1968).

341. *Haemoproteus* sp

Host : *Accipiter badius*; site of infection : blood.

Distribution : India : Maharashtra (exact locality not mentioned).

Remarks : McClure *et al.*, (1978) reported this unnamed species from this state.

342. *Haemoproteus* sp.

Host : *Galloperdix spadicea*; site of infection : blood.

Distribution : India : Maharashtra (exact locality not mentioned).

Remarks : McClure *et al.*, (1978) reported this unnamed species from this state.

343. *Haemoproteus* sp.

Host : *Streptopelia decaocto*; site of infection : blood.

Distribution : India : Maharashtra (exact locality not mentioned).

Remarks : McClure *et al.*, (1978) reported this unnamed species from this state.

344. *Haemoproteus* sp.

Host : *Streptopelia orientalis*; site of infection : blood.

Distribution : India : Maharashtra (exact locality not mentioned).

Remarks : McClure *et al.*, (1978) reported this unnamed species from this state.

345. *Haemoproteus* sp.

Host : *Streptopelia senegalensis*; site of infection : blood.

Distribution : India : Maharashtra (exact locality not mentioned).

Remarks : McClure *et al.*, (1978) reported this unnamed species from this state.

346. *Haemoproteus* sp.

Host : *Centropus sinensis*; site of infection : blood.

Distribution : India : Maharashtra (exact locality not mentioned).

Remarks : McClure *et al.*, (1978) reported this unnamed species from this state.

347. *Haemoproteus* sp.

Host : *Clamator jacobinus*; site of infection : blood.

Distribution : India : Maharashtra (exact locality not mentioned).

Remarks : McClure *et al.*, (1978) reported this unnamed species from this state.

348. *Haemoproteus* sp.

Host : *Halcyon smyrnensis*; site of infection : blood.

Distribution : India : Maharashtra (exact locality not mentioned).

Remarks : McClure *et al.*, (1978) reported this unnamed species from this state.

349. *Haemoproteus* sp.

Host : *Merops orientalis*; site of infection : blood.

Distribution : India : Maharashtra (exact locality not mentioned).

Remarks : McClure *et al.*, (1978) reported this unnamed species from this state.

350. *Haemoproteus* sp.

Host : *Megalaima haemacephala*; site of infection : blood.

Distribution : India : Maharashtra (exact locality not mentioned).

Remarks : McClure *et al.*, (1978) reported this unnamed species from this state.

351. *Haemoproteus* sp.

Host : *Megalaima viridis*; site of infection : blood.

Distribution : India : Maharashtra (exact locality not mentioned).

Remarks : McClure *et al.*, (1978) reported this unnamed species from this state.

352. *Haemoproteus* sp.

Host : *Megalaima zeylanica*; site of infection : blood.

Distribution : India : Maharashtra (exact locality not mentioned).

Remarks : McClure *et al.*, (1978) reported this unnamed species from this state.

353. *Haemoproteus* sp.

Host : *Tephrodornis pondicerianus*; site of infection : blood.

Distribution : India : Maharashtra (exact locality not mentioned).

Remarks : McClure *et al.*, (1978) reported this unnamed species from this state.

354. *Haemoproteus* sp.

Host : *Dicrurus caeruleus*; site of infection : blood.

Distribution : India : Maharashtra (exact locality not mentioned).

Remarks : McClure *et al.*, (1978) reported this unnamed species from this state.

355. *Haemoproteus* sp.

Host : *Dicrurus paradiseus*; site of infection : blood.

Distribution : India : Maharashtra (exact locality not mentioned).

Remarks : McClure *et al.*, (1978) reported this unnamed species from this state.

356. *Haemoproteus* sp.

Host : *Corvus macrorhynchus*; site of infection : blood.

Distribution : India : Maharashtra (exact locality not mentioned).

Remarks : McClure *et al.*, (1978) reported this unnamed species from this state.

357. *Haemoproteus* sp.

Host : *Dendrocitta vagabunda*; site of infection : blood.

Distribution : India : Maharashtra (exact locality not mentioned).

Remarks : McClure *et al.*, (1978) reported this unnamed species from this state.

358. *Haemoproteus* sp.

Host : *Turdoides striatus*; site of infection : blood.

Distribution : India : Maharashtra (exact locality not mentioned).

Remarks : McClure *et al.*, (1978) reported this unnamed species from this state.

359. *Haemoproteus* sp.

Host : *Hypsipetes madagascariensis*; site of infection : blood.

Distribution : India : Maharashtra (exact locality not mentioned).

Remarks : McClure *et al.*, (1978) reported this unnamed species from this state.

360. *Haemoproteus* sp.

Host : *Pycnonotus cafer*; site of infection : blood.

Distribution : India : Maharashtra (exact locality not mentioned).

Remarks : McClure *et al.*, (1978) reported this unnamed species from this state.

361. *Haemoproteus* sp.

Host : *Pycnonotus jocosus*; site of infection : blood.

Distribution : India : Maharashtra (exact locality not mentioned).

Remarks : McClure *et al.*, (1978) reported this unnamed species from this state.

362. *Haemoproteus* sp.

Host : *Aegithina tiphia*; site of infection : blood.

Distribution : India : Maharashtra (exact locality not mentioned).

Remarks : McClure *et al.*, (1978) reported this unnamed species from this state.

363. *Haemoproteus* sp.

Host : *Monticola cinclorhynchus*; site of infection : blood.

Distribution : India : Maharashtra (exact locality not mentioned).

Remarks : McClure *et al.*, (1978) reported this unnamed species from this state.

364. *Haemoproteus* sp.

Host : *Saxicoloides fulicata*; site of infection : blood.

Distribution : India : Maharashtra (exact locality not mentioned).

Remarks : McClure *et al.*, (1978) reported this unnamed species from this state.

365. *Haemoproteus* sp.

Host : *Turdus merula*; site of infection : blood.

Distribution : India : Maharashtra (exact locality not mentioned).

Remarks : McClure *et al.*, (1978) reported this unnamed species from this state.

366. *Haemoproteus* sp.

Host : *Orthotomus sutorius*; site of infection : blood.

Distribution : India : Maharashtra (exact locality not mentioned).

Remarks : McClure *et al.*, (1978) reported this unnamed species from this state.

367. *Haemoproteus* sp.

Host : *Prinia hodgsoni*; site of infection : blood.

Distribution : India : Maharashtra (exact locality not mentioned).

Remarks : McClure *et al.*, (1978) reported this unnamed species from this state.

368. *Haemoproteus* sp.

Host : *Prinia socialis*; site of infection : blood.

Distribution : India : Maharashtra (exact locality not mentioned).

Remarks : McClure *et al.*, (1978) reported this unnamed species from this state.

369. *Haemoproteus* sp.

Host : *Prinia sylvatica*; site of infection : blood.

Distribution : India : Maharashtra (exact locality not mentioned).

Remarks : McClure *et al.*, (1978) reported this unnamed species from this state.

370. *Haemoproteus* sp.

Host : *Muscicapa tickelliae*; site of infection : blood.

Distribution : India : Maharashtra (exact locality not mentioned).

Remarks : McClure *et al.*, (1978) reported this unnamed species from this state.

371. *Haemoproteus* sp.

Host : *Rhipidura albogularis*; site of infection : blood.

Distribution : India : Maharashtra (exact locality not mentioned).

Remarks : McClure *et al.*, (1978) reported this unnamed species from this state.

372. *Haemoproteus* sp.

Host : *Anthus hodgsoni*; site of infection : blood.

Distribution : India : Maharashtra (exact locality not mentioned).

Remarks : McClure *et al.*, (1978) reported this unnamed species from this state.

373. *Haemoproteus* sp.

Host : *Motacilla cinerea*; site of infection : blood.

Distribution : India : Maharashtra (exact locality not mentioned).

Remarks : McClure *et al.*, (1978) reported this unnamed species from this state.

374. *Haemoproteus* sp.

Host : *Lanius schach*; site of infection : blood.

Distribution : India : Maharashtra (exact locality not mentioned).

Remarks : McClure *et al.*, (1978) reported this unnamed species from this state.

375. *Haemoproteus* sp.

Host : *Lanius vittatus*; site of infection : blood.

Distribution : India : Maharashtra (exact locality not mentioned).

Remarks : McClure *et al.*, (1978) reported this unnamed species from this state.

376. *Haemoproteus* sp.

Host : *Acridotheres tristis*; site of infection : blood.

Distribution : India : Maharashtra (exact locality not mentioned).

Remarks : McClure *et al.*, (1978) reported this unnamed species from this state.

377. *Haemoproteus* sp.

Host : *Sturnus pagodarum*; site of infection : blood.

Distribution : India : Maharashtra (exact locality not mentioned).

Remarks : McClure *et al.*, (1978) reported this unnamed species from this state.

378. *Haemoproteus* sp.

Host : *Nectarina asiatica*; site of infection : blood.

Distribution : India : Maharashtra (exact locality not mentioned).

Remarks : McClure *et al.*, (1978) reported this unnamed species from this state.

379. *Haemoproteus* sp.

Host : *Nectarina lotenia*; site of infection : blood.

Distribution : India : Maharashtra (exact locality not mentioned).

Remarks : McClure *et al.*, (1978) reported this unnamed species from this state.

380. *Haemoproteus* sp.

Host : *Nectarina zeylanica*; site of infection : blood.

Distribution : India : Maharashtra (exact locality not mentioned).

Remarks : McClure *et al.*, (1978) reported this unnamed species from this state.

381. *Haemoproteus* sp.

Host : *Dicaeum erythronotus*; site of infection : blood.

Distribution : India : Maharashtra (exact locality not mentioned).

Remarks : McClure *et al.*, (1978) reported this unnamed species from this state.

382. *Haemoproteus* sp.

Host : *Zosterops palpebrosa*; site of infection : blood.

Distribution : India : Maharashtra (exact locality not mentioned).

Remarks : McClure *et al.*, (1978) reported this unnamed species from this state.

383. *Haemoproteus* sp.

Host : *Carpodacus erythrinus*; site of infection : blood.

Distribution : India : Maharashtra (exact locality not mentioned).

Remarks : McClure *et al.*, (1978) reported this unnamed species from this state.

384. *Haemoproteus* sp.

Host : *Melophus lathami*; site of infection : blood.

Distribution : India : Maharashtra (exact locality not mentioned).

Remarks : McClure *et al.*, (1978) reported this unnamed species from this state.

385. *Haemoproteus* sp.

Host : *Lonchura malabarica*; site of infection : blood.

Distribution : India : Maharashtra (exact locality not mentioned).

Remarks : McClure *et al.*, (1978) reported this unnamed species from this state.

386. *Haemoproteus* sp.

Host : *Lonchura punctulata*; site of infection : blood.

Distribution : India : Maharashtra (exact locality not mentioned).

Remarks : McClure *et al.*, (1978) reported this unnamed species from this state.

387. *Haemoproteus* sp.

Host : *Passer domesticus*; site of infection : blood.

Distribution : India : Maharashtra (exact locality not mentioned).

Remarks : McClure *et al.*, (1978) reported this unnamed species from this state.

388. *Haemoproteus* sp.

Host : *Petronia xanthocollis*; site of infection : blood.

Distribution : India : Maharashtra (exact locality not mentioned).

Remarks : McClure *et al.*, (1978) reported this unnamed species from this state.

389. *Haemoproteus* sp.

Host : *Ploceus philippinus*; site of infection : blood.

Distribution : India : Maharashtra (exact locality not mentioned).

Remarks : McClure *et al.*, (1978) reported this unnamed species from this state.

Family LEUCOCYTOZOIDAE

Diagnosis : Unpigmented gametocytes in the peripheral blood; schizogony in tissue cells of a vertebrate host; sporogony in insects other than mosquitoes.

Genus *Leucocytozoon* Sambon, 1908

Diagnosis : Unpigmented parasites in erythroblasts, erythrocytes, and (rarely) leucocytes of birds; host cell grossly hypertrophied, fusiform in some species, nucleus of the host cell always distorted and displaced peripherally (the form of distortion frequently of diagnostic value); first schizogonic cycle hepatic, subsequently in other tissues; schizonts with cytomeres; prepatent period short; sporogony in Simuliidae and Ceratopogonidae; oocysts small, unpigmented, usually containing fewer than 100 merozoites, 9-13 μm in length, one end more pointed than the other.

390. *Leucocytozoon capitonis* Bennett, Earle and Peirce, 1993

1993. *Leucocytozoon capitonis* Bennett, Earle and Peirce. *Ostrich*, **64** : 73-78.

Diagnosis : Macrogametocyte large, round to broadly ovate, 14.9 (1.7) μm $\times$ 12.4 (1.2) μm and 142.6 (23.4) μm^2 in area, occupying 79% of the area of the host cell-parasite complex; parasite nucleus large, round to ovoid, rarely elliptical without marked karyosome, occupying 7.6% of the area of the parasite; host cell nucleus forming a thin band, rarely as a small cap, covering 44% of the periphery of the parasite and 21% of the area of the host cell parasite complex.

Host : *Accipiter badius*; site of infection : blood.

Distribution : India : Maharashtra (exact locality not mentioned).

Remarks : *Remarks* : This species is described from Maharashtra state based on blood film 37116 from the small Green Barbet, *Megalaima viridis* collected by McClure on 24 April, 1969.

391. *Leucocytozoon* sp.

Host : *Accipiter badius*; site of infection : blood.

Distribution : India : Maharashtra (exact locality not mentioned).

Remarks : McClure *et al.*, (1978) reported this unnamed species from this state.

392. *Leucocytozoon* sp.

Host : *Francolinus pictus*; site of infection : blood.

Distribution : India : Maharashtra (exact locality not mentioned).

Remarks : McClure *et al.*, (1978) reported this unnamed species from this state.

393. *Leucocytozoon* sp.

Host : *Francolinus pondicerianus*; site of infection : blood.

Distribution : India : Maharashtra (exact locality not mentioned).

Remarks : McClure *et al.*, (1978) reported this unnamed species from this state.

394. *Leucocytozoon* sp.

Host : *Perdica argoondah*; site of infection : blood.

Distribution : India : Maharashtra (exact locality not mentioned).

Remarks : McClure *et al.*, (1978) reported this unnamed species from this state.

395. *Leucocytozoon* sp.

Host : *Streptopelia decaocto*; site of infection : blood.

Distribution : India : Maharashtra (exact locality not mentioned).

Remarks : McClure *et al.*, (1978) reported this unnamed species from this state.

396. *Leucocytozoon* sp.

Host : *Streptopelia orientalis*; site of infection : blood.

Distribution : India : Maharashtra (exact locality not mentioned).

Remarks : McClure *et al.*, (1978) reported this unnamed species from this state.

397. *Leucocytozoon* sp.

Host : *Streptopelia senegalensis*; site of infection : blood.

Distribution : India : Maharashtra (exact locality not mentioned).

Remarks : McClure *et al.*, (1978) reported this unnamed species from this state.

398. *Leucocytozoon* sp.

Host : *Centropus sinensis*; site of infection : blood.

Distribution : India : Maharashtra (exact locality not mentioned).

Remarks : McClure *et al.*, (1978) reported this unnamed species from this state.

399. *Leucocytozoon* sp.

Host : *Clamator jacobinus*; site of infection : blood.

Distribution : India : Maharashtra (exact locality not mentioned).

Remarks : McClure *et al.*, (1978) reported this unnamed species from this state.

400. *Leucocytozoon* sp.

Host : *Megalaima viridis*; site of infection : blood.

Distribution : India : Maharashtra (exact locality not mentioned).

Remarks : McClure *et al.*, (1978) reported this unnamed species from this state.

401. *Leucocytozoon* sp.

Host : *Tephrodornis pondicerianus*; site of infection : blood.

Distribution : India : Maharashtra (exact locality not mentioned).

Remarks : McClure *et al.*, (1978) reported this unnamed species from this state.

402. *Leucocytozoon* sp.

Host : *Parus major*; site of infection : blood.

Distribution : India : Maharashtra (exact locality not mentioned).

Remarks : McClure *et al.*, (1978) reported this unnamed species from this state.

403. *Leucocytozoon* sp.

Host : *Turdoides striatus*; site of infection : blood.

Distribution : India : Maharashtra (exact locality not mentioned).

Remarks : McClure *et al.*, (1978) reported this unnamed species from this state.

404. *Leucocytozoon* sp.

Host : *Pycnonotus cafer*; site of infection : blood.

Distribution : India : Maharashtra (exact locality not mentioned).

Remarks : McClure *et al.*, (1978) reported this unnamed species from this state.

405. *Leucocytozoon* sp.

Host : *Pycnonotus jocosus*; site of infection : blood.

Distribution : India : Maharashtra (exact locality not mentioned).

Remarks : McClure *et al.*, (1978) reported this unnamed species from this state.

406. *Leucocytozoon* sp.

Host : *Turdus merula*; site of infection : blood.

Distribution : India : Maharashtra (exact locality not mentioned).

Remarks : McClure *et al.*, (1978) reported this unnamed species from this state.

407. *Leucocytozoon* sp.

Host : *Zoothera citrina*; site of infection : blood.

Distribution : India : Maharashtra (exact locality not mentioned).

Remarks : McClure *et al.*, (1978) reported this unnamed species from this state.

408. *Leucocytozoon* sp.

Host : *Muscicapa tickelliae*; site of infection : blood.

Distribution : India : Maharashtra (exact locality not mentioned).

Remarks : McClure *et al.*, (1978) reported this unnamed species from this state.

409. *Leucocytozoon* sp.

Host : *Meloplus lathami*; site of infection : blood.

Distribution : India : Maharashtra (exact locality not mentioned).

Remarks : McClure *et al.*, (1978) reported this unnamed species from this state.

Subclass PIROPLASMIA

Order PIROPLASMIDA

Family BABESIIDAE

Diagnosis : Minute non-pigmented parasites of the erythrocytes of mammals; transmission by ticks.

Genus *Babesia* Starcovici,

Diagnosis : Apical complex reduced to a polar ring, rhoptries and subpellicular microtubules, filaments not present on parasitized erythrocytes.

410. *Babesia bigemina* (Smith and Kilborne, 1893)
(Fig. 172a-d)

1893. *Pyrosoma bigeminum* Smith and Kilborne, U.S. Dept. Agric. Bur. Anim. Indust. Bull., 1 : 177.
1926. *Babesia bigemina* (Smith and Kilborne) : Wenyon : Protozoology, Vol. II, Bailliere, Tindall and Cox, London, : 1-993.

Diagnosis : Parasite large intraerythrocytic, round, oval, irregular, or pyriform, occurring in pairs, individuals of each pair lying closely together; round forms 2-3 μm in diameter, pear-shaped forms 2-4 μm $\times$ 1.5-2.0 μm , occasionally 5-6 μm in length, extending across the R. B. C.; multiplication by characteristic budding process, buds remaining attached to their pointed ends.

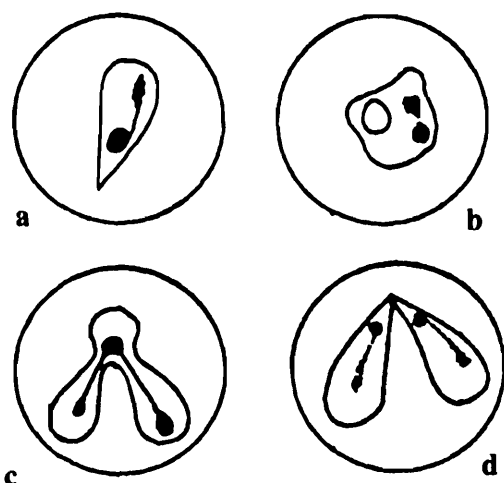


Fig. 172a-d. *Babesia bigemina*

Host : Cross bred calves, *Bubalus bubalis*; site of infection : blood.

Distribution : India : Maharashtra (Marathwada region).

Remarks : Shasstri *et al.*, (1981) observed babesiosis due to *B. bigemina* in both cross bred and indigenous cattle in the Marathwada region of Maharashtra. Muley *et al.*, (1979) experimentally studied this species in cross bred calves from this state.

411. *Babesia bovis* (Babes, 1888)
(Syn. *Babesia argentina* Lignieres, 1901)

1888. *Haematococcus bovis* Babes, C. R. Acad. Sci., 107 : 692.

1901. *Babesia argentina* Lignieres, Ann. Inst. Pasteur, 15 : 121.

1938. *Babesia bovis* : Bhatia : The Fauna of British India, including Ceylon and Burma. Protozoa : Sporozoa. Taylor and Francis, London, p. 306.

Diagnosis : Parasite small, round, pear-shaped or irregular, in pairs with an obtuse angle, measuring 1-2.5 μm $\times$ 1-2.2 μm in diameter; with vacuoles; situated at the centre of erythrocytes; nucleus red dot-like; oval or round forms varying in size, measuring 1.5-4.0 μm $\times$ 1.5-2.9 μm .

Host : Buffalo, *Bubalus bubalis*; site of infection : blood.

Distribution : India : Maharashtra (Marathwada region).

Remarks : Shastri *et al.*, (1981) observed *B. bovis* as mixed infection with *B. bigemina* in five cross bred calves in the Marathwada region of Maharashtra. Shastri and Kurundakar (1981) reported this species in buffalo from this state.

Family THEILERIIDAE

Diagnosis : Unpigmented parasites of red blood corpuscles of mammals, occurring in various forms but not showing any paired arrangement; schizogony in the endothelial cells of blood vessels, producing a number of merozoites.

Genus *Theileria* Bettencourt, Franca and Borgess, 1907

Diagnosis : Elements of apical complex much reduced, always including only rhoptries; polar ring or conoid lacking, usually without subpellicular microtubules, vector ixodid ticks, parasite in mammals.

412. *Theileria annulata* (Dschunkowsky and Luhs, 1904)

1904. *Theileria annulata* Dschunkowsky and Luhs, Zentralbl. Bacteriol. Parasitenk. Infektionskr. Hyg. Abt. I Orig., 35 : 486.
1988. *Theileria annulata* : Levine, The Protozoan Phylum Apicomplexa, Vol. II, CRC Press, Inc., Florida, p.42.

Diagnosis : Intraerythrocytic forms resembling small babesids, 1-2 μm $\times$ 0.5-1.0 μm ; schizonts

in spleen and lymph nodes, 10-20 µm in diameter; characterized by enlargement of lymph nodes and spleen, and congestion of the lungs and meninges, intestinal ulcers, anaemia and haemoglobinuria; occurring in cattle and transmitted by ixodiid ticks.

Host : *Bos indicus*, site of infection : blood.

Distribution : India : Maharashtra (Marathwada region).

Remarks : Shastri *et al.*, (1981) reported this species in bovines from this state.

413. *Theileria hirci* Dschunkovsky and Urodschevich, 1924

1924. *Theileria hirci* Dschunkovsky and Urodschevich, *Parasitology*, 16 : 107.

Diagnosis : Parasites small, variable in shape, occurring singly, in rows, or in triples or even in cross-like forms in the red cells, with chromatin granules of varying in shape and size; schizogony in the internal organs; occurring in sheep and goats and transmitted by ixodiid ticks.

Host : Sheep, *Ovis aries*; site of infection : blood.

Distribution : India : Maharashtra.

Remarks : Shastri *et al.*, (1981) reported acute theileriasis in sheep infected with this species from this state.

414. *Theileria mutans* (Theiler, 1906)

1905. *Piroplasma mutans* Theiler, *J. Comp. Path. & Therap.*, 19 : 297.

1988. *Theileria mutans* : Levine, *The Protozoan Phylum Apicomplexa*, Vol. II, CRC Press, Inc., Florida, p. 43

Diagnosis : Intraerythrocytic forms very small, comma-shaped, dumbbell-shaped, ring or cross-shaped, the larger ones about 1 µm in diameter; schizonts comparatively larger with ovoid nuclei; non-pathogenic; transmissible by blood inoculation; blood forms persisted for longer periods.

Host : *Bos indicus*, site of infection : blood.

Distribution : India : Maharashtra (Marathwada region).

Remarks : Shastri *et al.*, (1988) reported this species in bovines from this state along with its transmission by ticks.

415. *Theileria orientalis* (Yakimov and Sudachenkov, 1931)

1988. *Theileria orientalis* : Levine, *The Protozoan Phylum Apicomplexa*, Vol. II, CRC Press, Inc., Florida, p.43

Diagnosis : Not available.

Host : Sheep, *Ovis aries*; site of infection : blood.

Distribution : India : Maharashtra.

Remarks : Shastri *et al.*, (1988) reported this species in bovines from this state along with its transmission by ticks.

416. *Theileria ovis* Rodhain, 1916

1916. *Theileria ovis* Rodhain, *Bull. Soc. Path. Exot.*, 9 : 95.

1988. *Theileria ovis* : Levine, *The Protozoan Phylum Apicomplexa*, Vol. II, CRC Press, Inc., Florida, p. 43

Diagnosis : Not available.

Host : Sheep, *Ovis aries*; site of infection : blood.

Distribution : India : Maharashtra.

Remarks : Shastri and Deshpande (1987) reported latent infection of this species in sheep from this state.

417. *Theileria* sp.

Host : Buffalo calve, *Bubalus bubalis*; site of infection : blood.

Distribution : India : Maharashtra (Parbhani district).

Remarks : Shastri *et al.*, (1981) reported this unnamed species from this state.

418. *Theileria* sp.

Host : *Bos indicus*; site of infection : blood.

Distribution : India : Maharashtra.

Remarks : Shastri *et al.*, (1981) reported theileria infection from this state.

419. *Theileria* sp.

Host : *Ovis aries*; site of infection : blood.

Distribution : India : Maharashtra.

Remarks : Shastri *et al.*, (1981) reported theileria infection from this state.

420. *Theileria* sp.

Host : *Capra hircus*; site of infection : blood.

Distribution : India : Maharashtra.

Remarks : Shastri *et al.*, (1981) reported theileria infection from this state.

Incertae sedis to Order Piroplasmida

Genus *Anaplasma* Theiler, 1910

Diagnosis : Spherical body of chromatin, less than 0.5 μm in diameter, occurring in erythrocytes, ticks acting as vectors, parasitic in mammals.

421. *Anaplasma marginale* Theiler, 1910

1910. *Anaplasma marginale* Theiler, *Bull. Soc. Path. Exot.*, 3 : 135.

Diagnosis : Spherical, chromatin granular, measuring 0.2-40 μm in diameter, apparently with no cytoplasm, parasitophorous vacuole present, usually formed at the margin of the red cells.

Host : *Bos indicus*, *Ovis aries*; site of infection : blood.

Distribution : India : Maharashtra (Marathwada region).

Remarks : Shastri *et al.*, (1981) recorded this species from this state in few cross-bred calves and in only one indigenous bullock manifesting anemia.

422. *Anaplasma ovis*

Diagnosis : Not available.

Host : Sheep, *Ovis aries*; site of infection : blood.

Distribution : India : Maharashtra (Marathwada region).

Remarks : Shastri and Deshpande (1987) reported latent infection of this species in sheep from this state.

Phylum MYXOZOA

Class MYXOSPOREA

Order BIVALVULIDA

Suborder VARIISPORINA

Family MYXIDIDAE

Diagnosis : Spores with polar capsules located at the opposite ends; sutural line longitudinal, straight or curved.

Genus *Myxidium* Butschli, 1882

Diagnosis : Spores fusiform, straight or slightly crescentic or sigmoid with more or less pointed ends; shell valves smooth or with ridges; with 2 pyriform polar capsules usually coelozoic and occasionally histozoic.

423. *Myxidium mackiei* Bosanquet, 1910

1910. *Myxidium mackiei* Bosanquet, *Zool. Anz.*, 35 : 434-438.

Diagnosis : Vegetative form exhibiting distinction between ectoplasm and endoplasm; spores measuring 16 μm $\times$ 5 μm , with both ends bluntly pointed, spore coat markedly striated and usually formed in pairs; sporoblasts usually containing 6 nuclei, two of which together separately forming the spore valve, polar capsules and sporoplasm.

Host : *Trionyx gangeticus*; site of infection : kidney.

Distribution : India : Maharashtra (Mumbai).

Remarks : Bosanquet (1910) recorded this species from this state.

Family CERATOMYXIDAE

Genus *Ceratomyxa* Thelohan, 1892

424. *Ceratomyxa* sp.

Host : *Carcharinus bleekeri*

Distribution : India : Maharashtra.

425. *Ceratomyxa* sp.

Host : *Carcharinus limbatus*

Distribution : India : Maharashtra.

426. *Ceratomyxa* sp.

Host : *Carcharinus melanopterus*

Distribution : India : Maharashtra.

427. *Ceratomyxa* sp.

Host : *Carcharinus menisorrh*

Distribution : India : Maharashtra.

428. *Ceratomyxa* sp.

Host : *Carcharinus pleurotaenia*

Distribution : India : Maharashtra.

429. *Ceratomyxa* sp.

Host : *Cestraction blochii*

Distribution : India : Maharashtra.

430. *Ceratomyxa* sp.

Host : *Cestraction zygaena*

Distribution : India : Maharashtra.

431. *Ceratomyxa* sp.

Host : *Hemigaleus balfouri*

Distribution : India : Maharashtra.

432. *Ceratomyxa* sp.

Host : *Hypoprion macloiti*

Distribution : India : Maharashtra.

433. *Ceratomyxa* sp.

Host : *Pristis cuspidatus*

Distribution : India : Maharashtra.

434. *Ceratomyxa* sp.

Host : *Rhynchobatus djeddensis*

Distribution : India : Maharashtra.

435. *Ceratomyxa* sp.

Host : *Scoliodon palasorrh*

Distribution : India : Maharashtra.

436. *Ceratomyxa* sp.

Host : *Scoliodon sorrakowah*

Distribution : India : Maharashtra.

437. *Ceratomyxa* sp.

Host : *Scoliodon walbeehmi*

Distribution : India : Maharashtra.

438. *Ceratomyxa* sp.

Host : *Scoliodon* sp.

Distribution : India : Maharashtra.

Family CHLOROMYXIDAE

Genus *Chloromyxum* Mingazini, 1890

439. *Chloromyxum* sp.

Host : *Carcharinus bleekeri*

Distribution : India : Maharashtra.

440. *Chloromyxum* sp.

Host : *Carcharinus limbatus*

Distribution : India : Maharashtra.

441. *Chloromyxum* sp.

Host : *Carcharinus melanopterus*

Distribution : India : Maharashtra.

442. *Chloromyxum* sp.

Host : *Cestraction blochii*

Distribution : India : Maharashtra.

443. *Chloromyxum* sp.

Host : *Cestraction zygaena*

Distribution : India : Maharashtra.

444. *Chloromyxum* sp.

Host : *Chiloscyllium griseum*

Distribution : India : Maharashtra.

445. *Chloromyxum* sp.

Host : *Hemigaleus balfouri*

Distribution : India : Maharashtra.

446. *Chloromyxum* sp.

Host : *Pristis cuspidatus*

Distribution : India : Maharashtra.

447. *Chloromyxum* sp.

Host : *Rhynchobatus djeddensis*

Distribution : India : Maharashtra.

448. *Chloromyxum* sp.

Host : *Rhynoteria javanica*

Distribution : India : Maharashtra.

449. *Chloromyxum* sp.

Host : *Scoliodon palasorrah*

Distribution : India : Maharashtra.

450. *Chloromyxum* sp.

Host : *Scoliodon sorrakowah*

Distribution : India : Maharashtra.

451. *Chloromyxum* sp.

Host : *Scoliodon walbeehmi*

Distribution : India : Maharashtra.

452. *Chloromyxum* sp.

Host : *Scoliodon* sp.

Distribution : India : Maharashtra.

453. *Chloromyxum* sp.

Host : *Trygon bleekeri*

Distribution : India : Maharashtra.

Remarks : Setna (1942) made preliminary observations on several myxosporean parasites

belonging to the above genera *Ceratomyxa* and *Chloromyxum* occurring in sharks from Maharashtra coasts.

Suborder PLATYSPORINA

Family MYXOBOLIDAE

Genus *Myxobolus* Butschli, 1882

454. *Myxobolus cerebralis* Hofer, 1903

1903. *Myxobolus cerebralis* Hofer, *Alla. Fischereizig.*, **28** : 728.

Diagnosis : Spores variable in valvular view, lenticular in sutural view, measuring 7.4-9.7 μm $\times$ 7.0-10.0 μm ; shell valve symmetrical smooth; sutural ridge narrow; polar capsules oval, 4.2-6.0 μm $\times$ 3.0-3.5 μm , equal, filling entire spore cavity.

Host : *Cirrhina mrigala*; site of infection : cartilage of head and vertebral column.

Distribution : India : Maharashtra (Wardha).

Remarks : Maheswari (1986) reported this species from this state.

Phylum CILIOPHORA

Class KINETOFRAGMINIFERA

Order TRICHOSTOMATIDA

Family BALANTIDAE

Genus *Balantidium* Claparede and Lachman, 1858

Diagnosis : Body oval, ellipsoid to subcylindrical and uniformly ciliated; cytostome located at the base of an anteriorly situated vestibulum; cytopharynx not well developed; contractile vacuole and cytophyge terminal; parasitic in the gut of both vertebrates and invertebrates.

Remarks : Shete and Krishnamurthy (1984) described the following eight balantid species from this state.

Key to the species

1. Vestibule sac-like 2
- Vestibule V-shaped or U-shaped 3
2. Body very much elongated, measuring 128.3-250.8 μm $\times$ 21.9-47.0 μm ; with ovoidal or

- elongate ovoid macronucleus located anywhere from near the vestibule to the posterior end of the body *B. ganapati*
- Body typically elongated, 73.1-108.7 $\mu\text{m} \times$ 36.6-52.2 μm ; with C-shaped macronucleus located in the middle-third of the body *B. tigrinae*
3. Vestibule V-shaped 4
- Vestibule U-shaped 6
4. Body typically elongated and somewhat fusiform, 71.1-112.8 $\mu\text{m} \times$ 36.6-51.2 μm , anterior-half truncated; with sausage-shaped macronucleus *B. aurangabadensis*
- Body typically pyriform to elliptical 5
5. Body dimensions 133.7-249.7 $\mu\text{m} \times$ 73.1-139.0 μm ; vestibule broad at the anterior half; macronucleus a typical lobed appearance on one side *B. megastomae*
- Body dimensions 70.0-89.9 $\mu\text{m} \times$ 43.9-56.4 μm ; vestibule constricted near the middle; macronucleus ovoidal *B. ranae*
6. Body highly variable in shape, measuring 50.0-85.7 $\mu\text{m} \times$ 26.1-50.2 μm ; macronucleus spherical to subspherical *B. mininucleutam*
- Body not variable 7
7. Body typically pyriform, measuring 70.0-93.0 $\mu\text{m} \times$ 33.4-48.0 μm with macronucleus typically sausage-shaped *B. corlissi*
- Body typically elongated with both ends rounded measuring 51.2-104.5 $\mu\text{m} \times$ 26.1-41.8 μm ; macronucleus typically sausage-shaped or kidney-shaped *B. cyanophlycti*

455. *Balantidium aurangabadensis* Shete and Krishnamurthy, 1984
(Fig. 173)

1984. *Balantidium aurangabadensis* Shete and Krishnamurthy, *Arch. Protistenk.*, **128** : 181-183.

Diagnosis : Body typically elongated and somewhat fusiform, 71.1-112.8 (87.7) $\mu\text{m} \times$ 36.6-51.2 (43.6) μm , anterior half truncated and

somewhat conical with bluntly rounded end, posterior end broadly rounded and occasionally with a knob-like tip; pellicle well developed, uniformly covered with cilia forming 49 closelyset longitudinal kineties; vestibule V-shaped, 11.5 μm in diameter, very conspicuous, symmetrical and extending from anterior tip of the body; macronucleus typically elongated, sausage-shaped, lying vertically or obliquely in the middle third of the body; micronucleus small and round; cytoplasm not differentiated into ectoplasmic layer.

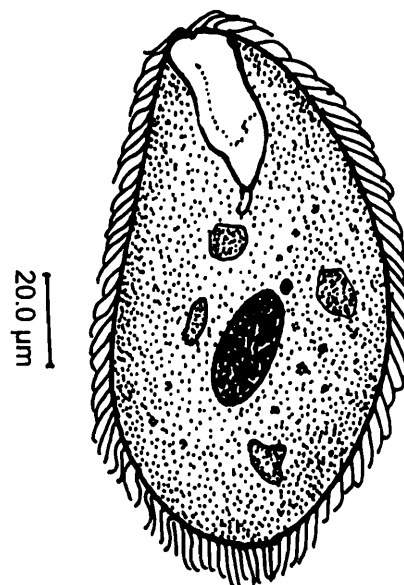


Fig. 173. *B. aurangabadensis*

Host : *Rana tigrina*; **Site of infection** : rectum.

Distribution : India : Maharashtra (Aurangabad).

456. *Balantidium corlissi* Shete and Krishnamurthy, 1984
(Fig. 174)

1984. *Balantidium corlissi* Shete and Krishnamurthy, *Arch. Protistenk.*, **128** : 188-190.

Diagnosis : Body typically pyriform, 70.0-93.0 (79.2) $\mu\text{m} \times$ 33.4-48.0 (38.7) μm , maximum width slightly behind the middle, anterior half bluntly conical while posterior end broadly rounded; pellicle uniformly covered with cilia arranged in 56 kineties on either side; vestibule U-shaped, almost uniform in diameter, subterminal, asymmetrical and extending about one-third the body length; macronucleus typically sausage-

shaped, situated obliquely near the middle of the body; micronucleus spherical and conspicuous; cytoplasm clearly differentiated into ectoplasm and endoplasm.

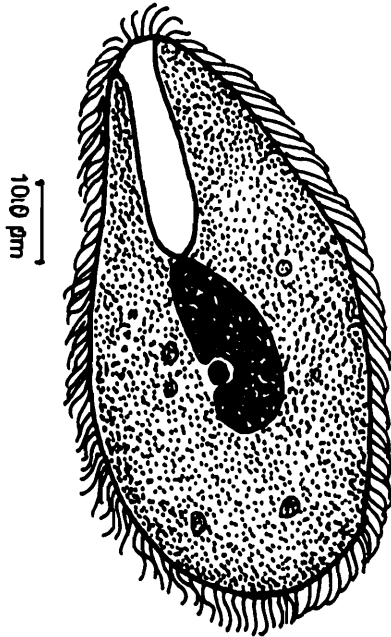


Fig. 174. *B. corlissi*

Host : *Rana cyanophlyctis*; site of infection : rectum.

Distribution : India : Maharashtra (Aurangabad).

457. *Balantidium cyanophlycti* Shete and Krishnamurthy, 1984 (Fig. 175)

1984. *Balantidium cyanophlycti* Shete and Krishnamurthy, *Arch. Protistenk.*, 128 : 187-188.

Diagnosis : Body typically elongated with both ends bluntly rounded, 51.2-104.6 (82.3) μm $\times$ 26.1-41.8 (33.6) μm , both the dorsal and ventral margins flattened and almost parallel to one another; pellicle uniformly covered with cilia about 4.2 μm long, arranged in 51 kineties on either side; vestibule U-shaped, almost uniform in diameter, terminal, symmetrical and extending about one-third of the body length; macronucleus typically sausage-shaped or kidney-shaped, situated generally in the middle third of the body; micronucleus conspicuous; lying embedded on the surface of the macronucleus or very close to it, measuring about 3.3 μm in diameter.

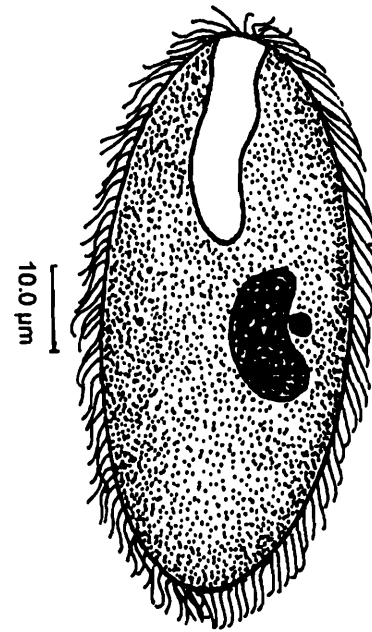


Fig. 175. *B. cyanophlycti*

Host : *Rana cyanophlyctis*; site of infection : rectum.

Distribution : India : Maharashtra (Aurangabad).

458. *Balantidium ganapati* Shete and Krishnamurthy, 1984 (Fig. 176)

1984. *Balantidium ganapati* Shete and Krishnamurthy, *Arch. Protistenk.*, 128 : 192-194.

Diagnosis : Body very much elongated and narrow, 123.3-250.8 (186.6) μm $\times$ 21.9-47.0 (30.7)

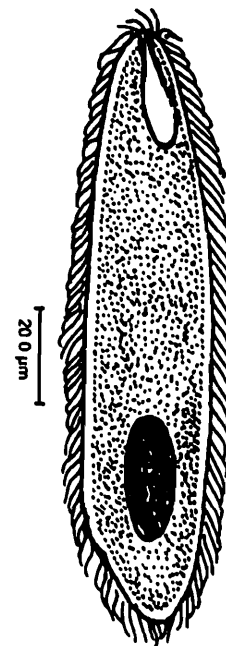


Fig. 176 *B. ganapati*

μm , anterior half slightly wider than the posterior, anterior and posterior ends both tapering and bluntly pointed; vestibule sac-like with the anterior half slightly narrower and posterior broader, terminal, slightly asymmetrical and extending about one-fifth of the body length; macronucleus ovoidal or elongate ovoid, extremely variable in position being situated anywhere from near the vestibule to posterior end of the body; micronucleus not seen; cytoplasm clearly differentiated into thin ectoplasm and granular endoplasm.

Host : *Rana cyanophlyctis*; site of infection : rectum.

Distribution : India : Maharashtra (Aurangabad).

459. *Balantidium megastomae* Shete and Krishnamurthy, 1984
(Fig. 177)

1984. *Balantidium megastomae* Shete and Krishnamurthy, 128 : 185-187

Diagnosis : Body elliptical to pyriform, 133.7-249.7 (193.4) μm $\times$ 73.1-139.0 (104.3) μm , maximum width near the middle or slightly behind, anterior end pointed, posterior end obtusely

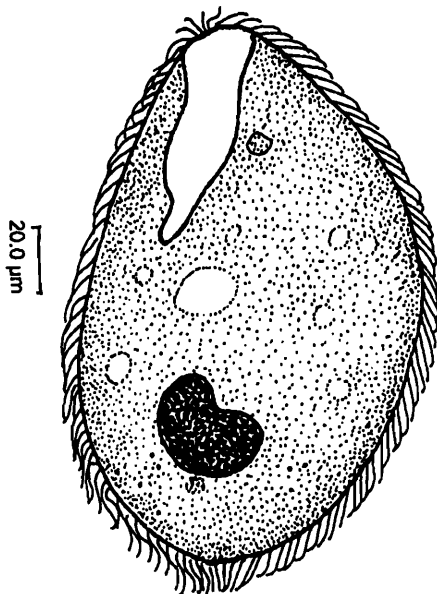


Fig. 177. *B. megastomae*

rounded; pellicle well developed; vestibule relatively shorter; broad anterior half and much narrow, tapering and V-shaped posterior half,

almost uniform in diameter, almost terminal, less than one-third of the body length; macronucleus having outline on three sides but a typical lobed appearance on one side, situated in the middle or posterior third of the body; micronucleus typically spherical measuring 4.2 μm in diameter; cytoplasm differentiated into narrow ectoplasm and massive endoplasm.

Host : *Rana cyanophlyctis*; site of infection : rectum.

Distribution : India : Maharashtra (Aurangabad).

460. *Balantidium mininucleatum* Shete and Krishnamurthy, 1984
(Fig. 178)

1984. *Balantidium mininucleatum* Shete and Krishnamurthy, *Arch. Protistenk.*, 128 : 191-192.

Diagnosis : Body variable, being pyriform, elliptical or elongate ovoid, 50.0-85.7 (74.3) μm $\times$ 26.1-50.2 (37.3) μm , anterior and posterior ends conically or bluntly rounded; vestibule U-shaped, almost uniform in diameter, terminal, typically

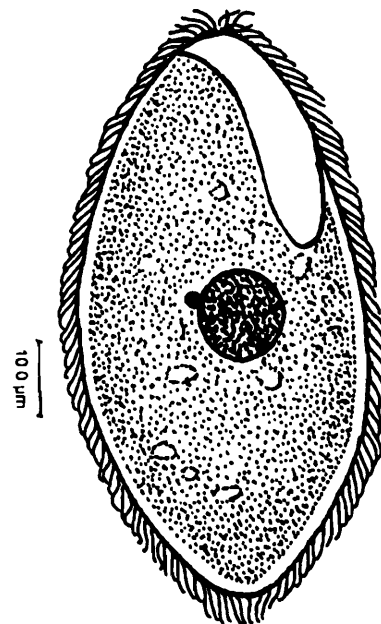


Fig. 178. *B. mininucleatum*

asymmetrical and extending anywhere about one-third to half the body length; macronucleus typically spherical to subspherical, situated anywhere from near the vestibule to the posterior end of the body; micronucleus small and spherical;

ectoplasm relatively very thin and endoplasm highly granular and often vacuolated.

Host : *Rana cyanophlyctis*; site of infection : rectum.

Distribution : India : Maharashtra (Aurangabad).

461. *Balantidium ranae* Shete and Krishnamurthy, 1984
(Fig. 179)

1984. *Balantidium ranae* Shete and Krishnamurthy, *Arch. Protistenk.*, **128** : 183-185.

Diagnosis : Body typically pyriform or elliptical, 70.0-89.9 (81.4) μm $\times$ 43.9-56.4 (50.4) μm , maximum width slightly posterior to the middle, anterior half narrower and slightly tapering while posterior half broadly rounded; pellicle uniformly covered with cilia arranged in 61 kineties on each side; vestibule V-shaped, marked bend or constriction near the middle, anterior part relatively broader (11.3 μm) than the posterior (2.3 μm), subterminal, slightly asymmetrical and extending about one-third of the body length; macronucleus ovoidal, lying obliquely near the middle of the body or slightly posterior to it;

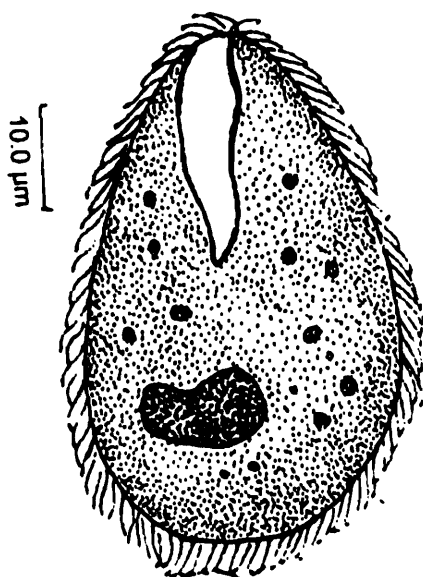


Fig. 179. *B. ranae*

micronucleus small and spherical; cytoplasm clearly differentiated into ectoplasm and endoplasm with food vacuoles and granular inclusion.

Host : *Rana tigrina*; site of infection : rectum.

Distribution : India : Maharashtra (Aurangabad).

462. *Balantidium tigrinae* Shete and Krishnamurthy, 1984
(Fig. 180)

1984. *Balantidium tigrinae* Shete and Krishnamurthy, *Arch. Protistenk.*, **128** : 179-181.

Diagnosis : Body typically elongated, 73.1-108.7 (92.4) μm $\times$ 36.6-52.2 (45.3) μm , anterior half slightly conical while posterior half obtuse and rounded; pellicle covered with cilia arranged in 42 kineties on each side; vestibule sac-like, typical bend or twist near the middle; anterior part slightly narrower and the posterior part broader, closer to the ventral margin, asymmetrical and extending more than one-third of the body length; macronucleus bent upon itself in the form of C-shaped loop, lying in the middle third of the body; micronucleus small and spherical; cytoplasm clearly differentiated into thin, clear ectoplasm and massive, granular endoplasm.

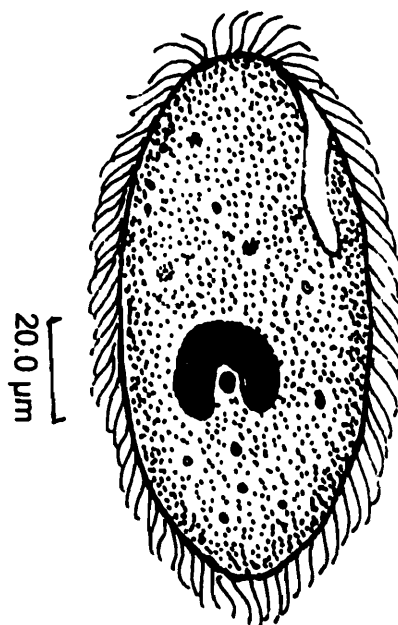


Fig. 180. *B. tigrinae*

Host : *Rana tigrina*; site of infection : rectum.

Distribution : India : Maharashtra (Aurangabad).

463. *Balantidium* sp.

Diagnosis : Body fusiform and much elongated, measuring 161-252 (205) μm $\times$ 29-63 (40) μm ; vestibule about one-fifth of body length, having parallel and thickened edges.

Host : *Rana cyanophlyctis*; site of infection : rectum.

Distribution : India : Maharashtra (Aurangabad).

Remarks : Advant *et al.*, (1981) recorded occurrence of this unnamed species from this state.

Class OLIGOHYMENOPHOREA

Subclass HYMENOSTOMATA

Order SCUTICOCILIATIDA

Suborder THIGMOTRICHINA

Family HYSTEROCINETIDAE

Genus *Protoptychostomum* Raabe, 1949

464. *Protoptychostomum* sp.

Diagnosis : Body typically elongated, flattened and leaf-like, possessing an inverted V-shaped sucker and a funnel-shaped peristomal groove posteriorly; body dimensions 94.1-145.0 (120.5) μm $\times$ 35.5-73.5 (47.5) μm ; a single contractile vacuole, 65-75 kineties and an elongated ribbon-like macronucleus present.

Host : *Perionyx sansibaricus*; site of infection : not mentioned.

Distribution : India : Maharashtra (Aurangabad).

Remarks : Krishnamurthy *et al.*, (1981) reported this thigmotrich ciliate from this state.

Class POLYHYMENOPHOREA

Order HETEROTRICHIDA

Family NYCTOTHERIDAE

Key to the genera

1(2) Body ovoid, pyriform or reniform, left margin convex, right margin more or less flat; micronucleus always below macronucleus, commensal of anurans *Nyctotheroides*

2(1) Body generally less flat, micronucleus most

often located above macronucleus, commensal of both invertebrates and vertebrates *Nyctotherus*

Genus *Nyctotherus* Leidy, 1849

1849. *Nyctotherus* Leidy, *Proc. Acad. Nat. Sci. Philad.*, 4 : 233.

Diagnosis : As in the key.

465. *Nyctotherus hardwickii* Janakidevi, 1961

1961. *Nyctotherus hardwickii* Janakidevi, *Z. Parasitenk.*, 21 : 155-1158.

Diagnosis : Not available.

Host : *Uromastix hardwickii*; site of infection : rectum.

Distribution : India : Maharashtra (Mumbai).

Remarks : Janakidevi (1961) described this species from this state.

466. *Nyctotherus* sp.

Diagnosis : Ciliate measuring 44.93-85.68 (66.28) μm $\times$ 36.57-62.69 (51.83) μm ; macronucleus elongated and band-shaped or sausage-shaped; cytopharynx almost straight and uniform in diameter.

Host : *Polyphaga indica*; site of infection : rectum.

Distribution : India : Maharashtra.

Remarks : Sultana *et al.*, (1981) reported this unnamed species from this state.

Genus *Nyctotheroides* Grasse, 1928

Diagnosis : As in the key.

Remarks : Shete (1982a,b) described seven species of this genus *Nyctotheroides* from this state as follows.

Subgenus *Nyctotheroides* Grasse, 1928467. *Nyctotheroides (Nyctotheroides) ameroi* Shete, 1982 (Fig. 181)

1982. *Nyctotheroides (Nyctotheroides) ameroi* Shete, *Arch. Protistenk.*, 125 : 173-180.

Diagnosis : Body typically elliptical, measuring 79.4-120.2 (105.4) μm $\times$ 63.7-92.0 (75.7) μm , with anterior half somewhat conical and broadly rounded and posterior half almost hemispherical; ventral margin almost straight or slightly curved with clear depression near the middle, dorsal margin of the body markedly convex; entire body covered with several parallel rows of short cilia; peristomial groove ventral and peristome situated near the middle; cytopharynx directed dorsalwards, and then downward, forming 65-86° angle and measuring 60.6-76.2 (67.8) μm ; macronucleus fairly large, elongated and sausage-shaped, 39.7-55.4 (47.4) μm $\times$ 12.5-18.8 (16.1) μm , lying almost parallel, anterior to the curve of the cytopharynx; micronucleus not seen; cytopyege absent.

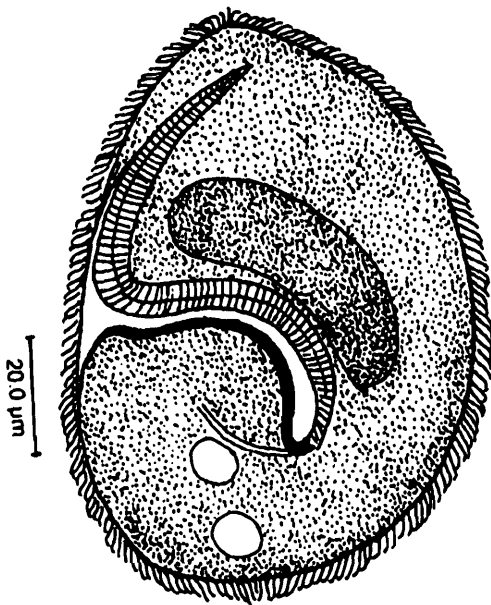


Fig. 181. *Nyctotheroides (N) ameroi*

Host : *Rana cyanophlyctis* : site of infection : rectum.

Distribution : India : Maharashtra (Aurangabad).

468. *Nyctotheroides (Nyctotheroides) indicum*
Shete, 1982
(Fig. 182)

1982. *Nyctotheroides (Nyctotheroides) indicum* Shete, Arch. Protistenk., 125 : 173-180.

Diagnosis : Body elongate-ovoid to elliptical, measuring 102.4-158.8 (139.3) μm $\times$ 71.0-107.6 (85.1) μm , with both ends broadly rounded,

anterior half slightly narrower than posterior half; both ventral and dorsal margin convex; entire body covered with a coat of uniform cilia; peristomial groove ventral, relatively narrow, short and restricted to the posterior half, peristome located slightly anterior of the middle; cytopharynx projected obliquely downwards or dorsalwards, forming 70° angle and measuring 58.5-71.0 (64.6) μm in length; macronucleus elongate-ovoid or irregular in shape, 32.4-50.1 (43.7) μm $\times$ 14.0-21.9 (17.7) μm , situated just above the cytopharynx; micronucleus not seen; cytopyege narrow tube-like, 15.4 μm in length extending obliquely across near the posterior end of the body.

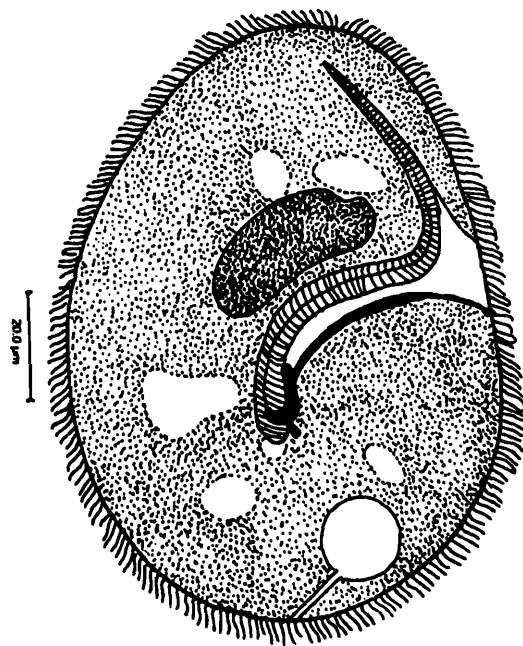


Fig. 182. *N (N) indicum*

Host : *Bufo melanostictus* : site of infection : rectum.

Distribution : India : Maharashtra (Aurangabad).

469. *Nyctotheroides (Nyctotheroides)*
ratnagiriensis Shete, 1982
(Fig. 183)

1982. *Nyctotheroides (Nyctotheroides) ratnagiriensis* Shete, Arch. Protistenk., 125 : 173-180.

Diagnosis : Body elliptical, measuring 76.3-99.3 (86.7) μm $\times$ 52.2-73.1 (62.0) μm , with anterior half bluntly triangular and posterior half almost hemispherical; ventral margin almost straight

compared to the conspicuously convex dorsal margin; entire body covered with parallel rows of uniform cilia; peristomial groove extending obliquely on the ventral side and peristome situated at or slightly behind the middle; cytopharynx directed downwards, forming 67-88° angle and measuring 43.9-76.2 (60.3) μm ; macronucleus quite elongated and somewhat banana-shaped, 32.4-48.0 (39.2) $\mu\text{m} \times 7.3$ -12.5 (9.9) μm , lying a little distance above the cytopharynx; micronucleus not seen; cytopye straight, delicate and narrow, measuring 11.5-24.0 (18.8) μm .

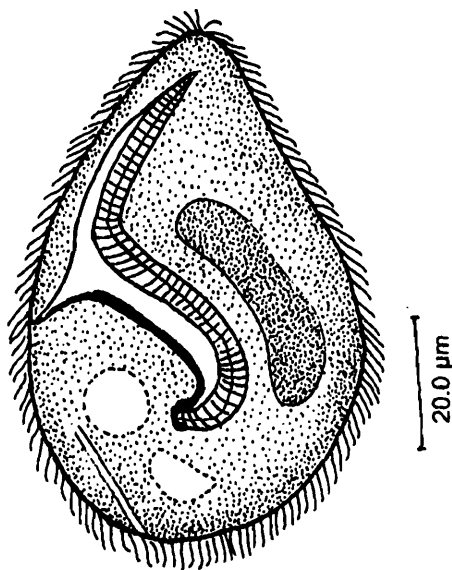


Fig. 183. *N (N) ratnagiriensis*

Host : *Rana cyanophlyctis* : site of infection : rectum.

Distribution : India : Maharashtra (Ratnagiri).

Subgenus *Aduncuperistomatus* Amaro and Sena, 1968

470. *Nyctotheroides* (*Aduncuperistomatus*) *aurangabadensis* Shete, 1982 (Fig. 184)

1982. *Nyctotheroides* (*Aduncuperistomatus*) *aurangabadensis* Shete, *Arch. Protistenk.*, **125** : 163-172.

Diagnosis : Body oval to elliptical, 145.2-200.6 (173.2) $\mu\text{m} \times 103.4$ -140.0 (125.3) μm , anterior end slightly pointed, while posterior end broadly rounded, posterior half slightly broader than the

anterior half; ventral margin somewhat flattened with slight depression in the middle. dorsal margin conspicuously convex; entire body covered with short uniform cilia; peristomial groove ventral and peristome located near the middle; cytopharynx typically J-shaped, projecting dorsalwards, forming 81° angle and measuring 76.3-123.3 (102.1) μm ; macronucleus elongated, 46.0-59.6 (54.3) $\mu\text{m} \times 16.7$ -25.0 (22.0) μm , lying obliquely above the cytopharynx; micronucleus not seen; cytopye relatively wider, very conspicuous and measuring 21.9-40.7 (32.0) μm in length.

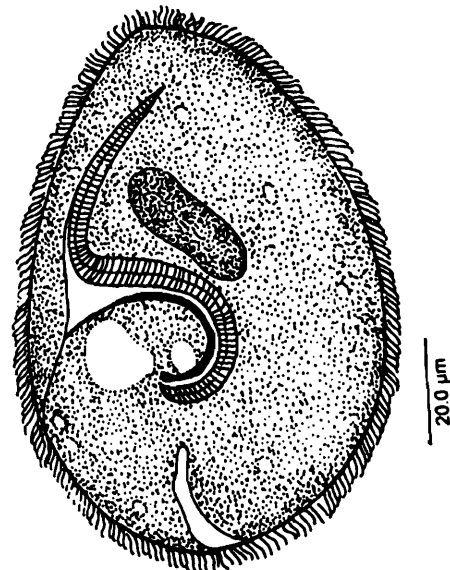


Fig. 184. *N (A) aurangabadensis*

Host : *Bufo melanostitus* : site of infection : rectum.

Distribution : India : Maharashtra (Aurangabad).

471. *Nyctotheroides* (*Aduncuperistomatus*) *cyanophlyctis* Shete, 1982 (Fig. 185)

1982. *Nyctotheroides* (*Aduncuperistomatus*) *cyanophlyctis* Shete, *Arch. Protistenk.*, **125** : 163-172.

Diagnosis : Body oval to elliptical, 123.3-208.9 (157.4) $\mu\text{m} \times 87.8$ -134.8 (105.3) μm , with both ends bluntly rounded, posterior half slightly broader than the anterior half; both margins convex, dorsal more convex than ventral margin; entire body covered with several parallel rows of

short uniform cilia; peristomial groove ventral and fairly long; peristome located near the middle; cytopharynx typically J-shaped, forming 80° angle and measuring 87.8-146.3(99.5) μm ; macronucleus 33.4-64.8 (44.5) μm $\times$ 16.7-31.3 (24.2) μm , characteristically notched dorsally and lying obliquely above the cytopharynx; micronucleus not seen; cytophyge Y-shaped.

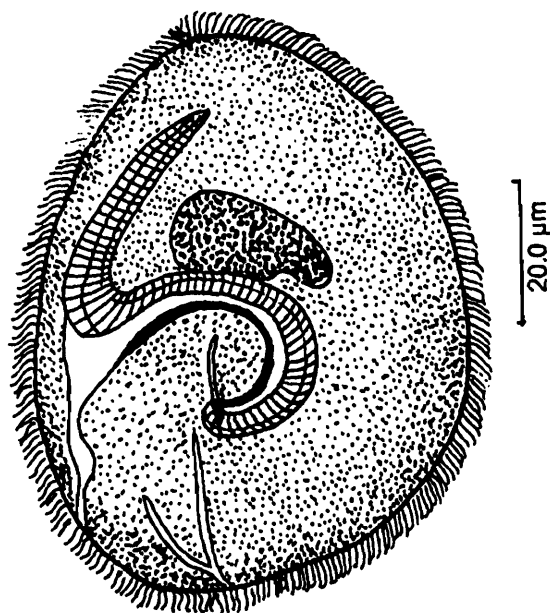


Fig. 185. *N (A) cyanophlyctis*

Host : *Rana cyanophlyctis* : site of infection : rectum.

Distribution : India : Maharashtra (Ratnagiri).

472. *Nyctotheroides (Aduncuperistomatus) marathwadensis* Shete, 1982
(Fig. 186)

1982. *Nyctotheroides (Aduncuperistomatus) marathwadensis* Shete, Arch. Protistenk., 125 : 163-172.

Diagnosis : Body typically egg-shaped or elliptical, 193.3-271.7 (227.3) μm $\times$ 116.0-149.4 (130.9) μm , with slightly pointed anterior end and a rounded posterior end; both margins typically convex; entire body covered with several rows of short uniform cilia; peristomial groove narrow; peristome located near the middle; cytopharynx typically J-shaped, forming 86° angle and measuring 186.0-225.7 (206.4) μm ; macronucleus 36.6-57.5 (45.1) μm $\times$ 20.9-31.3 (25.8) μm , broadly round ventral end and a pointed or notched

dorsal end, lying obliquely immediately above the cytopharynx; micronucleus not seen; cytophyge quite long.

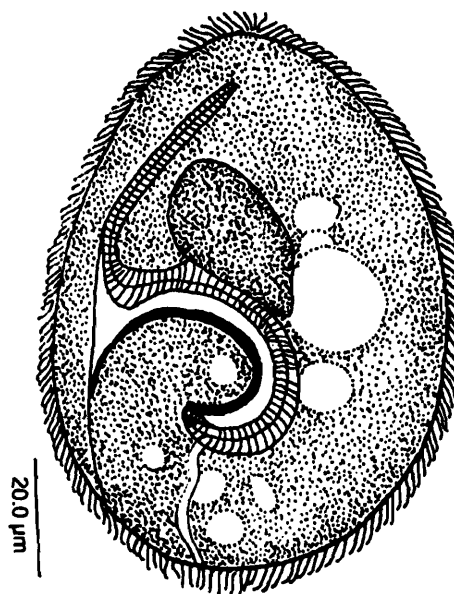


Fig. 186 *N (A) marathwadensis*

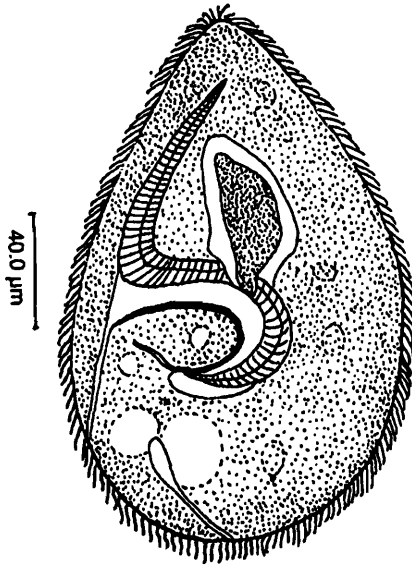
Host : *Rana tigrina* : site of infection : rectum.

Distribution : India : Maharashtra (Aurangabad).

473. *Nyctotheroides (Aduncuperistomatus) melanosticti* Shete, 1982
(Fig. 187)

1982. *Nyctotheroides (Aduncuperistomatus) melanosticti* Shete, Arch. Protistenk., 125 : 163-172.

Diagnosis : Body typically elliptical, 131.7-169.3 (147.0) μm $\times$ 92.0-113.9 (103.8) μm , anterior half triangular and bluntly rounded, posterior half semispherical; both margins smoothly convex, dorsal more curved than ventral margin; entire body covered with short and uniform cilia; peristomial groove ventral and fairly long; peristome located near the middle; cytopharynx typically J-shaped, forming 74° angle and measuring 74.2-107.6 (92.8) μm ; macronucleus somewhat triangular or irregular, 31.3-52.2 (38.0) μm $\times$ 13.6-31.3 (21.2) μm , somewhat pointed while the posterior-dorsal end broader with a typical notch, lying obliquely above the cytopharynx; micronucleus not seen; cytophyge narrow, long and delicate.

Fig. 197. *N (A) melonosticti*

Host : *Bufo melanostictus* : site of infection : rectum.

Distribution : India : Maharashtra (Aurangabad).

Family SICUOPHORIDAE

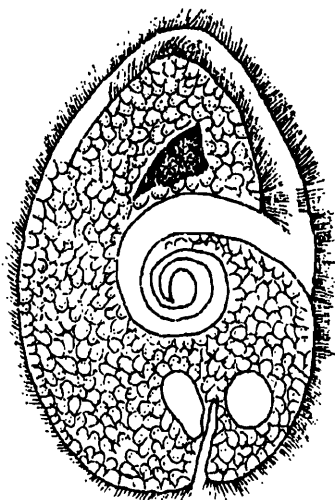
Geuns *Sicuophora* de Puytorac and Grain, 1969

474. *Sicuophora macropharyngea*
(Bezenberger, 1904)

(Syn. *Nyctotherus macropharyngeus*
(Bezenberger, 1904)
(Fig. 188)

1904. *Nyctotherus macropharyngeus* Bezenberger, Arch. Protistenk., 3 : 138.

1973. *Sicuophora macropharyngea* : Albert, J. Protozool., 20 : 51-57.

Fig. 188. *Sicuophora macropharyngea*

Diagnosis : Body oval, 225 μm $\times$ 134 μm in dimension; infundibulum forming a coil in two to two and a half spiral turns; adhesive organelle extending over entire body surface with distinct fibrillar structures; macronucleus oval, cone-shaped or pentagonal; cytoproct narrow and cleft-like.

Host : *Rana tigrina*; site of infection : rectum.

Distribution : India : Maharashtra (Mumbai), Andhra Pradesh.

Remarks : Bezenberger (1904) reported this species from this state.

GENERAL REMARKS ON DISTRIBUTION

Distribution of parasites is associated with the distribution of hosts even though the host may be infected far away from the site of actual collection of hosts. In this document district-wise distribution of parasitic protozoan species so far recorded from the state of Maharashtra is furnished. The species-wise distribution at the district level has been shown under respective parasitic species in the systematic account. However, the extent of work done and the protozoan parasites recorded at the district level from this state indicated using serial number of the species given in the systematic list and systematic account is summarized hereunder :

1. **Ahmednagar district** : AP : 335 = 1; Total = 1.
2. **Amaravati district** : AP : 260 = 1; Total = 1.
3. **Aurangabad district** : SA : 1, 16, 21-23, 26-28, 53, 55-58, 60, 61, 63-65, 72-85, 87-97, 99-102, 113-124, 126-128, 132-139, 141, 142, 149-151, 153, 154, 156-161, 164, 169, 170, 172-178, 181-183, 185, 186 = 99; AP : 188, 189, 235-238, 240-282, 285-294, 298, 301, 302, 414, 421, 422 = 65; CI : 455-464, 466-468, 470, 472 = 15; Total = 179.
4. **Beed district** : SA : 40 = 1; AP : 198-200, 203-209 = 10; Total = 11.
5. **Chandrapur** : SA : 37 = 1; Total = 1.
6. **Jalgaon district** : AP : 233 = 1; Total = 1.
7. **Mumbai district** : SA : 165 = 1; AP : 191-197, 215, 217, 229, 232, 284, 295-297, 299,

- 300 = 17; MY : 423 = 1; CI : 465, 474 = 2; Total = 21.
8. Nagpur district : AP : 339, 332 = 2; Total = 2.
9. Nanded district : SA : 53, 55-58, 72, 74-77, 82-84, 85, 88, 114, 115, 117, 132-137, 138, 149-151, 153, 154, 156, 157, 170, 172-174, 178 = 35; Total = 35.
10. Osmanabad district : SA : 98 = 1; Total = 1.
11. Parbhani district : SA : 1, 3, 5, 7, 9-12, 17-19, 24, 25, 30, 39, 86, 166 = 18; AP : 272, 304-307 = 5; Total = 23.
12. Pune district : SA : 31 = 1; AP : 187, 188 = 2; Total = 3.
13. Raigad district : AP : 188, 189 = 2; Total = 2.
14. Ratnagiri district : SA : 184 = 1; AP : 230 = 1; CI : 469, 473 = 2; Total = 4.
15. Solapur district : SA : 8, 28, 29 = 3; Total = 3.
16. Thane district : AP : 188, 189 = 2; Total = 2.
17. Wardha district : MY : 451 = 1; Total = 1.
18. Marathwada region (unspecified) : SA : 13-15, 37-39, 45-47 = 9, AP : 411 = 1; Total = 10.
19. Maharashtra (unspecified) : SA : 32-36, 41-44, 48-52, 54, 59, 62, 66-71, 103-112, 125, 129-131, 143-146, 148, 152, 154, 162, 163, 167, 168, 180 = 48; AP : 210-2214, 216, 218-228, 310-324, 326, 329-331, 334, 336, 339-409, 412, 413, 415-417 = 114; MY : 424-453 = 30; CI : 463 = 1; Total = 193.

Note : AP = Apicomplexa, CI = Ciliophora, MY = Myxozoa, SA = Sarcocystis

DISTRICT-WISE DISTRIBUTION

The district-wise distribution of protozoan parasites including unspecified locality from Maharashtra is shown in Table 1. It is seen that 17 out of 33 districts have been listed for protozoan parasites. Infections from hosts with one or more species were recorded from 10 districts only though all the districts are supposed to harbour

some of human inhabiting malarial and intestinal parasites for their widespread occurrence throughout the state as well as the country. This is mainly due to infection of two intestinal (*Entamoeba histolytica* and *Giardia intestinalis*) and three malarial parasites (*Plasmodium falciparum*, *P. malariae* and *P. vivax*) in human host. The representation of parasite species and or host in the remaining districts indicates dearth of thorough survey from the state. Of the 17 districts, Aurangabad represents the highest of 179 protozoan parasites embracing 4 phyla followed by Nanded (35 species belonging to single phylum Sarcocystis), which is evidently due to localized concentration of study in and around Aurangabad district where workers from Marathwada University had made their intensive study for obvious reasons. The remaining districts show less representation of protozoan species (often by a single species) indicating under exploration of these districts from this state (Figs. 189-192).

Table 1. District-wise distribution of species belonging to different phyla

Districts	Sarcocystis phyla	Apicom- plexa	Myxo- zoa	Cilio- phora	Total
Ahmednagar	-	1			1
Amaravati		1	-		1
Aurangabad	99	65		15	179
Beed	1	10	2	-	11
Chandrapur	1	-	-		1
Jalgaon	-	1	-		1
Mumbai	1	17	1	2	21
Nagpur		2			2
Nanded	35				35
Nasik		9	-		9
Osmanabad	1				1
Parbhani	18	5	-		23
Pune	1	2	-	-	3
Raigad		2	-	-	2
Ratnagiri	1	1	-	2	4
Solapur	3	=	-	-	3
Thane		2			2
Wardha			1	-	1

GROUP-WISE DISTRIBUTION

Protozoan phyla-wise distribution of protozoan parasites from Maharashtra in terms of number of families, genera and species is presented in Table 2. It clearly reveals the representation of two phyla viz., Sarcemastigophora and Apicomplexa in higher diversity. Host group-wise distribution of host species and protozoan species is depicted in Table 3, which shows that 78 species of Aves harboured infection with protozoan parasites from the state, followed by Pisces (44 species), while highest number of protozoan species recorded from birds (128 species) followed by mammals (84 species).

Table 2. Distribution of parasitic protozoa from Maharashtra

Phyla/Subphyla	Number of protozoan taxa		
	Family	Genera	Species
Phylum Sarcemastigophora	12	22	186
Subphylum Mastigophora	10	19	183
Subphylum Opalinata	1	1	1
Subphylum Sarcodina	1	1	2
Phylum Apicomplexa	17	29	236
Phylum Myxozoa	4	4	32
Phylum Ciliophora	4	5	20
Total	52	86	474

Table 3. Group-wise distribution of host species harbouring parasitic protozoa from Maharashtra

Host group	Host species	Parasite species
Oligochaeta	5	9
Crustacea	1	3
Insecta	25	78
Arachnida	1	1
Myriapoda	4	10
Pisces	44	68
Amphibia	4	48
Reptilia	23	50
Aves	78	128
Mammalia	17	84
Total	242	474

In overall, 242 species of invertebrate and vertebrate hosts belonging to 10 major groups are recorded to harbour 474 species of protozoan parasites. Of the 242 host species, 36 species belong to invertebrates and 206 represent vertebrate hosts. Most of these host species were reported to harbour one or two parasites, while two species of invertebrates viz., *Periplaneta americana* and *Oryctes rhinoceros* and 7 species of vertebrates viz., *Bufo melanostictus*, *Rana cyanophlyctis*, *Rana tigrina*, *Bos indicus*, *Ovis aires*, *Bubalus bubalis* and *Capra hircus*, are recorded as host for 10 or more protozoan parasites from the state.

SUMMARY

1. A comprehensive systematic account of 474 species of parasitic protozoa belong to the four phyla viz., Sarcemastigophora (186 species), Apicomplexa (236 species), Myxozoa (32 species) and Ciliophora (30 species) from Maharashtra state is provided.
2. A total of five species of coccidian parasites viz., *Eimeria hemidactyli*, *E. knowlesi*, *E. columbae*, *E. debliciecki* and *E. zuernii* constitute first report from this state.
3. A systematic list of 474 species of parasitic protozoa along with their hosts and locality is also furnished.
4. A host-parasite list with references is also provided.
5. District-wise, phyla-wise and host-group-wise distribution of species are discussed.

ACKNOWLEDGEMENT

The authors are thankful to the Director, Zoological Survey of India and to the Head of the Department of Zoology of Andhra University and Dr. B.A. Marathwada University for facilities provided for this work to respective contributors of this document. Thanks are also due to Ms. Mousumi Roy for her technical help in finalizing this manuscript.

REFERENCES

- Advant, S.B., Shete, S.G. and Madre, V.E. 1981. A preliminary report on an interesting species of *Balantidium* Claparde and Lachmann, 1858 from the frog *Rana cyanophlyctis*. *Proc. All. India Symp. On "Perspectiveve in Research on Protozoa"* Aurangabad, p. 33.
- Aiyar, K.R.S. 1937. The occurrence of coccidian in dogs at Bombay. *Indian vet. J.*, **14** : 139-142.
- Aiyar, K.R.S. 1937. The occurrence of coccidian in dogs at Bombay. *Proc. Indian Sci Congr.*, p. 402.
- Ali, M.S., Singh, B., Chhabra, M.B. and Samad, A. 1981. Prevalence of *Toxoplasma* antibodies in sheep, goats and human in Marathwada region of Maharashtra. *Proc. All India Symp. On "Perspectiveve in Research on Protozoa"*, Aurangabad, pp. 10-11.
- Amoji, S.D. and Rodgi, S.S. 1972. New species of gregarine, *stenophora mahabaleshwari* sp. nov. from the millipade, *strongylosoma* sp. *J. Karnatak Univ.*, **17** : 96.
- Baker, J.R. 1976. Biology of the trypanosomes of birds. In : *Biology of the Kinetoplastida* (Eds. W.H.R. Lumsden and D.A. Evans). Academic Press, London, **1** : 131-174.
- Ball, G.H. 1957. A haemogregarine in the water snake *Coluber karolini* from the vicinity Bombay, Inda. *J. Protozool.*, **4** Suppl., **6** : 108-110.
- Ball, G.H. 1958. A haemogregarine from a water snake *Natrix piscator* taken in the vicinity Bombay, Inda. *J. Protozool.*, **5**(4) : 274-281.
- Ball, G.H. 1959. Some gregarines from crustaceans taken near Bombay, Inda. *J. Protozool.*, **6** : 8-13.
- Bennett, G.F. 1978. Avian Haemoproteidae. 8. The haemoproteids of the bee-eater family (Meropidae). *Can. J. Zool.*, **56** : 1721-1725.
- Bennett, G. F. 1980. Avian Haemoproteidae. 14. The haemoproteids of the avian family Rallidae. *Can. J. Zool.*, **58** : 321-325.
- Bennett, G. F. 1989. New species of haemoproteids from the avian families Paridae and Sittidae. *Can. J. Zool.*, **67** : 2685-2688.
- Bennett, G.F. and Bishop, M.A. 1992. *Host-parasite catalogue of the avian haematozoa, Supplement 1 and Bibliography of avian blood-inhabiting Protozoa, Supplement 2*. Memorial University of Newfoundland, Occasional Papers in Biology, No. **15**, : 246.
- Bennett, G.F., Bishop, M.A. and Peirce, M.A. 1991. The species and distribution of the haemoproteids of the avian family Muscicapidae *sensu latu* (Passeriformes). *J. Nat. Hist.*, **25** : 23-43.
- Bennett, G.F., Bishop, M.A. and Peirce, M.A. 1993. Checklist of the avian species of *Plasmodium* Marchiafava & Celli, 1885 (Apicomplexa) and their distribution by the avian family and Wallacean life zones. *Syst. Parasitol.*, **26** : 171-179.
- Bennett, G.F., Earle, R.A. and Peirce, M.A. 1993. The Leucocytozoidae of South African Birds : Musophagiformes, Cuculiformes and Piciformes. *Ostrich*, **64** : 73-78.
- Bennett, G.F., Greiner, E.C. and Campbell, A.G. 1975. Avian Haemoproteidae. 5. The haemoproteids of the family Threskiornithidae. *Can. J. Zool.*, **53** : 634-638.
- Bennett, G.F. and Nandi, N.C. 1981. Avian Haemoproteidae. 16. The haemoproteids of the avian family Capitonidae (the barbets). *Can. J. Zool.*, **59** : 2064-2071.
- Bennett, G.F. and Peirce, M.A. 1981. Avian Haemoproteidae. 15. The haemoproteids of the avian family Zosteropidae. *Can. J. Zool.*, **59** : 1165-1160.

- Bennett, G.F. and Peirce, M.A. 1988. Morphological form in the avian Haemoproteidae and an annotated checklist of the genus *Haemoproteus* Kruse, 1890. *J. Nat. Hist.*, **22** : 1683-1696.
- Bennett, G.F. and Peirce, M.A. 1990. The haemoproteid parasites of the pigeons and doves (family Columbidae). *J. Nat. Hist.*, **24** : 311-325.
- Bennett, G.F. and Peirce, M.A. 1991. The haemoproteids of the Old World avian families Alaudidae (larks), Irenidae (leaf birds), and Motacillidae (wagtails and pipits). *J. Nat. Hist.*, **24** : 939-947.
- Bennett, G.F., Peirce, M.A. and Earle, R.A. 1990. The haemoproteids of the shrikes of the avian family Laniidae (Passeriformes). *S. Afr. J. Zool.*, **25**(3) : 194-198.
- Bennett, G.F., Peirce, M.A. and Earle, R.A. 1994. An annotated checklist of the valid avian species of *Haemoproteus*, *Leucocytozoon* (Apicomplexa : Haemosporida) and *Hepatozoon* (Apicomplexa : Haemogregarinidae). *Syst. Parasitol.*, **29** : 61-73.
- Bennett, G.F., Whiteway, M.A. and Woodworth-Lynas, C.B. 1982. *Host-parasite catalogue of the avian haematozoa*. Memorial University of Newfoundland, Occasional Papers in Biology, No. **5** : 243.
- Berestneff, N. 1903. "Über ainer neuer Blutparasiten der indischen Fresche" *Arch. Protistenk.*, **2** : 334-348.
- Bezenberger, E. 1904. Ueber Infusorien aus Asiotischen Anuren. *Arch. Protistenk.*, **3** : 138.
- Bhaskar Rao, T., 1969. The morphology and incidence of the genus *Monocercononoides* (Grassi, 1879) Travis, 1932 of insects found in Andhra Pradesh. *Proc. Indian Acad. Soc. (B)*, **70** : 208-214.
- Bhaskar Rao, T., Bhaskar Rao, T.S. and Devi, A. 1976. *Chilomastix hemidactyli* n.sp. from a lizard *Hemidactylus* of warongal, A.P., India. *Acta Protozool.*, **15**(3) : 289-292.
- Bhatia, B.L. 1936. *The Fauna of British India, including Ceylon and Burma. Protozoa : Ciliophora*. Taylor and Francis, London.
- Bhatia, B.L. 1938. *The Fauna of British India, including Ceylon and Burma. Protozoa : Sporozoa*. Taylor and Francis, London.
- Bhatia, B.L. and Chatterjee, G.B. 1925. On some gregarinee parasites of Indian earthworms. *Arch. Protistenk.*, **52** : 189-206.
- Bhatia, B.L. and Gulati, A.N. 1927. On some parasitic ciliates from Indian frogs, toads, earthworms and cockroaches. *Arch. Protistenk.*, **57** : 85-120.
- Bhatia, B.L. and Setna, S.B. 1926. On some more gregarine parasites of Indian earthworms. *Arch. Protistenk.*, **53** : 361-377.
- Bishop, M.A. and Bennett, G.F. 1986. Avian Haemoproteidae. 23. The haemoproteids of the avian family Coraciidae (rollers). *Can. J. Zool.*, **64** : 1860-1863.
- Bishop, M. and Bennett, G.F. 1990. The haemoproteids of the avian families Corvidae (crows and jays) and Sturnidae (starlings and mynas) (Passeriformes). *Can. J. Zool.*, **68** : 2251-2256.
- Bosanquet, W.C. 1910. Brief notes on two myxosporidian organisms (*Pleistophora hippoglossoides* n. sp. and *Myxidium mackiei* n. sp.). *Zool. Anz.*, **35** : 434-438.
- Berestneff, N. 1903. "Übereinen neuen Blutparasiten der indischen Frosche" *Arch. Protistenk.*, **2** : 334-338.

- Bezenberger, E. 1904. Uber infusorien aus asiatischen anuren. *Arch. Protistenk.*, **3** : 138-174.
- Bray, R.S. 1958. On the parasite protozoa of Liberia. 1. Coccidia of some small mammals. *J. Protozool.*, **5** : 81.
- Chakravarty, M. and Kar, A.B. 1945. Studies on Haemosporidia from Indian birds. Series 1. *J. R. Asiat. Soc. Bengal Sci.*, **11** : 36-39.
- Chakravarty, M. and Kar, A.B. 1947. Oversvations on two reptilian coccidia. *J. R. Asiat. Soc. Bengal*, **12** : 3-5.
- Corliss, J.O. 1979. *The Ciliated Protozoa : Characterization, Classification and Guide to the Literature*. 2nd Edition, Pergmon Press, Oxford, New York, etc., ix+459.
- Das, A.K., Mandal, A.K., Nandi, N.C., Nandi, R. and Sarkar, N.C. 1993. Parasitic Protozoa. *Fauna of West Bengal, State Fauna Series*, **3**(Part 12) : 135-467.
- Deshpande, A.V., Shastri, U.V. Deshpande, M.S., Deshpande, P.D. and Pathak, S.V. 1981. Prevalence of gastrointestinal parasites of dogs in Parbhani town (Maharashtra state) *Proc. All. India Symp. On "Perspectiveve in Research on Protozoa"*, Aurangabad, p. 19.
- Dhanda, V. and Mourya, D.T. 1981. *Lankesteria* spp. (Eugregarinida; Diplocystidae) parasitizing mosquitoes in Maharashtra state. *Indian J. Parasitol.*, **5**(20) : 211-214.
- Dhoot, V.M., Upadhye, S.V. and Kolte, S.W. 2002. Prevalence of parasitism in wild animals and birds of Maharajbag Zoo, Nagpur. *Indian vet. J.*, **79**(3) : 225-227.
- Donavan, N.C. 1920 Malaria of monkeys at the foot of the Nilgiris. *Indian J. Med. Res.*, **7** : 717-721.
- Garnhaam, P.C.C. 1966. *Malaria parasites and other Haemosporidia*. Blackwell Scientific Publications, Oxford, 1114 pp.
- Gatne, M.L. and Narsapur, V.S. 1992. Record of *Eimeria leuckarti* (Flesch 1881) Reichenow 1940, in a horse in Bombay. *Indian vet. J.*, **69**(2) : 169.
- Gawande, G.M. 1987. Morphology and systematics of Opalinales from Amphibia. Ph.D. Thesis, Marathawada University (Unpublished), 169 pp.
- Gill, B.S., 1954. Speciation and viability of poultry coccidia in 120 faecal samples preserved in 2.5 percent potassium dichromate solution. *Indian J. vet. Sci.*, **24**(4) : 245-247.
- Gill, B.S., 1954. On the pathogenicity of *Eimeria acervulina* (Tyzzer, 1929) to susceptible poultry. *Indian vet. J.* **31** : 95-98.
- Gill, B.S. 1956. Coccidiosis of chicks. *Indian vet. J.*, **32** : 350-355.
- Gill, B.S. 1961. Incidence of *Eimeria necatrix* infection in Indian Poultry. *Indian J. Vet. Sci.*, **31** : 304-307.
- Gill, B.S. 1968. The coccidian oocysts (Protozoa : Sporozoa) of Indian cattle. *Proc. zool. Soc. calcutta*, **21** : 101-121.
- Gill, B.S. 1973. On the validity of *Eimeria bomayensis* Rao and Hiregauder, 1953-1954, *E. khurodensis* Rao and Hiregauder, 1953-1954, *E. aereyi* Rao and Bhatwadekar, 1959 and *Eimeria mundurgi* Hiregauder, 1956, *E. weymingensis* Huizing and Winger, 1942 and *E. bukidnonensis* Tubanghi, 1931 of cattle and *Eimeria gokaki* Rao and Bhatwadekar, 1959 of buffalos. *Agric. Univ. J. Res.*, **10** : 442-453.

- Gill, B.S., Chhabra, M.B. and Lall, N.B. 1963. A new coccidium—*Eimeria bareillyi* n. sp. from buffaloes. *Arch. Protistenk.*, **106** : 571-574.
- Gill, B.S. and Ray, H.N., 1957. Life cycle and cytology of *Eimeria tenella* Rallict and Lucet, 1891 (Protozoa : Sporozoa) with notes symptomology and pathology of the infection. *Proc. zool. Soc. Calcutta Mukherjee Memori*, vol. pp. 337-383.
- Gill, B.S. and Ray, H.N. 1960. The coccidia of domestic rabbit and the common field har of India. *Proc. zool. Soc., Calcutta*, **13** : 128-143.
- Gupta, K.R., Dhariwal, V.K., Jain, A.C., Shiv, D.C. 2007. A rare case of trypanosomiasis in a two month old infant in Mumbai, India. *J. Commun. Dis.*, **39**(2) : 71-74.
- Greiner, E.C., Bennett, G.F., Herman, C.M. and Laird, M. 1975. Avian Haematozoa. Taxonomic keys and colour pictorial guide to species of *Plasmodium*. *Wildl. Dis.*, **68** : 1-58.
- Halwani, A. 1930. On a new species of *Eimeria* (*E. southwelli*) from *Aetobatis narinari*. *Ann. Trop. Med. Parasit.*, **24** : 1-3.
- Halwani, A. 1930. A new coccidium *Eimeria southwelli* from a shark. *Trans. Roy. Soc. Trop. Med. Hyg.*, **23** : 326.
- Hiregauder, L.S. 1956a. A new species of *Eimeria* from a cow calf in Bombay state. *Curr. Sci.*, **25** : 197.
- Hiregauder, L.S. 1956b. A record of *Globidium leuckarti* (Flesch) from a horse in India. *Curr. Sci.*, **25** : 334-335.
- Hiregauder, L.S. and Rao, S.R. 1966. Further observations on the occurrence and distribution of *Eimeria bukidnonensis* Tubanghi, 1931 with *Eimeria khurodensis* Rao and Hiregauder, 1954. *Indian vet. J.*, **43** : 782-785.
- Jadhav, V.D., Nikam, S.R., Shaikh, J.D. and Pakale, S.S. 2001. Prevalence of incidence of coccidia in goats from Marathwada region, Maharashtra. *Dr. B. A. M. U. J. Sci.*, **31**(8) : 35-38.
- Janakidevi, K. 1961. A new species of *Hexamastix* (Protozoa) Parasitic in the Spiny tailed lizard, *Uromastix hardwicki*. *Z. Parasitenk.*, **21** : 151-154.
- Janakidevi, K. 1961. A new ciliate from the Spiny tailed lizard. *Z. Parasitenk.*, **21** : 155-158.
- Janakidevi, K. 1961. A new species of *Proteromonas* from the Spiny tailed lizard. *Arch. Parasitenk.*, **105** : 450-454.
- Joshi, P.P., Shegokar V., Powar, S., Herder, S., Katti, R., Salkar, S., Dani, V., Bhargava, A., Jammin, J., Truc, P., 2005. Human trypanosomiasis caused by *Trypanosoma evansi* in India : the first case report. *Am. J. Trop. Med. Hyg.*, **73** : 491-495.
- Kalyankar, S.D., Vyas, G.H. and Sapre, M.A. 1981. Preliminary observations of *Entamoeba histolytica* and *Entamoeba coli* in Aurangabad. *Proc. All. India Symp. On "Perspectiveve in Research on Protozoa"*, Aurangabad, pp. 6-7.
- Kalyankar, S.D., Vyas, G.H., Sapre, M.A. and Kotambe, D.S. 1981. A report on giardiasis in Aurangabad. *Proc. All. India Symp. On "Perspectiveve in Research on Protozoa"* Aurangabad, pp. 8-9.
- Karandikar, K.R. and Rodgi, S.S., 1956. Ciliates and flagellates from the millipedes of Bombay-Karnatak. *Jour. of the Univ. of Bombay*, **25** : 1-11.

- Khulda, J. and Lom, J. 1964. Remarks on diplomastigine flagellates from the intestine of fishes. *Parasitology*, **54** : 753-762.
- Knowles, R. and Das Gupta, B.M. 1935. The coccidian of lizards. *Indian J. Med. Res.*, **22** : 701-707.
- Knowles, R., White, R.S. and Das Gupta, B.M. 1930. Studies in the parasitology of malaria. *Indian Med. Res.*, **18** : 1-436.
- Kreier, J.P. ed. 1978. *Parasitic Protozoa*. Vol. I-IV, Academic Press, New York.
- Kreier, J.P. and Baker, J.R. eds. 1994. *Parasitic Protozoa*. Vol. I-VIII, Academic Press, New York.
- Krishnamurthy, R. 1963. On a new species of *Proteromonas* from the *Chameleor*. *J. biol. Sci.*, **6** : 14-18.
- Krishnamurthy, R. 1967. A note on the occurrence of *Proteromonas chameleoni* Krishnamurthy, 1963 (Protozoa : Mastigophora). *J. Bombay Nat. Hist. Soc.*, **64**(3) : 582-583.
- Krishnamurthy, R. 1967. A new flagellate of the genus *Monocercomonas* Grassi, 1879 from the green snake in India. *Riv. Parasitol.*, **28**(4) : 161-164.
- Krishnamurthy, R. 1967. The morphology of *Trichomitus batrachorum* (Party, 1852) Honigberg, 1963 from two squamate reptiles *Eryx johnii* and *Varanus* sp. *Curr. Sci.*, **36**(24) : 672-674.
- Krishnamurthy, R. 1967. Two new species of the genus *Monocercomonoides* Travis, 1932 (Protozoa : Mastigophora) from reptiles. *Proc. Indian Acad. Sci.*, **66** : 184-191.
- Krishnamurthy, R. 1968. A new flagellate of the genus *Proteromonas* Kunstler, 1883 from an Indian Lizard. *Parasitology*, **58** : 531-534.
- Krishnamurthy, R. 1968. Studies on the morphology of the monocercomonad flagellates from reptiles in India. I. Parasites of snakes. *Riv. Parassitol.*, **29**(1) : 1-16.
- Krishnamurthy, R. 1968. Studies on the morphology of the monocercomonad flagellates from reptiles in India. II. Parasites of lizards. *Riv. Parassitol.*, **29**(2) : 81-90.
- Krishnamurthy, R. 1968. Studies on the morphology of the monocercomonad flagellates from reptiles in India. III. A review, with a key to the species. *Riv. Parassitol.*, **29**(4) : 233-240.
- Krishnamurthy, R. 1969. A new flagellate, *Rhizomastix ranae* from the rectum of common frog, *Rana tigrina*, *Marth. Univ. J. Sci.*, **8** : 133-136.
- Krishnamurthy, R. 1970. A brief review of the genus *Proteromonas* Kunstler, 1883 (Protozoa : Mastigophora), with key to the species. *Marathwada Univ. J. Sci.*, **9** : 117-120.
- Krishnamurthy, R. 1970. Description of a new flagellate (Protozoa : Mastigophora) *Chilomastix qadrii* n.sp. from frogs in India. *Ann. Parasitol. Hum., Comp.*, **45**(3) : 261-265.
- Krishnamurthy, R. and Bawazir, S.S. 1981. Morphological variations in the oocyst of *Eimeria ovina* Levine and Ivens, 1970. *Proc. Indian Acad. Parasit.*, **2** : 16-19.
- Krishnamurthy, R. Bawazir, S.S. and Nikam, S.R. 1981. Prevalence of coccidian in sheep in the Marathwada region—An analysis. *Proc. All. India Symp. On "Perspectiveve in Research on Protozoa"* Aurangabad, p. 17.
- Krishnamurthy, R., Bhosale, V.M. and Iyer, S.V. 1981. A record of *Isospora* sp. from the swift (*Micropus affinis* Gray). *Proc. All. India Symp. On "Perspectiveve in Research on Protozoa"*, Aurangabad, p. 31.

- Krishnamurthy, R. and Deshmukh, P.B. 1971. The description of a new protozoan of the genus *Monocercomonas* from a lizard. *Marathwada Univ. J.*, **10**(3) : 109-112.
- Krishnamurthy, R. and Deshmukh, P.B. 1981. Flagellates of the genus *Pentatrichomonas* Mesnil, 1914 occurring in birds in Maharashtra. *Proc. All. India Symp. On "Perspectiveve in Research on Protozoa"*, Aurangabad, p. 26.
- Krishnamurthy, R. and Kshirsagar, H.S. 1976. Incidence of coccidia in goats of Marathwada region (Maharashtra). *Nat. Sci. J. Marathwada Univ.*, **15**(8) : 153-156.
- Krishnamurthy, R. and Kshirsagar, H.S. 1978. A comparative study of the prevalence of coccidian in goats in India with a note on their pathogenecity. *Proc. Asian Congr. Paraitol.*, pp. 22-23.
- Krishnamurthy, R. and Kshirsagar, H.S. 1978. Studies on variations in the seasonal incidence of some coccidia of goats in the Marathwada region (Maharashtra). *Proc. Asian Congr. Paraitol.*, p. 194.
- Krishnamurthy, R. and Kshirsagar, H.S. 1980. Two new species of *Eimeria* Schneider, 1875, from rats in India. *Arch. Protistenk.*, **123** : 215-220.
- Krishnamurthy, R., Lalpotu, P.A. and Iyer, S.V. 1981. *Protoptychostomum* sp. (Thigmotricha : Hysteroecinetidae) the first record from an Indian Oligochaete. *Proc. All. India Symp. On "Perspectiveve in Research on Protozoa"* Aurangabad, pp. 32-33.
- Krishnamurthy, R. and Madre, V.E. 1975. A preliminary report on the incidence of flagellates (Protozoa : Mastigophora) in amphibians and reptiles of Marathwada region. *Marathwada Univ. J. Sci.*, **14**(7) : 219-222.
- Krishnamurthy, R. and Madre, V.E. 1976. *Retortamonas viperae* n. sp., a new flagellate from the rectum of a viper. *Nat. Sci. J. Marathwada Univ.*, **15**(8) : 129-131.
- Krishnamurthy, R. and Madre, V.E. 1977. A new trichomonad flagellate *Trichomitus granulatus* n. sp. from the rectum of the frog, *Rana cyanophlyctis* in Maharashtra, India. *Proc. Nat. Congr. Parasitol.*, p. 15.
- Krishnamurthy, R. and Madre, V.E. 1979. Studies on the morphology of three new species of monocercomonad flagellates from amphibians in India. *Arch. Protistenk.*, **121** : 64-72.
- Krishnamurthy, R. and Madre, V.E. 1979. Studies on two flagellates of the genus *Monocercomonoides* Travis, 1932 (Mastigophora : Polymastigina) from amphibians and reptiles in India. *Acta Protozool.*, **18**(2) : 251-257.
- Krishnamurthy, R. and Shastry, U.V. 1976. Studies on *Eimeria bareillyi* Gill, Chhabra and Lall, 1963 from buffalo calves in Maharashtra, India. *Riv. Parassitol.*, **37** : 71-77.
- Krishnamurthy, R. and Shete, S.G. 1981. Observations on the rectal flagellates of Indian amphibians I. Genus : *Hexamitus* Dujardin, 1838. *Arch. Protistenk.*, **124** : 391-397.
- Krishnamurthy, R. and Shete, S.G. 1981. Observations on the rectal flagellates of Indian amphibians II. Genus : *Monocercomonas* Grassi 1879. *Arch. Protistenk.*, **124** : 398-404.
- Krishnamurthy, R. and Shete, S.G. 1981. Observations on the rectal flagellates of Indian amphibians III. Genus : *Trichomitus* Swezy, 1915. *Arch. Protistenk.*, **124** : 405-409.
- Krishnamurthy, R. and Sultana, T. 1972. A preliminary report on the incidence of flagellates (Protozoa : Mastigophora) in arthropods of Maharashtra. *Marathwada Univ. J. Sci. (Biol. Sci.) (B)*, **11**(4) : 147-150.

- Krishnamurthy, R. and Sultana, T. 1976a. The morphology of *Monocercomonoides chakravartii* n. sp. (Protozoa : Mastigophora) from the gut of the insect *Polyphaga indica*. *Curr. Sci.*, **35** : 184-186.
- Krishnamurthy, R. and Sultana, T. 1976b. The morphology of two new flagellates of the genus *Monocercomonoides* Travis, 1932 from insects in India. *Proc. Indian Acad. Sci.*, **84** : 109-115.
- Krishnamurthy, R. and Sultana, T. 1976. *Tubulimonoides gryllotalpae* n. g. n. sp. (Mastigophora : Oxymonadida) from the cricket in India. *Proc. Indian Acad. Sci.*, **84B**(4) : 137-140.
- Krishnamurthy, R. and Sultana, T. 1976. Two new flagellates of the genus *Monocercomonas* Grassi, 1879 (Protozoa : Mastigophora) from insects in India, with key to the species. *Nat. Sci. J. Marathawada Univ.*, **15**(8) : 133-141.
- Krishnamurthy, R. and Sultana, T. 1977. The flagellates of the genus *Monocercomonoides* Travis, 1932 (Mastigophora : Oxymonadida) from insects in India – A review, with a key to the species. *Proc. Zool. Soc. Calcutta*, **32** : 51-55.
- Krishnamurthy, R. and Sultana, T. 1977. Studies on two flagellates of the genus *Monocercomonoides* Travis, 1932 from the gut of the dung beetle larva (*Oryctes rhinoceros*) in India. *Arch. Protistenk.*, **119** : 121-126.
- Krishnamurthy, R. and Sultana, T. 1977. New flagellate *Hexamastix marathwadensis* sp. n. from an insect *Polyphaga indica*. *Acta Protozool.*, **16**(3/4) : 219-223.
- Krishnamurthy, R. and Sultana, T. 1977. *Retortamonas indica* n. sp. (Mastigophora : Retortamonadida) a flagellate from *Polyphaga indica*. *Geobios*, **4** : 43-44.
- Krishnamurthy, R. and Sultana, T. 1978. A new species of the genus *Polymastix* Butschli, 1884 from an insect *Polyphaga indica* in India. *Arch. Protistenk.*, **120** : 301-303.
- Krishnamurthy, R. and Sultana, T. 1980. The description of new flagellate *Monocercomonoides spirostreptae* sp. n. (Mastigophora : Oxymonadida), from the millipedes in Maharashtra, India. *Acta Parasitol. Polonica*, **27** : 257-260.
- Krishnamurthy, R. Sultana, T. and Iyer, S.V. 1978. The pattern of incidence of intestinal flagellates in relation to some host groups in Marathwada region. *Proc. Asian Congr. Paraitol.*, p. 22.
- Krishnamurthy, R. Sultana, T. and Shete, S.G. 1979. An interesting hexamitid flagellate from the gut of *Calotes versicolor* in Maharashtra, 2nd National Congress of Parasitology, Varanasri, May 1979, p. 54.
- Krishnamurthy, R. and Wahul, M.A. 1981. Prevalence of trypanosome infection in freshwater fishes of Maharashtra. *Proc. All. India Symp. On "Perspectiveve in Research on Protozoa"*, Aurangabad, p. 22.
- Krishnamurthy, R. and Wahul, M.A. 1986. Studies on the morphology of some trypanoplasms from the blood of fresh water fishes in Maharashtra. II. From fishes of the genus *Labeo*. *Arch. Protistenk.*, **131** : 319-325.
- Kshirsagar, H.S. 1980. Two new species of *Isospora* Schneider, 1881 from rats in India. *Arch. Protistenk.*, **123** : 267-271.
- Kshirsagar, H.S. and Krishnamurthy, R. 1981. Eimerian parasites of the Indian Palm Squirrel (*Funambulus palmarum*) in Maharashtra. *Proc. All. India Symp. On "Perspectiveve in Research on Protozoa"* Aurangabad, p. 31.
- Kudo, R. R. 1966. *Protozoology*. 5th Edition. Charles C. Thomas, Springfield, Illinois.

- Laird, M. 1959. *Blastocrithidia* n. g. (Mastigophora : Protominadina) for *Crithidia* (in part), with a subarctic record for *B. gerridis* (Patton). *Canad. J. Zool.*, **37** : 749-752.
- Lee, J.J., Hunter, S.H. and Bovee, E.C. 1985. An Illustrated Guide to the Protozoa. Society of Protozoologists, Lawrence, Kansas.
- Levine, N.D. 1967. *Protozoan Parasites of Domesticated Animals and Man*. Burgess Publishing Company, Minnesota, pp. 1-412.
- Levine, N.D. 1988. *The Protozoan Phylum Apicomplexa*. Vol. I & II. CRC Press, Florida.
- Levine, N.D. and Campbell, G.C. 1971. A checklist of the species of the genus *Haemoproteus* (Apicomplexa, Plasmodiidae). *J. Protozool.*, **18**(3) : 475-484.
- Levine, N.D., Corliss, J.O., Cox, F.E.G., Deroux, G., Grain, J., Honigberg, B.M., Leedale, G.F., Loeblich, A.R., Lom, J., Lynn, D., Merinfeld, G., Page, F.C., Poljansky, G., Sprague, V. Vavra, J. and Wallace, F.G. 1980. A newly revised classification of protozoa. *J. Protozool.*, **27** : 37-59.
- Lingard, A. 1904. A short account of the various *Trypanomosa* found to date in the blood of some lower animals and fish. *Indian Med. Gaz.*, **39** : 445.
- Madre, V.E. 1978. A redescription of *Trichomitus batrachorum* (Part, 1852) Honigberg, 1953 from three new hosts in the Marathwada region. *Mrathwada Univ. J. Sci.*, (Bio Sci.), **17**(10) : 89-95.
- Madre, V.E. 1978. Observations on the monocercomonad flagellates from the gut of amphibians in Maharashtra. *Proc. Asian Congr. Parasitol.*, p. 185.
- Madre, V.E. 1979. The description of some species of the genus *Monocercomonas* Grassi (1879) from the reptiles in India. I. Subgenus *Monocercomonas* Krishnamurthy, 1968. *Riv. Parassitol.*, **39**(1) : 43-53.
- Madre, V.E. 1979. Two species of flagellates of the genus *Chilomastix* Alexeieff, 1912 (Mastigophora : Retortamonadina) from amphibians and reptiles in India. *Acta Protozool.*, **18**(2) : 243-250.
- Madre, V.E. 1979. The description of some species of the genus *Monocercomonas* Grassi (1879) from the reptiles in India. I. Subgenus *Alimonas* Krishnamurthy, 1968. *Riv. Parassitol.*, **40**(1-2) : 91-96.
- Madre, V.E. and Krishnamurthy, R. 1976. Studies on two flagellates from the rectum of the viper, *Vipera russeli* in Aurangabad. *Nat Sci. J. Marathwada Univ.*, **15**(8) : 143-147.
- Maheswari, S.C. 1986(1987). Occurrence of whirling disease in *Cirrhina mrigala* in Wardha. *J. Bombay Nat Hist. Soc.*, **83**(3) : 673.
- Mali, M.S. 1993. Description of new flagellate *Retortamonas masoodi* n. sp. (Mastigophora : Retortamonadida) from *Gryllotalpa africana*. *Proc. Zool. Soc. Calcutta*, **46**(1) : 55-59.
- Mali, M.S. 1993. Studies on the *Polymastix jadhavii*, a new flagellate from the gut of the cockroach *Periplareta americana* in India. *Geobios New Rep.*, **14**(2) : 189-191.
- Mali, M., Kulkarni, S. and Mali, S. 2002. Morphology of *Rhizomastrix murthi* n. sp. (Mastigophora; Rhizomastigida) from the gut of cockroach *Periplaneta americana*. *Proc. Zool. Soc., Calcutta*, **55**(1) : 77-80.
- Mali, M., Kulkarni, S. and Mali, S. 2001. Two species of the flagellates of the genus *Monocercomonoides* Travis 1932 from the gut of the beetle larva (*Oryctes rhinoceros*) in India. *Geobios*, **23**(4) : 201-204.

- Mali, M., Kulkarni, S., Suresh, G. and Mali, S. 2003. The *Hexamastix sangappe* n. sp., a new flagellate (Protozoa, Mastigophora) from the gut of *Pycnoscelus surinamensis*. *Geobios*, **30**(1) : 80-82.
- Mali, M., Kulkarni, S.G. and Mali, S.B. 2003. *Tubulimonoides aurangabadae* n. sp. (Mastigophora : Oxymonadida)—a new flagellate from the gut of *Oryctes rhinoceros*. *Geobios*, **30** : 291-292.
- Mali, M. and Mali S. 2004. *Monocercomonoides khultabadae* n.sp., a new flagellate from the gut of *Pycnoscelus surinamensis*. *Uttar Pradesh J. Zool.*, **24**(1) : 55-58.
- Mali, M. and Sultana, T. 1993. The morohology of *Tubulimonoides shivamurthii* n. sp. a new flagellate from the gut of *Oryctes rhinoceros*. *Geibios New Rep.*, **12**(1) : 30-32.
- Mandal, A.K. 1987. *Fauna of India. Protozoa : Sporozoa : Eucocciida : Eimeriidae*. Zool. Surv. India, Calcutta, pp. xvi+460.
- Mandal, A.K., Das, A.K. and Nandi, N.C. 1990. Collection and Preservation of Animals : Protozoa and Mesozoa. In : *Handbook of Zoological Collections*, ZSI, pp. 1-17.
- Mandal, A.K. and Nandi, N.C. 1980. Collection and Preservation of Parasitic Protozoa. *Proc. Workshop Tech. Parasitol. Zool. Surv. India*, Calcutta, pp. 1-11.
- Mandal, F.B. Nandi, N.C. and Mandal, A.K. 1993. Catalogue of Protozoans Occurring in Reptiles from India. *Rec. Zool. Surv. India Occ. Paper No.*, **148** : 1-36.
- Manjrekar, S.L. 1954. Annual Progress Report of Assistant Disease Investigation Officer (Sheep and Goat), Bombay state. 1.
- McClure, H.E., Poonswood, P., Greiner, E.C. and Laird, M. 1978. *Haematozoa in the birds of Eastern and Southern Asia*. Memorial University of Newfoundland, Canada.
- Mello, I.F. de, 1935. New Haemoproteids of some Indian birds. *Proc. Indian Acad. Sci.*, **2B** : 469-475.
- Mello, I.F. de, 1937. Further contributions to the study of the blood parasites of the Indian birds, together with a list of haemoparasites hitherto recorded. *J. Roy. Asiat. Soc. Bengal, (Sci.)*, **2**(2) : 95-122.
- Mello, F. De and Brito, J. de. 1929. Sur ua calonymphidae parasite d'um termite indiver. *C.R. Sei. Soc. Biol. Filiales*, **101** : 394-397.
- Mello, F. de and Uttangi, J.C. 1959. A calonymphid flagellate found in the Indian millipede *Thyropygus* sp. (Harapagophorida). *Curr. Sci.*, **19** : 122-123.
- Mourya, D.T. and Dhanda, V. 1981. Studies on *Lankesteria* sp. (Eugregarinida : Diplocystidae) parasitizing *Aedes albopictus* (Skuse). *Indian J. Parasitol.*, **5**(2) : 119-133.
- Mourya, D.T., Geevarghese, G. and Gokhale, M.D. 1996. *Ascogregarina cheopisi* sp. n. (Protozoa : Apicomplexa) from the flea *Xynopsylla (Xenopsylla) cheopisi*. *Entemon*, **21**(1) : 103-104.
- Mourya, D.T., Geevarghese, G. and Gokhale, M.D. 1996. Note on occurrence of *Trypanosoma (Herptosoma)* sp. in *Rattus rattus* in Beed District, Maharashtra. *J. Comm. Dis.*, **28**(4) : 299-300.
- Nandi, N.C. 1976. Avian haematozoa from upper stretches of Godavari River Basin, Nasik and Ahmednagar districts, Maharashtra. *Indian J. Anim. Hlth.*, **15**(2) : 137-138.
- Nandi, N.C. 1984. Index catalogue of avian haematozoa from India. *Rec. zool. Surv. India Occ. Paper No.*, **48** : 1-63.
- Nandi, N.C. 2004. Protozoa. In : *Collection, Preservation and Indentification of Animals*. J.R.B. Alfred and Ramakrishna (eds.), pp. 3-11. (Published : Director, Zool. Surv. India).

- Nandi, N.C. and Bennett, G.F. 1997. The prevalence, distribution and checklist of avian haematozoa in the Indian subcontinent. *Rec. zool. Surv. India*, **96**(1-4) : 83-150.
- Nandi, N.C., Kalavati, C. Das, A.K. and Nandi, R. 2004. Parasitic Protozoa. *Fauna of Andhra Pradesh, State Fauna Series*, **5**(Part 6) : 1-422. Zool. Surv. India, Kolkata.
- Nandi, N.C., Nandi, R. and Mandal, A.K. 1983. Index catalogue and Bibliography of Protozoan Parasites from Indian Fishes. *Rec. zool. Surv. India Occ. Paper No.* **41** : 1-46.
- Nandi, N.C., Nandi, R. and Mandal, A.K. 2002. Index catalogue and Bibliography of Protozoan Parasites from Indian Fishes : Supplement-I *Rec. zool. Surv. India Occ. Paper No.*, **193** : 1-65.
- Nie, D. 1935. Intestinal ciliates of Amphibia of Nanking. *Contr. Biol. Lab. Sci. Soc. China, Zool. Ser.*, **8** : 183-199.
- Nikam, S.R. 1999. Species composition and relative prevalence of *Eimeria* in sheep and goats from Marathwada region Maharashtra. *Ecol. Env. & Cons.*, **5**(3) : 211-213.
- Nikam, S.R. and Jadhav, V.D. 2001. Seasonal incidence of coccidiosis in Marathwada region, Maharashtra. *Environ. & Ecol.*, **19**(2) : 458-459.
- Nikam, S.R. and Kamble, S.B. 1999. Prevalence of incidence of coccidian in sheep from Marathwada region, Maharashtra. *Geobios new Reports*, **18** : 22-24.
- Nikam, S.R. and Shaikh, J.D. and Jadhav, V.D. Pokale, S.S. 2001. Seasonal incidence of malaria in Aurangabad district, Maharashtra state. *Dr. B. A. M. U. J. Sci.*, **31**(8) : 63-66.
- Pawar, S.D. and Gatne, M.L. 2005. Prevalence of canine hepatozoonosis in Mumbai. *Indian vet. J.*, **82**(5) : 554-555.
- Peirce, M.A. 1977. Haematozoa of East African birds. II. Redescription of *Haemoproteus centropi* a parasite of the Cuculidae. *E. Afr. Wilfl. J.*, **15** : 57-60.
- Peirce, M.A., Bennett, G.F. and Bishop, M. 1990. The haemoproteids of the avian order Falconiformes. *J. Nat. Hist.*, **24** : 1091-1100.
- Pokale, S.S. 2002. Studiesn on protozoan parasites of fishes. Ph.D. Thesis Marathwada University (unpublished), 207pp.
- Pokale, S.S., Nikam, S.R. and Shaikh, J.D. 2002. Seasonal variance of *Trypanosoma* sp., from the fishes of Aurangabad, India. *Uttar Pradesh J. Zool.*, **22**(1) : 91-92.
- Rahal, E.M., Bishop, M.A. and Bennett, G.F. 1987. Avian Haemoproteidae. 25. The haemoproteids of the avian family Pycnonotidae (bulbuls). *Can. J. Zool.*, **65** : 322-328.
- Ray, R. and Choudhury, A. 1984. Haemogregarines of Indian anurans. *Tech. Monograph No.*, **10** : Zool. Surv. India, pp. 1-66.
- Rodgi, S. and Amoji, S.D. 1970. On a new cephaline gregarine, *Stenophora mruthunjayi*, parasitic in the gut of the millipede, *Condromorpha kelaarti* Hunb. *J. Anim. Morphol. Physiol.*, **16** : 196.
- Rao, S.R. 1952. *Eimeria smithi* a case of dysentery in cattle in Bombay state. *Bombay vet. Coll. Mag.*, **3** : 35.
- Rao, S.R. and Bhatavdekar, M.Y. 1957. *Eimeria rayi* sp. nov. a new coccidium from dog, belonging to the genus *Eimeria*. *Bombay vet. Coll. Mag.*, **6** : 7.
- Rao, S.R. and Bhatavdekar, M.Y. 1959. Some records of coccidia of cattle in Bombay with a description of two new species. *Bombay vet. Coll. Mag.*, **8** : 23-25.

- Rao, S.R. and Hiregauder, L.S. 1952. Coccidiosis in cats and dogs in Bombay. *Indian vet. J.*, **29** : 109-112.
- Rao, S.R. and Hiregaudir, L.S. 1954. Coccidial fauna of cattle in Bombay state, with particular reference to a recent outbreak at Aarey Milk Colony, together with a description of two new species *Eimeria bombayensis* & *Eimeria khurodensis*. *Bombay vet. Coll. Mag.*, **4** : 24-28.
- Rao, S.R. and Hiregauder, L.S. 1954. Coccidiosis in sheep and goats in Bombay state. *Bombay vet. Coll. Mag.*, **4** : 29-33.
- Raote, Y.V. 1986. Prevalence of Coccidia of sheep in Akola region. *Livestock Adviser*, **11**(9) : 125-126.
- Raote, Y.V. and Bhagat, S.S. 1988. A note on the prevalence of coccidia species in buffalo. *Punjabrao Krishi Vidyapith Res. J.*, **12**(1) : 95.
- Raote, Y.V. and Bhagat, S.S. 1990. A note on the prevalence of coccidia of cattle in Akola region. *Punjabrao Krishi Vidyapith Res. J.*, **14**(1) : 95-96.
- Ring, M. 1959, Studies on the parasitic protozoa of wild mice from Berkshire, with the description of a new species of *Trichomonas*. *Proc. Zool. Soc.*, London, **132** : 381-401.
- Saratchandra, B. 1979. *Monocercomonas calotesi* n.sp. from the rectum of *Colotes versicolor*. *Indian J. Parasitol.*, **3**(1) : 73-74.
- Setna, S.B. 1927. *Grayallia quadruspina*, a new genus and species of monoyetid gregarine parasite in an oligochaete *Pheretima heterocheta* (Mich.). *Parasitology*, **19** : 335.
- Setna, S.B. 1933. Fish and Reptilian coccidian. *Curr. Sci.*, **2** : 97.
- Setna, S.B. 1942. Preliminary observation on Myxosporidia from sharks. *Curr. Sci.*, **11** : 469-470.
- Setna, S.B. and Bana, R.H. 1935. *Eimeria harpodoni* n. sp. a new coccidium from *Harpodon nehereus* (Ham. & Buch.). *J. R. Microsc. Soc.*, **55** : 165.
- Setna, S.B. and Bana, R.H. 1935. *Eimeria flaviviridis* n. sp. from the gall bladder of *Hemidactylus falviviridis*. *J. R. Microsc. Soc.*, **55** : 256.
- Setna, S.B. and Bhatia, B. L. 1934. On some gregarines from the prawn, *Parapeneopsis sculptilis* (Heller). *Parasitology*, **26** : 34.
- Shastri, S.R., Shastri, U.V. and Deshpande, P.D. 1985. Haematozoan infections in buffalo, *Bubalus bubalis* in Maharashtra. *Indian J. Parasit.*, **9**(2) : 183-185.
- Shastri, U.V. 1990. *Sarcocystis* infection in goats in Maharashtra. *Indian vet. J.*, **67** : 70-71.
- Shastri, U.V. et al. 1985. Studies on *Theileria* sp. from buffalo, *Bubalus bubalis* from Maharashtra. *Indian J. Parasit.*, **9**(2) : 275-279.
- Shastri, U.V. et al. 1988. Occurrence of *Theileria orientalis* in bovines from Maharashtra state and its transmission by *Haemaphysalis bispinosa* ticks. *Indian J. Parasit.*, **12**(1) : 173-177.
- Shastri, U.V. and Deshpande, P.D. 1987. Effect of spleenectomy on latent infection of *Anaplasma ovis* and *Theileria ovis* in sheep and goats with observation on treatment with Oxytetracycline and Benencil. *Indian J. Anim. Hlth.*, **26**(1) : 13-17.

- Shastri, U.V., Deshpande, P.D. and Deshpande, M.S. 1980. Some observations on *Theileria mutans* like haematozoan parasites of cattle in Maharashtra. *Proc. Asian Sem. On "Haemoprotozoan Diseases"*, Haryana Agri. Univ., Hissar. Abstract A14.
- Shastri, U.V., Deshpande, P.D. and Deshpande, M.S. 1981. *Hyalomma anatolicum anatolicum* (Koch, 1844) as a possible vector for transmission of *Trypanosoma theileri* in cattle and buffaloes. *Proc. All. India Symp. On "Perspectiveve in Research on Protozoa"* Aurangabad, p. 14.
- Shastri, U.V., Ghafoor, M.A. and Krishnamurthi, R. 1976. Some observations on coccidian lesions associated with endogenous phases in buffalo calves. *Indian J. Anim. Sci.*, **46**(10) : 556-561.
- Shastri, U.V., Ghafoor, M.A. and Krishnamurthi, R. 1974. A note on clinical coccidiosis in buffalo calves due to *Eimeria bariellyi* Gill, Chhabra and Lall, 1963 in Maharashtra. *Indian vet. J.*, **51** : 301-302.
- Shastri, U.V. and Kurundakar, V.D. 1981. Occurrence of *Babesia bovis* (= *Babesia argentina*) in a buffalo. *India vet. J.*, **58**(1) : 61-63.
- Shastri, U.V. and Krishnamurthi, R. 1975. A note on pathological lesions in clinical bubaline coccidiosis due to *Eimeria bareillyi*. *Indian J. Anim. Sci.*, **45**(1) : 46-47.
- Shastri, U.V., Krishnamurthi, R. and Ghafoor, M.A. 1973. Some observations on pathogenicity of *Eimeria bareillyi* in buffalo calves. *Indian J. Anim. Res.*, **7**(1) : 23-25.
- Shastri, U.V., Krishnamurth, R. and Sultana, T. 1979. A note on an interesting trypanosomatid flagellates (*Blastocrithidia* sp.) from a tick *Hyalomma anotolicum anatolicum* in Maharashtra. 2nd National Congress of Parasitology, Varanasi, May, 1979 p. 18.
- Shastri, U.V. and Mandakhalikar, M.R. 1992. Some observations on Parbhani isolate of *Toxoplasma* from cat. *Indian vet. J.*, **69**(1) :
- Shastri, U.V., Pathak, S.V. Deshpande, P.D., Deshpande, A.V. and Deshpande, M.S. 1981. Some observations on characteristics of a benign *Theileria* sp. isolated from indigenous cattle in Parbhani (Maharashtra).. *Proc. All. India Symp. On "Perspectiveve in Research on Protozoa"* Aurangabad, p. 16.
- Shastri, U.V., Pathak, S.V., Deshpande, A.V., Deshpande, P.D., Deshpande, M.S. and Hatwelkar, V.M. 1981. Occurrence of haematozoa of domesticated animals in Marathwada region (Maharashtra). *Proc. All. India Symp. On "Perspectiveve in Research on Protozoa"* Aurangabad, p. 18.
- Shastri, U.V. and Ratnaparkhi, M.R. 1992. *Toxoplasma* and other intestinal coccidian in cats in Maharashtra. *Indian vet. J.*, **69**(1) : 14-16 (Parbhani).
- Shastri, U.V. and Takerkhade, M.L. 1979. A note on an interesting *Trypanosoma* sp. from cow calf in Maharashtra, 2nd National Congress of Parasitology, Varanasi, May, 1979 p. 59.
- Shegokar, V.R., Power, R.M., Joshi, P.P., Bhargava, A., Dani, V.S., Katti, R. Zare, V.R. Khanande, V.R., Janin, J. and Truc, P. 2006. Human trypanosomiasis caused by *Tripanosoma evansi* in a village in India : preliminary serologic survey of the local population. *Am. J. Trop. Med. Hyg.*, **75**(5) : 869-870.
- Shete, S.G. 1982a. Observations on the rectal ciliates of the genus *Nyctotheroides* Grasse 1928 from Indian amphibians. 1. Subgenus *Aduncuperistomatus*. *Arch. Protistenk.*, **125**(1-4) : 163-172.

- Shete, S.G. 1982b. Observations on the rectal ciliates of the genus *Nyctotheroides* Grasse 1928 from Indian amphibians. 2. Subgenus *Nyctotheroides*. *Arch. Protistenk.*, **125**(1-4) : 173-180.
- Shete, S.G. and Krishnamurthy, R. 1984. Observations on the rectal ciliates of the genus *Balantidium* Claparède and Lachmann, 1858 from Indian amphibians *Rana tigrina* and *R. cyanophlyctis*. *Arch. Protistenk.*, **128** : 179-194.
- Sultana, T. 1975. The morphology of *Hexamastix alexeieffi* n. sp. a new flagellate from the gut of a blattid *Pycnoscelus surinamensis* (Linnaeus). *Nat. Sci. Marathwada Univ.*, **14**(7) : 223-227.
- Sultana, T. 1975. A redescription of *Monocercomonoides ganapatii* Bhaskar Rao, 1969 from *Gryllotalpa africana*. *Nat. Sci. J. Marathwada Univ.*, **14**(7) : 229-232.
- Sultana, T. 1976. *Monocercomonoides krishnamurthii* n. sp., a new flagellate (Protozoa : Mastigophora) from the gut of a blattid in India. *Nat. Sci. J., Marathwada Univ.*, **15**(8) : 149-152.
- Sultana, T. 1976. Studies on two new species of flagellates of the genus *Polymastix* Butschli, 1884 from insects in India. *Acta Protozool.*, **15**(1) : 1-8.
- Sultana, T. 1976. *Rhizomastix dastagiri* n. sp. (Mastigophora : Rhizomastigida) a new flagellate from the gut of the cockroach *Periplaneta americana*. *Acta Protozool.*, **15**(1) : 9-13.
- Sultana, T. 1976. Three species of flagellates of the genus *Retortamonas* (Mastigophora : Retortamonadidae) from *Gryllotalpa africana* in India. *Acta Protozool.*, **15**(2) : 125-137.
- Sultana, T. 1976. A new diplomonad flagellate *Hexamitus murthii* n. sp. from the cockroach *Periplaneta americana*. in India. *Riv. Parassitol.*, **37**(1) : 7-11.
- Sultana, T. 1976. On a new species of the genus *Hexamastix* Alexeieff 1912 from the gut contents of an insect *Polyphaga indica* in India. *Riv. Parassitol.*, **37**(1) : 1-5.
- Sultana, T. and Krishnamurthy, R. 1976. *Monocercomonas nathi* n. sp., a new flagellate (Protozoa : Mastigophora) from the gut of an insect *Polyphaga indica* from India. *Riv. Parassitol.*, **37**(1) : 129-131.
- Sultana, T., Deshmukh, R.B. and Kulkarni, A.A. 1981. An interesting Nyctotherid ciliate from an insect *Polyphaga indica*. *Proc. All. India Symp. On "Perspectiveve in Research on Protozoa"* Aurangabad, p. 33.
- Sultana, T., and Hulsurkar, S.V. 1981. *Monocercomonoides* sp. from the gut of dung beetle larva (*Oryctes rhinoceros*) in Maharashtra. *Proc. All. India Symp. On "Perspectiveve in Research on Protozoa"* Aurangabad, p. 29.
- Sultana, T., and Hulsurkar, S.V. 1995. The morphology of two new species of the genus *Polymastix* Butschli, 1884 from the larva of dung beetle *Nat. Symp. on Environmental Implications of free-living and parasitic protozoa*, March, 1995, Abs. 2.3.
- Sultana, T. and Krishnamurthy, R. 1978. *Monocercomonoides gryllusae* n. sp. (Mastigophora : Oxymonadida) from *Gryllus bimaculatus*. *Geobios*, **6** : 114-115.
- Sultana, T. and Krishnamurthy, R. 1979. The morphology of *Monocercomonoides blattae*, from the gut of *Blatta* sp. in India. *Marathwada Univ. J. Sci.*, **18** : 141-143.
- Sultana, T., Krishnamurthy, R. and Kulkarni, A.A. 1981. The morphology of *Blastocrithidia* spp. from three insect hosts in the Marathwada region. *Proc. All. India Symp. On "Perspectiveve in Research on Protozoa"*, Aurangabad, pp. 28-29.

- Sultana, T., Krishnamurthy, R., Deshmukh, R.B. and Hulsurkar, S.V. 1981. Morphological variations in flagellates of the genus *Leptomonas* Kent, 1880 from Indian insects. *Proc. All. India Symp. On "Perspectiveve in Research on Protozoa"*, Aurangabad, p. 29.
- Uttangi, J.C. 1951. On some ciliate parasites of frogs and toads of Karnataka, Bombay Presidency. *Rec. Indian. Mus.*, **49** : 139-156.
- Wahul, M.A. 1982. Studies on some haemoflagellates of fishes. *Ph. D. Thesis*, Marathwada University (unpublished), 236 pp.
- Wahul, M.A. 1985. Four new species of *Trypanoplasma* from the fresh water fishes of the genus *Mystus* in Maharashtra. *Proc. Indian Acad. Sci., (Anim. Sci.) (B)*, **94**(1) : 25-35.
- Wahul, M.A. 1986. Studies on the morphology of some trypanoplasms from the blood of freshwater fishes in Maharashtra. I. from fishes of the genus *Puntius*. *Arch. Protistenk.*, **131** : 309-318.
- Wahul, M.A. 1986. Morphology of three new trypanosomes from freshwater fishes of the genus *Puntius*. *Arch. Protistenk.*, **132** : 101-111.
- Wahul, M.A. 1986. Three new trypanosomes from freshwater fishes of the genus *Mystus* from Maharashtra (India). *Indian J. Parasit.*, **10**(2) : 217-227.
- Wahul, M.A. 1986. *Trypanoplasma wallagoi* sp. nov. fom the fresh water shark *Wallago attu* of Maharashtra (India). *Indian J. Parasitol.*, **10**(2) : 229-233.
- Wahul, M.A. 1987. Studies on the morphology of three new species of trypanosomes from the fresh water fish *Mastacembelus armatus* in Maharashtra (India). *Arch. Protistenk.*, **133** : 111-124.
- Wenyon, C.M. 1926. *Protozoology*. 2 Vols. Balliere, Tindall and Cox, London.
- Zargar, S.L. 1945. On two new haemoproteids of Indian birds. *Proc. Indian Acad. Sci.*, **21B** : 124-127.
- (Note : Ph. D. Thesis on Protozoa from Marathwoda University were also consulted in preparing this document).

FREELIVING PROTOZOA

L. BINDU and D. SAHA

Zoological Survey of India, M-Block, New Alipore, Kolkata-700 053

INTRODUCTION

Perusal of literature reveals that there are only a few scattered reports on the freeliving protozoa of Maharashtra. The present communication includes 52 species of freeliving protozoa under 32 genera and 23 families, out of which 33 are testacids and 19 are ciliates. All the specimens studied were collected by the scientists of the Zoological Survey of India in recent years (2005-2007) from Maharashtra. The collections were made from 13 districts of the state *viz.*, Aurangabad, Nashik, Thane, Pune, Satara, Kolhapur, Sindhudurg, Sangli, Jalgaon, Akola, Amaravathi, Wardha and Nagpur. Amongst these 14 species marked by asterisks (*) are not collected during the present study.

MATERIAL AND METHODS

Freeliving protozoans were collected from freshwater ponds, puddles, streams and rivers and also from soil mosses, rock mosses and tree mosses of different localities from 13 districts mentioned earlier.

For the collection of freshwater protozoa water samples along with some algae, water weeds, bottom ooze and flocculent matter arising out of washing of water weeds and aquatic plants were collected and kept in wide mouthed sampling jars made up of glass. These jars were then brought to the laboratory and kept for few days, keeping their lids open for considerable increase in protozoa population occurring in those samples. The

samples were then thoroughly examined under the light microscope from time to time.

Freeliving ciliates were isolated by micropipette and examined in living condition by keeping them in a natural medium. Sometimes methocyl solution was used for slowing down the movement of fast moving ciliates for the study of their internal structures in situ under light microscope. Sometimes Lugol's solution was added as killing agent and for detecting peripheral organellae.

Schaudinn's fixative and Carnoy's fluid were used for making permanent slides of freeliving ciliates. The first one is effective for keeping the exact natural shape of the specimen while the second one is good for studying nuclear structure. Heidenhain's iron haematoxylin and Delafield's haematoxylin were used for staining the ciliates. In some cases dry silver impregnation method was employed to study their infra structures. These slides were mounted in DPX.

For preparing permanent slides of freshwater testacid rhizopods empty tests were isolated from the bottom ooze of the samples. Testacids were also collected by squeezing different parts of the aquatic vegetation including their roots and submerged portion of leaves. The testacids were placed in microslides, air dried after two or three washings in absolute alcohol and then mounted in DPX.

For collecting moss inhabiting protozoa moss samples were brought to the laboratory. A portion of each sample was kept in petri dish and sprinkled regularly with sufficient distilled water. After one

or two days aqueous drops drawn from the moss by micropipette were kept on microslides and examined thoroughly under the light microscope. Any testacid observed in those drops were fixed and mounted in the same manner as stated earlier for freshwater testacids. For more details Das *et al.* (1993, 1995) and Chattopadhyay and Das (2003) may be consulted. For terminology refer fauna of West Bengal, part-12 (Das *et al.*, 1993).

SYSTEMATIC LIST

(Classification after Levine *et al.*, 1980)

Subkingdom PROTOZOA

Phylum SARCOMASTIGOPHORA

Class LOBOSEA

Order AMOEBIDA

Family HARTMANNELLIDAE

- *1. *Hartmannella crumpae* Singh & Hanumaiah, 1979

Family THECAMOEBIDAE

- *2. *Vennella cutleri* Singh & Hanumaiah

Family ACANTHAMOEBIDAE

- *3. *Acanthamoeba culbertsoni* (Singh & Das, 1970)

- *4. *Acanthamoeba rhyodes* (Singh, 1952)

Family ECHINAMOEBIDAE

- *5. *Echinamoeba exundans* (Page, 1967)

Family VAHLKAMPFIIDAE

- *6. *Vahlkampfia russelli* (Singh, 1952)

- *7. *Naegleria gruberi* (Schardinger, 1899)

Order ARCELLINIDA

Family MICROCORYCIIDAE

8. *Amphizonella violacea* Greeff

Family ARCELLIDAE

9. *Pyxidicula operculata* Ehrenberg

10. *Arcella discoides* Ehrenberg, 1843

11. *Arcella vulgaris* Ehrenberg, 1830 (1832)

Family CENTROPYXIDAE

12. *Centropyxis aculeata* (Ehrenberg, 1832) Stein, 1857.

13. *Centropyxis ecornis* (Ehrenberg, 1841) Leidy, 1879.

14. *Centropyxis laevigata* Penard, 1890

15. *Centropyxis minuta* Deflandre, 1929.

16. *Centropyxis orbicularis* Deflandre, 1929

17. *Centropyxis penardi* Deflandre.

18. *Centropyxis spinosa* (Cash & Hopkinson, 1905) Deflandre, 1929

19. *Cyclopyxis eurytoma* (Deflandre, 1929)

20. *Trigonopyxis arcula* (Leidy, 1879) Penard, 1912

Family DIFFLUGIIDAE

21. *Diffugia lithophila* (Penard)

Family NEBELIDAE

22. *Awerintzewia cyclostoma* (Penard, 1902) Schouteden, 1906

Class FILOSEA

Order GROMIIDA

Family EUGLYPHIDAE

23. *Assulina muscorum* Greef, 1888.

24. *Assulina seminulum* (Ehrenberg, 1840) Leidy, 1878

25. *Euglypha acanthophora* (Ehrenberg, 1842) Perty, 1849

26. *Euglypha ciliata* (Ehrenberg, 1848), Perty 1849

27. *Euglypha laevis* (Ehrenberg, 1845), Perty 1849

28. *Euglypha tuberculata* Dujardin, 1841

29. *Euglypha rotunda* Wailes & Penard, 1911

30. *Euglypha strigosa* (Ehrenberg, 1872) Leidy, 1878

31. *Trinema enchelys* (Ehrenberg, 1838), Leidy, 1878

32. *Trinema lineare* Penard, 1890

33. *Tracheleuglypha dentata* (Vejdowsky, 1832) Deflandre, 1928

Phylum CILIOPHORA

Class KINETOFRAGMINOPHOREA

Order PROSTOMATIDA

Family PRORODONTIDAE

34. *Prorodon discolor* (Ehrenberg, 1835)

Order PLEUROSOTOMATIDA

Family AMPHILEPTIDAE

35. *Loxophyllum levigatum* Sauerby, 1928

36. *Litonotus fasciola* (Ehrenberg, 1838)

Order KARYORELICTIDA

Family LOXODIDAE

37. *Loxodes vorax* Stokes, 1885

Order TRICHOSOTOMATIDA

Family PLAGIOPYLIDAE

38. *Plagiopyla nasuta* Stein, 1860

Order COLPODIDA

Family COLPODIDAE

39. *Colpoda cucullus* Mullur, 1773

40. *Colpoda maupasi* Enriques, 1908

Family CYRTOLOPHOSIDIDAE

*41. *Cyrtolophosis elongatus* (Schewiakoff, 1893)

*42. *Cyrtolophosis minutus* (Schewiakoff, 1889)

Order CYRTOPHORIDA

Family CHILODONELLIDAE

*43. *Chilodonella cucullulus* (Mullur, 1883)

44. *Chilodonella* sp.

Class OLIGOHYMENOPHOREA

Subclass HYMENOSTOMATIA

Order HYMENOSTOMATIDA

Family OPHRYOGLENIDAE

*45. *Ophryoglena flava* (Ehrenberg, 1833)

Family PARAMECIIDAE

46. *Paramecium caudatum* Ehrenberg, 1833

Family FRONTONIIDAE

47. *Frontonia depressa* (Stokes, 1886)

48. *Frontonia leucas* (Ehrenberg, 1838)

Family UROCENRIDAE

*49. *Urocentrum turbo* (Muller, 1786)

Class POLYHYMENOPHOREA

Subclass SPIROTRICHIA

Order HYPOTRICHIDA

Family OXYTRICHIDAE

50. *Oxytricha bifaria* Stokes

*51. *Oxytricha fallax* Stein, 1859

52. *Pleurotricha grandis* Stein, 1859

SYSTEMATIC ACCOUNT

Subkingdom Protozoa

Phylum SARCOMASTIGOPHORA

Class LOBOSEA

Order AMOEBIDA

Family HARTMANNELLIDAE

1. *Hartmannella crumpae* Singh and Hanumaiah, 1979

1979. *Hartmannella crumpae* Singh and Hanumaiah, monograph no. 1, *J. microbiol.* page 34, figures 133-145.

Diagnosis : Cysts rounded or spherical, single layered with an outer gelatinous layer 6.3-9.8 μ m in diameter, during excystation amoeba detaches itself from the cyst wall; preformed pore lacking.

Distribution : India : Maharashtra, West Bengal, Gujarat and Uttar Pradesh.

Family THECAMOEBIDAE

2. *Vennella cutleri* Singh and Hanumaiah, 1979

1979. *Vennella culteri* Singh and Hanumaiah monograph No. 1, *J. microbiol.* page 48, figures 222-237.

Diagnosis : Outline flabellate with large broad flattened hyaline ectoplasmic veil proceeding raised endoplasmic hump; breadth usually greater than length; cysts single walled, spherical with an outer gelatinous layer; dimension 8.4-196 μ m.

Distribution : India : Maharashtra, West Bengal and Gujarat.

Family ACANTHAMOEBIDAE

Genus *Acanthamoeba* Volkonsky

Key to the species

1(2) Ectocysts wrinkled, endocyst markedly polygonal and stellate, with tips of rays usually in depression of wrinkled ectocyst *A. rhyodes*

2(1) Ectocyst noticeably wrinkled and pathogenic to mice by nasal installation *A. culbertsoni*

3. *A. culbertsoni* (Singh and Das, 1970)

1970. *Hartmannella culbertsoni* Singh and Das. *Trans. roy. soc. (B)*, 259. pp. 451-455. Figs 87-98.

Diagnosis : Cysts rounded or oval, ectocyst considerably wrinkled or sometimes circular; endocyst rounded or with slight angles; endocyst in contact with the ectocyst at the point of operculum.

Distribution : India : Maharashtra, West Bengal, Gujarat and Uttar Pradesh.

Remarks : This species is pathogenic to mice by nasal installation.

4. *A. rhysodes* (Singh, 1952)

1952. *Hartmannella rhysodes* Singh, *Phil Trans. Roy. Soc. Lond.*, B. 236, p. 405.

Diagnosis : Endocyst stellate or irregularly polyhedral; ectocyst rippled or wrinkled and loosely applied to endocyst.

Distribution : India : Maharashtra, West Bengal, Gujarat and Uttar Pradesh.

Remarks : This species is found in soil, mud and sewage sludge.

5. *Echinamoeba exundans* (Page, 1967)

1967. *Hartmannella exundans* Page, *J. Protozool.* 14, p. 515, fig. 113.

Diagnosis : Flattened triangular to elongate and limax-like, with anterior edges; cysts smooth, spherical or ovoid, ectocyst closely opposed to endocyst, occasionally raised at some points.

Distribution : India : Maharashtra, West Bengal, Gujarat and Uttar Pradesh.

Remarks : This species is found in soil, mud and sewage sludge.

Order SCHIZOPYRENIDA

A single family, Vahlkampfiidae under this order is represented from this state.

Family VAHLKAMPFIIDAE

Limax amoebae with locomotion by successive eruptive, hyaline, hemispherical waves, often

alternating to either side at the anterior end, with hyaloplasm sometimes spilling rearward alongside, nuclear division promitotic.

Genus *Vahlkampfia* Chatton & Lalung-Bonnaire

6. *Vahlkampfia russelli* (Singh, 1952)

1952. *Schizopyrenus russelli* (Singh), *Phil. Trans. roy. soc. B*, 236, p. 405.

Diagnosis : Monopodial during active locomotion; cytoplasm with circular and cylindrical refractive granules; nucleus vesicular with central nucleolus; ectocyst widely separated from endocyst except at some points of contact, in some specimens ectocyst wavy.

Distribution : India : Maharashtra, West Bengal, Gujarat and Uttar Pradesh.

Genus *Naegleria* Alexeieff7. *Naegleria gruberi* (Schardinger, 1899)

1899. *Amoeba gruberi* Schardinger, *Sber. Akad. Wiss. Wein.*, 108, p. 713.

Diagnosis : Cysts rounded or slightly oval and smooth walled; sometimes outer wall with irregular architecture can be separated; several pores with plugs; flagellate stage easily produced.

Distribution : India : Maharashtra, West Bengal, Gujarat and Uttar Pradesh.

Remarks : This species is found in soil, mud and sewage sludge.

Order ARCELLINIDA

Family MICROCORYCIIIDAE

Genus *Amphizonella* Greeff

Diagnosis : Test membranous with a double marginal contour; inner membrane smooth, well defined; outer serrulate, aperture inverted, a single nucleus; pseudopodia blunt, digitate and divergent, size 96µm × 32 µm.

8. *Amphizonella violacea* Greeff

1959. *Amphizonella violacea* Greeff : Deflandre, *Rhizopoda and Actinopoda* (In : *Fresh water Biology*, Chapter 9 : 235 ed. Edmonson.)

Material examined: 1 ex. Semodah, 22.ix.2007, Bindu. L. and party.

Diagnosis : Protoplasm violet-tinted with chlorophyllous corpuscles and grains; one nucleus; test patelliform; size 96 µm × 32 µm.

Remarks : First report from India.

Family ARCELLIDAE

Genus *Pyxidicula* Ehrenberg

9. *Pyxidicula operculata* (Agardh, 1966)

1966. *Pyxidicula operculata* (Agardh); Kudo, *protozoology*, pp. 571-572, fig. 204, a-b.

Material examined : 2 exs., Kolkaz, 22.ix.2007, Bindu. L. and party.

Diagnosis : Test smooth, brown; a single vesicular nucleus; pseudopodia short.

Distribution : Maharashtra (Kolkaz, Amaravathi), West Bengal.

Remarks : First report from Maharashtra ; collected from fresh water with vegetation.

Genus *Arcella* Ehrenberg, 1830 (1832)

1830(1832) *Arcella* Ehrenberg, *Abh. K. Akad. Wiss berlin*, P. 40.

Diagnosis : Test membranous, rigid, appearing either smooth in texture or with a very fine reticular pattern, usually yellowish in colour, turning brown with age, sometimes colourless; in dorsal or ventral view circular or oval in shape, in lateral view varying from plano-convex to hemispherical; externally test plain or in some cases variously ornamented, encrusted with chitinous particles; oral aperture central, usually circular, rarely of different shape, turned inwards and appearing as an inverted funnel; nuclei two or more.

10. *Arcella discoides* Ehrenberg, 1843

1843. *Arcella discoides* Ehrenberg, *Ber. K. Akad. Wiss.*, Berlin, p. 139.

1928. *Arcella discoides* Ehrenberg: deflandre, *Arch. Protistenkd.*, 64, p. 256.

Material examined : 2 exs., Nath seeds,

Aurangabad, 29.xii.2005, Bindu L and party; 1ex., Trambakeswar, Nashik, 06.i.2006, Bindu L and party; 2 exs., Kanchad forest, Vada, 8.i.2006; 5 exs., Pench National Park, Nagpur, 28.ix.2007, Bindu L. and Party.

Diagnosis : Test light yellow, smooth, flattened, circular in front view and plano-convex in lateral view with a rounded border, height of test about one-third to one-fourth the diameter, oral aperture large and circular.

Distribution : India: Maharashtra (in press), Andhra Pradesh, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Himachal Pradesh, Sikkim, Tripura, Uttarakhand and West Bengal.

Remarks : This species has been collected from the bottom ooze of freshwater ponds and also from mosses.

11. *Arcella vulgaris* Ehrenberg, 1830 (1832)

1830(1832). *Arcella vulgaris* Ehrenberg, *Abh. K. Akad. Wiss. Berlin*, p. 40.

1928. *Arcella vulgaris* Ehrenberg, *Arch. Protistenkd.*, 64, p. 219.

Material examined : 3 exs., Kanchad forest, Vada, 8.i.2006, Bindu L and party, 2 exs., Amne village, Thane, 10.i.2006, Bindu L and party; 2 exs., Dandoba, Sangli, 08.xii.2006, Bindu L and party; 2exs., Oorash, Sindhudurg, 05.xii.2006, Bindu L and party; 2exs., Mogarkaza, Nagpur, 28.ix.2007, Bindu L and party; 4 exs., Pench National Park, Nagpur, 28.ix.2007, Bindu L and party.

Diagnosis : Test usually light yellow, discoid, circular in front view, low bell shaped or hemispherical in lateral view, with lateral border rounded or slightly prominent and rounded; height of test about half the diameter, facets or pits variable in number, bounded by prominent folds and ranged in 2 to 3 circles (mostly 2), aperture circular, entire and central.

Distribution : India : Maharashtra, Andhra Pradesh, Arunachal Pradesh, Manipur, Nagaland, Himachal Pradesh, Sikkim and West Bengal.

Remarks : This species is collected from submerged vegetation in freshwater and also from moss samples.

Family CENTROPYXIDAE

Genus *Centropyxis* Stein, 1929

1929. *Centropyxis* Stein : Deflandre, Arch. Protistenkd, 67, p. 322.

Diagnosis : Test dorso-ventrally flattened, spheroidal at posterior portion and tapering towards aperture region; oral aperture eccentric and ventral, typically invaginated without a raised rim.

Key to the genera of the family Centropyxidae collected from Maharashtra

1. Aperture triangular, test hemispherical
..... genus *Trigonopyxis*
Aperture not triangular 2
2. Test swollen at posterior part, oral aperture eccentric genus *Centropyxis*
– Test regularly arched, oral aperture centrally located genus *Cyclopyxis*

Genus *Centropyxis* Stein, 1857

1857. *Centropyxis* Stein, Sitz. Bohm. Gesellsch. Wiss.

1859. *Centropyxis* Stein, Abhk. Bohm, Gesellsch. Wiss. 10, p. 43.

1929. *Centropyxis* Stein, Deflandre, Arch. Protistenkd., 67, p. 322.

Diagnosis : Test mostly membranous, encrusted with foreign particles or covered with sandy material, dorso-ventrally flattened, swollen at posterior portion and tapering towards apertural region, aperture eccentric, typically invaginated without a raised rim.

Key to the species of the genus *Centropyxis* collected from Maharashtra

1. Test furnished with spines 2
– Test without any spine 4
2. Test beset with a few divergent spines

arranged in a single row, usually resembling scrap, oral aperture circular or oval 3

- Test furnished with variable number of spines frequently curved and distributed irregularly or dorsal side, aperture lobate or circular with irregular border *C. spinosa*
3. Test cap-shaped in ventral view; in lateral view fundus (post-oral region) obtusely rounded with spines at posterior part, oral aperture circular *C. aculeata*
4. Test hemispheroid in lateral view, oral aperture not bordered by any xenosomes.. 6
– Aperture plagiostomic without any apertural bridge 7
5. Test more or less elliptical, discoid or oval in ventral view, mature shell large, with dimensions 195-267 μm X 85-102 μm , oral aperture circular or round *C. ecornis*
6. Aperture obliquely invaginated (plagiostomic) having apertural bridges *C. laevigata*
– Test small, usually below 50 μm in diameter, encrusted with siliceous particles, oral aperture, encrusted with siliceous particles, oral aperture circular *C. minuta*
7. Test nearly hemispherical formed of flat sandy particles, clothed in a chitinous colorless matrix, 300-400 μm in diameter *C. penardi*
– Test comparatively large, usually above 70 μm in diameter, encrusted with large stony particles on its dorsal border, oral aperture nearly semi-circular *C. orbicularis*

12. *Centropyxis aculeata* (Ehrenberg, 1832) Stein, 1857

1832. *Arcella* Ehrenberg, Abh. Preuss. Akad. Wiss., Berlin, p. 40.

1957. *Centropyxis aculeata* Stein, Sitz. Bohm, Gesellsch. Wiss. Prague, 5(10), p. 41.

Material examined : 2 exs., Marathwada University campus, Aurangabad, 30. xii. 2005, Bindu L and party; 2 exs., Kanchad forest, Vada,

09.i.2006, Bindu L and party; 3 exs., Padgah village, Thane, 11.i.2006, Bindu L and party; 2exs., Panhala, Kolhapur, 01.xii.2006, Bindu L and party; 2exs., Vada, Mahabaleswar, 29.xi.2006, Bindu L and party; 6 exs., Pench National Park, Nagpur, 28.ix.2007, Bindu L and party.

Diagnosis : Test compressed in ventral view, cap-shaped in lateral view; fundus obtusely rounded and furnished with few spines (usually 4-6), divergent at the border of the test, arranged in a single somewhat regular row; aperture eccentric and circular or oval, test brownish, frequently encrusted with quartz crystals and sometimes with sand particles.

Distribution : India : Maharashtra, Andhra Pradesh, Arunachal Pradesh, Himachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Orissa, Rajasthan, Sikkim, Tripura and West bengal.

Remarks : This species is collected from freshwater bodies amongst vegetation and also from moss.

13. *Centropyxis ecornis* (Ehrenburg, 1841) Leidy, 1879

1841. *Arcella ecornis* Ehrenburg, *Abh. Akad. Wiss. Berlin*, p. 368.
1879. *Centropyxis leornis* Leidy, *Freshwater Rhizopods of North America*, pl. 30, Figs. 20-24.
1929. *Centropyxis ecornis* : Deflandre, *Arch. Protistenkd.*, 67, p. 359.

Material examined : 2 exs., Dandoba, Sangli, 08.xii. 2006, Bindu L and party; 3 exs., Shahuwadi forest, Kolhapur, 03.xii.2006, Bindu L and party; 1 ex., Ganesh lake, Pune, 24.xi. 2006, Bindu L and party; 2exs., Bordharan dam, Wardha, 25. ix. 2007, Bindu L and party; 4 exs., Makhala, Amaravathi, 22.ix. 2007, Bindu L and party.

Diagnosis : In ventral view test discoidal or largely elliptical, sometimes irregular in outline, without any spine and covered with quartz grains, in lateral view dorsal surface slightly arched and slightly more elevated at posterior part, aperture usually circular, sometimes irregularly lobed and much eccentric.

Distribution : India : Maharashtra, Andhra Pradesh, Arunachal Pradesh, Himachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, Uttarakhand and West Bengal.

Remarks : This species is collected from freshwater and moss.

14. *Centropyxis laevigata* Penard 1890

1890. *Centropyxis laevigata* Penard, *Mem. Soc. Phys.*, Geneve, 31(2), p. 151.
1902. *Centropyxis laevigata* Penard, *Fauna rhizopodique du bassin du Lemman*, Geneve, p. 306.
1929. *Centropyxis laevigata*: Deflandre, *Arch. Protistenkd.*, 67, p. 363.

Material examined : 2 exs., Kanchad forest, Vada, 08.i.2006, Bindu L and party; 3 exs., Panchavada, Mahabaleswar, 29.xi.2006; 2 exs., Lonovala, Pune, 25.xi.2006, Bindu L and party; 2exs., Mogarkaza, Nagpur, 28.ix.2007, Bindu L and party; 4 exs., Pench National Park, Nagpur, 28.ix.2007. Bindu L and party.

Diagnosis : Test yellowish brown, nearly circular in ventral view, usually slightly compressed in one side; in lateral view test nearly hemispherical, being broader at posterior extremity; aperture eccentric, obliquely invaginated having apertural bridges and its outer margin broadly rounded.

Distribution : India : Maharashtra, Sikkim, Mizoram and West Bengal.

Remarks : This species is collected from moss.

15. *Centropyxis minuta* Deflandre, 1929

1929. *Centropyxis minuta* Deflandre, *Arch. Protistenkd.*, 67, p. 366.
1879. *Diffugia constricta* Leidy, *Freshwater Rhizopods of North America*, p. 18, Figs. 15-16.
1902. *Diffugia constricta* Penard, *Fauna Rhizopodique du bassin du Lemman*, Geneve, p. 299, Figs. 13-14.

Material examined : 2 exs., Marathwada University campus, Aurangabad, 30.xii.2005, Coll. Bindu L and party; 2 exs., Pashan lake, Pune, 26.xi.2006, Coll. Bindu L and party; 2 exs., Shahuwadi forest, Kolhapur, 3.xii.2006, Coll.

Bindu L and party; 3 exs., Pench National Park, Nagpur, 28.ix.2007, Coll. Bindu L and party.

Diagnosis : Test small, greyish or brown, less conspicuous, more or less circular in ventral view, subspherical in lateral view with slightly more elevated posterior part; aperture circular, eccentric and, in general, obliquely invaginated (plagiostomic), test encrusted with siliceous particles.

Distribution : India : Maharashtra, Andhra Pradesh, Arunachal Pradesh, Himachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, Tripura, Jammu and Kashmir, Uttarakhand and West Bengal.

Remarks : This species is collected from moss.

16. *Centropyxis orbicularis* Deflandre, 1929

1929. *Centropyxis orbicularis* Deflandre, *Arch. Protistenkd.*, 67, p. 334.

Material examined : 2 exs., Kudal, Sindhudurg, 4. xii. 2006, Coll. Bindu L and party; 1 ex., Vada, Satara, 29.xi.2006, coll. Bindu L and party; 2 exs., Mogarkaza, Nagpur, 28.ix.2007, Coll. Bindu L and party.

Diagnosis : Test brownish, almost circular in ventral view, ventral surface flat; in lateral view test semi circular, displaying considerable invagination towards the oral aperture; oral aperture nearly semi-circular, plagiostomic; test encrusted with large stony particles on its dorsal border.

Distribution : India : Maharashtra, Andhra Pradesh, Sikkim and Uttarakhand.

Remarks : This species is collected from moss.

17. *Centropyxis penardi* Deflandre 1929

1929. *Centropyxis penardi* Deflandre, *Arch. Protistenkd. Jena*, 67, p. 368, figs. 159-160.

Material examined : 1 ex., Hingani, Wardha, 25.ix.2007, Coll. Bindu L and party; 1 ex., Vadali forest, Amaravathi, 21.ix.2007, Coll. Bindu L and party.

Diagnosis : Test nearly hemispherical, formed

of small flat sandy particles covered with colourless chitinous matrix; oral aperture centrally located, occupying more than half of the diameter of the shell.

Distribution : India : Maharashtra (present record) and West Bengal.

Remarks : First report from Maharashtra.

18. *Centropyxis spinosa* (Cash and Hopkinson, 1905) Deflandre, 1929

1905. *Centropyxis spinosa* (Cash and Hopkinson, 1905) Deflandre, *Arch. Protistenkd.*, 67, P. 353.

Material examined : 2 exs., Haloli forest range, Thane, 13.i.2006, Coll. Bindu L and Party; 3 exs., Pench National Park, Nagpur, 28.ix.2007, Coll. Bindu L and party; 3 exs., Makhala, Amaravathi, 22.ix.2007, Coll. Bindu L and party.

Diagnosis : Test brownish, more or less circular and cylindrically flat and furnished with variable number of spines, usually 6-8; spines frequently curved and distributed irregularly on the dorsal side; aperture eccentric, lobate or circular with irregular border; test chitinous with quartz crystals.

Distribution : India : Maharashtra, Andhra Pradesh, Arunachal Pradesh, Manipur, Nagaland, Himachal Pradesh, Sikkim, Meghalaya, Mizoram, Uttarakhand and West Bengal.

Remarks : This species has been collected from freshwater tanks and wet mosses.

Genus *Cyclopyxis* (Deflandre)

1929. *Centropyxis* (*Cyclopyxis*) Deflandre, *Arch. Protistenkd.*, 67, P. 330-337.

Diagnosis : Test regularly arched, oral aperture centrally located.

19. *Cyclopyxis eurystoma* (Deflandre, 1929)

1929. *Centropyxis* (*Cyclopyxis*) *eurystoma* Deflandre, *Arch. Protistenkd.*, 67, P. 371.

Material examined : 2 exs., Salama, Nagpur, 29.9.2007, Coll. Bindu L and party; 2 exs., Pashan lake, Pune, 26.xi.2006, Coll. Bindu L and party; 1 ex., Kolkaz, Amaravathi, 22.ix.2007, Coll. Bindu L and party.

Diagnosis : Test hemispherical in lateral view, circular or elliptical in ventral view, brownish, aperture central, circular and slightly invaginated with regular smooth edge and half the diameter of the test; test encrusted with quartz particles.

Distribution : India : Maharashtra and Arunachal Pradesh.

Remarks : This species is collected from wet moss samples.

Genus *Trigonopyxis* (Leidy, 1879)
Penard, 1912

1879. *Diffugia* Leidy, *Freshwater Rhizopoda of North America*, P. 116.

1912. *Trigonopyxis* Penard, *Rev. Suisse. Zool.*, 20(1), pp. 9 & 13.

Diagnosis : Test hemispherical, aperture central and triangular, occasionally irregular.

20. *Trigonopyxis arcula* (Leidy, 1879)
Penard, 1912

1879. *Diffugia arcula* Leidy, *Freshwater Rhizopoda of North America*, P. 116, pl. 15, figs. 35-37 & pl. 16, figs. 30-31.

1912. *Trigonopyxis* Penard, *Rev. Suisse. Zool.*, 20(1), pp. 9&13, pl 1, figs. 698.

Material examined : 1 ex., Kanchad forest, Vada, 8.i.2006, Coll. Bindu L and party; 2 exs., Kudal, Sindhudurg, 4.xii.2006, Coll. Bindu L and party; 1 ex., Mogarkaza, Nagpur, 28.ix.2007, Coll. Bindu L and party.

Diagnosis : Test brownish, hemispherical, aperture central, invaginated, triangular but sometimes irregular, usually surrounded by a small ring of organic cement.

Distribution : India : Maharashtra (present record), Assam, Sikkim and West Bengal.

Remarks : This species is reported for the first time from Maharashtra. It is collected from moss samples.

Family DIFFLUGIIDAE

Genus *Diffugia* Leclera, 1815

1915. *Diffugia (partim)* Leclera, *Mem. du Mus.*, 2, P. 474.

1958. *Diffugia* Gauthier-Lievre and Thomas, *Arch. Protistenkd.*, 103, P. 240.

Diagnosis : Test made of or containing sandy particles, possessing axial symmetry, shape of test varying from globular to elongate pyriform or acuminate, aperture at the extremity of the test.

21. *Diffugia lithophila* (Penard)

1902. *Diffugia hydrostatica* var. *lithophila* Penard, *Fauna Rhizopodique du basin Leman*, Geneve, p. 274.

1958. *Diffugia lithophila* Gauthier-Lievre and Thomas, *Arch. Protistenkd.*, 103, p. 286.

Material examined : 1ex., Ganesh lake, Pune, 24.xi.2006, Coll. Bindu L and party; 1 ex., Panhala, Kolhapur, 1.xii.2006, Coll. Bindu L and party; 2 exs., Savungi, Nagpur, 28.ix.2007, Coll. Bindu L and party; 1 ex., Vadali forest, Amaravathi, 21.ix.2007, Coll. Bindu L and party; 3 exs., Kapshi forest, Akola, 18.ix.2007, Coll. Bindu L and party.

Diagnosis : Test ovoid-globular or sub globose drawn out to the aperture in the form of a short collar, aperture circular without any lobe or crenulation, test covered with well arranged stony particles.

Distribution : India : Maharashtra (present record), Andhra Pradesh, Arunachal Pradesh, Manipur, Nagaland, Meghalaya, Tripura and West Bengal.

Remarks : This species constitutes first report for the state; collected from freshwater ponds and lakes.

Family NEBELIDAE

Genus *Awerintzewia* Schouteden, 1906

1902. *Heliopera (Partim)* Penard, *Fauna Rhizopodique du basin, du, Lleman*, Geneve, pp. 390-393.

1906. *Awerintzewia* Schouteden, *Ann. Biol.*, 1, P. 357.

1919. *Averintzia* Cash, Wailes and Hopkinson, *The British Freshwater Rhizopoda and Heliozoa*, 4, p. 64.

Diagnosis : Test coloured, broadly ovoid, compressed, surface covered with quartz grains, wall of the test around aperture considerably thickened, usually tapering gradually to normal, aperture oval.

22. *Awerintzewia cyclostoma* (Penard, 1902)
Schouteden, 1906

1902. *Heliopera cyclostoma* Penard, *Fauna Rhizopodique du basin, du, Lleman, Geneve*, pp. 390-393.
1906. *Awerontzewia cyclostoma* Schouteden, *Ann. Boil.*, 1, 3, p. 357.
1919. *Awerintzewia cyclostoma* Cash, Wailes and Hopkinson, *The British Freshwater Rhizopoda and Heliozoa*, 4, p. 65.

Material examined : 1 ex., Kanchad forest, Vada, 8.i.2006, Coll. Bindu L and party; 2 exs., Vadali forest, Amaravathi, 21.ix.2007, Coll. Bindu L and party.

Diagnosis : Test broadly ovoid, compressed and coloured with quartz platelets of various size, several plates large and scattering, others small filling in between larger ones; colour usually a dark violet or steel blue; aperture small, terminal, oval, bordered internally by a thickened wall of the test.

Distribution : India : Maharashtra (present record), Mizoram, Sikkim, Uttarakhand and West Bengal.

Remarks : This species is reported for the first time from Maharashtra; collected from moss samples.

Class FILOSEA
Order GROMIIDA
Family EUGLYPHIDAE

Diagnosis : Test composed of siliceous scales or platelets cemented together, body hyaline, pseudopodia filiform, often branching, sometimes anastomosing.

Key to the genera of the family Euglyphidae

1. Aperture terminal2
- Aperture subterminal4
2. Test brown or colourless, aperture elliptical, elongate or oval view, bordered by a very thin and finely dentate membrane
..... genus *Assulina*

- Test hyaline, aperture in oral view circular or oval, bordered by aperture platelets or by a neck without platelets3
- 3. Test with a distinct hyaline collar, denticulate or laciniate, aperture bordered by a neck without any apertural paltelets
.....genus *Tracheleuglypha*
- Test without any collar, aperture bordered by regularly arranged serrated or denticulated platelets genus *Euglypha*
- 4. Test ovoid, formed of circular, imbricated, siliceous platelets, aperture cirucular, oblique and invaginated genus *Trinema*

Genus *Assulina* Ehrenberg, 1872

1848. *Diffflugia (Partim)* Ehrenberg, *Ber. Akad. Berlin*, P. 379.
1871. (1872). *Assulina (Partim)* Eherenber, *Abh. Akad. Berlin*, P. 226.
1879. *Assulina*: Leidy, *Freshwater Rhizopods of North America*, P. 224.

Diagnosis : Test brown or colourless, ovoid, glabrous, compresed, formed of elliptical, imbricated, siliceous platelets, arranged more or less regularly in diagonal rows, aperture oval, terminal, truncate or with a short neck bordered by a thin chitinous dentate membrane.

Key to the species of the genus *Assulina* from Maharashtra

- Test small, usually oviform in shape, 40-55 µm in length *A. muscorum*.
– Test comparatively large, ranging from 60-90 µm, usually pyriform in shape
..... *A. seminulum*

23. *Assulina muscorum* Greef, 1888

1879. *Assulina seminulum (partim)* Leidy, *Freshwater Rhizopods of North America*, pl. 37, figs. 15 16, 26.
1888. *Assulina muscorum* Greef, *Sitzber. Ges. Nat. Marburg.*, P. 117.
1915. *Assulina muscorum*: Cash, Wailes and Hopkinson, *The British Freshwater Rhizopoda and Heliozoa*, 3, p. 55.

Material examined : 2 exs., Kolkaz, Amaravathi, 22.ix.2007, Coll., Bindu L and party; 2 exs., Pench National park, Nagpur, 28.ix.2007, Coll. Bindu L and party.

Diagnosis : Test small, yellowish to dark brown and sometimes colourless, oviform, compressed, truncate anteriorly at aperture, composed of imbricated oval or elliptical platelets, usually arranged in alternating diagonal rows, sometimes irregularly; aperture terminal, elliptical, bordered by a thin chitinous membrane with undulate or irregularly dentate margin, aperture with pronounced and distinctly lobed collar of organic cement.

Distribution : India : Maharashtra, Arunachal Pradesh, Assam, Himachal Pradesh, Sikkim, Tripura, Mizoram, and West Bengal.

Remarks : This species is collected from freshwater and moss samples.

**24. *Assulina seminulum* (Ehrenberg, 1848)
Leidy, 1879**

1848. *Diffugia seminulum* Ehrenberg, *Ber. Akad. Berlin*, P. 379.

1879. *Assulina seminulum* (Partim) Leidy, *Freshwater Rhizopods of North America*, P. 255.

Material examined : 2 exs., Trambakeswar, Nashik, 6.i.2006, Coll. Bindu L and party; 1 ex., Kolkaz, Amaravathi, 22.ix.2007, Coll. Bindu L and party.

Diagnosis : Test about one and a half times larger than that of *A. muscorum*, yellowish to dark brown, pyriform or ovoid in broad view, compressed, composed of imbricated oval or elliptical siliceous platelets, aperture terminal, oval surrounded by a thin chitinous membrane with regularly dentate or undulate margin.

Distribution : India : Maharashtra, Andhra Pradesh, Manipur, Nagaland, and Sikkim.

Remarks : This species is collected from freshwater and moss samples.

Genus *Euglypha* Dujardin, 1841

1841. *Euglypha* Dujardin, *Zooph. Infus.*, P. 131.

1915. *Euglypha* : Cash, Wailes and Hopkinson, *The British Freshwater Rhizopoda and Heliozoa*, 3, P. 3.

1962. *Euglypha* : Decloitre, *Arch. Protistenkd.*, 106, P. 51.

Diagnosis : Test hyaline, ovoid or elongated, formed of circular, oval or scutiform siliceous, imbricated paltelets, arranged in alternating longitudinal rows, aperture terminal, circular or elliptic, bordered by serrated or denticulate platelets.

Key to the species of the genus *Euglypha*

1. Test furnished with cilia or spines 2
 - Test without any spine 3
2. Test furnished with fine needle like cilia, produced from the margins or distributed over the surface of the test, aperture bordered by 8-14 platelets with 3-5 denticulations in each *E. ciliata*
 - Some platelets of the posterior half of the test and at the base of the funds prolonged into spines, aperture bordered by one or occasionally two rows of serrated plates
..... *E. acanthophora*
3. Aperture bordered with one or two rows of finely serrated platelets, test platelets oval, rarely circular *E. tuberculata*
 - Aperture not bordered with serrated plates.... 4
4. Apertural platelets terminated with a semicircular projection *E. rotunda*
 - Apertural platelets pointed and always shiny at their margin and leaving wider gaps in between their terminal ends *E. laevis*
5. Aperture circular and several stout spines emerging from the junction of test platelets, apertural paatelets thickened *E. strigosa*

**25. *Euglypha acanthophora*
(Ehrenberg, 1842) Perty, 1849**

1842. *Diffugia acanthophora* Ehrenberg, *Abh. Acad. Berlin*, 1841 (1842), pp. 413, 444, pl. 4, fig. 36.

1848. *Euglypha acanthophora* Perty, *Mitth. Nat. Ges. Bern.*, P. 45.

1915. *Euglypha acanthophora* : Cash, Wailes and

Hopkinson, *The British Freshwater Rhizopoda and Heliozoa*, 3, P. 8.

Material examined : 2 exs., Marathwada University campus, Aurangabad, 30. xii. 2005, Coll. Bindu L and party; 2 exs., Panchvada, Satara, 29.xi.2006, Coll. Bindu L and party; 2 exs., Ganesh lake, Pune, 24.xi.2006, Coll. Bindu L and party; 8 exs., Pench National Park, Nagpur, 28.ix.2007, Coll. Bindu L and party; 5 exs., Makhala, Amaravathi, 22.ix.2007, Coll. Bindu L and party.

Diagnosis : Test ovoid or slightly elongated towards aperture, not compressed; aperture circular, bordered by one or occasionally two rows of finely serrated apertural platelets; test platelets elliptical, some platelets of posterior half and at the base of funiculi prolonged into spines, spines usually 4-7 in number.

Distribution : Maharashtra, Andhra Pradesh, Manipur, Meghalaya, Nagaland, and West Bengal.

Remarks : This species is collected from freshwater ponds among vegetation and bottom zone.

26. *Euglypha ciliata* (Ehrenburg, 1848) Leidy, 1878

1848. *Diffugia ciliata* Ehrenburg, *Ber. Acad. Berlin*, P. 379.

1878. *Euglypha ciliata* Leidy (*Partim*), *Proc. Acad. Philad.*, P. 172.

1915. *Euglypha ciliata* : Cash, Wailes and Hopkinson, *The British Freshwater Rhizopoda and Heliozoa*, 3, P.34.

Material examined : 2 exs., Trambakeswar, Nashik, 6.i.2006, Coll. Bindu L and party; 1 ex., Kanchad forest, Vada, 8.i.2006, Coll. Bindu L and party; 2 exs., Oorash, Sindhudurg, 5.xii.2006, Coll. Bindu L and party; 2 exs., Pinkapur, Nagpur, 28.ix.2007, Coll. Bindu L and party; 2 exs., Borkhadi, Wardha, 24.ix.2007, Coll. Bindu L and party; 3 exs., Padmalaya reserve forest, Jalgaon, 15.ix.2007, Coll. Bindu L and party.

Diagnosis : Test oviform, compressed, oval in transverse section, usually furnished with hairy spines emerging from the margins or from all

over the surface of the test, occasionally glabrous, formed of oval imbricated platelets, aperture oval, bordered by 8-14 apertural platelets with 3 or 5 serrations or teeth in each plate.

Distribution : India : Maharashtra (present record), Andhra Pradesh, Arunachal Pradesh, Assam, Jammu and Kashmir, Mizoram, Sikkim, Tripura, and West Bengal.

Remarks : This species is reported for the first time from Maharashtra and is collected from ground and rock mosses.

27. *Euglypha leavis* (Ehrenburg, 1845)

1845. *Diffugia leavis* : Ehrenburg, *Ber. Acad. Berlin*, P.307.

1849. *Euglypha leavis* : Perty, *Mitth. Nat. Ges. Bern.*, P.163.

1915. *Euglypha leavis*: Cash, Wailes and Hopkinson, *The British Freshwater Rhizopoda and Heliozoa*, 3, P.32, pl. 34, figs. 10-12, pl. 39, figs.5-7, figs. 118 & 122.

Material examined : 2 exs., Sevagram, Wardha, 26.ix.2007, Coll. Bindu L. and party; 2 exs., Vadali forest, Amaravathi, 21.ix.2007, Coll. Bindu L and party.

Diagnosis : Test oviform, glabrous, transverse section elliptical or subcircular, aperture elliptical to sub-circular, bordered by a single row of apertural platelets pointed terminally, shiny at their margin and leaving wider gap in between their terminal ends, test platelets oval and slightly imbricated, often displaying a scallariform pattern.

Distribution : India : Maharashtra (present record), Andhra Pradesh, Himachal Pradesh, Meghalaya, Tripura, Uttarakhand and West Bengal.

Remarks : This species constitutes first record for Maharashtra. It is collected from freshwater and moss samples.

28. *Euglypha tuberculata* Dujardin, 1841

1841. *Euglypha tuberculata* Dujardin, *Zooph. Infus.*, P. 251.

1915. *Euglypha tuberculata* : Cash, Wailes and Hopkinson, *The British Freshwater Rhizopoda and Heliozoa*, 3 p. 13, pl. 33, figs. 6-7, pl. 35, figs. 3-5, text-figs. 112-114.

Material examined : 4 exs., Makhala, 22.ix.2007, freshwater, Coll. Bindu L. and Party.

Diagnosis : Test elongate-oviform, not compressed, glabrous, test platelets round or broadly oval, imbricating, giving a regular hexagonal design, aperture circular, bordered by 8-12 finely serrated platelets, arranged in a single or double rows.

Distribution : India : Maharashtra, Andhra Pradesh, Arunachal Pradesh, Assam, Himachal Pradesh, Jammu and Kashmir, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, Tripura, Uttarakhand and West Bengal.

Remarks : This species is collected from freshwater amongst vegetation and from bottom ooze; also in submerged and wet moss.

29. *Euglypha rotunda* Wailes and Penard

1911. *Euglypha rotunda* Wailes and Penard, *Proc. roy. Iris. Acad.*, 31, p. 17.

1915. *Euglypha rotunda* : Cash, Hopkinson and Wailes, *The British Freshwater Rhizopoda and Heliozoa*, 3, p. 31, pl. 34, fig. 9; pl. 35, figs. 14-16, text-fig. 121.

Material examined : 4 exs., Pench National Park, Nagpur, 28.ix.2007, freshwater, Coll. Bindu L. and party; 2 exs., Kolkaz, Amaravati, 22.ix.2007, freshwater, Coll. Bindu L. and party.

Diagnosis : Test small, oviform, glabrous, compressed, test platelets oval, about twice as long as broad, slightly imbricated, aperture circular, bordered by 8 apertural platelets; apertural platelets with one median tooth bent towards interior of the aperture and 2 pairs of lateral teeth, platelets of the test oval and imbricated.

Distribution : India : Maharashtra, Arunachal Pradesh, Andhra Pradesh, Himachal Pradesh, Jammu & Kashmir, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, Tripura, Uttarakhand and West Bengal.

Remarks : This species is collected from ground and rock mosses.

30. *Euglypha strigosa* (Ehrenberg, 1872) Leidy, 1878

1871(1872) *Diffflugia strigosa* Ehrenberg, *Abh. Akad. Berlin*, p. 143, pl. 2B, fig. 31.

1878. *Euglypha strigosa* Leidy, *Proc. Acad. Philad.*, p. 172.

1915. *Euglypha strigosa* : Cash, Wailes and Hopkinson, *The British Freshwater Rhizopoda and Heliozoa*, 3, p. 28, pl. 36, Figs. 1-6, pl. 39, figs. 1-4, text fig. 120.

Material examined : 4 exs., Pench National Park, Nagpur, 28.ix.2007, freshwater, Coll. Bindu L. and party; 2 exs., Dandoba, Sangli, 8.xii.2006, freshwater, Coll. Bindu L. and party.

Diagnosis : Test ovoid-elliptic in transverse section, compressed, several stout spines emerging from the junction of the test platelets singly or sometimes in pair, aperture circular, bordered by 10-12 denticulated, thickened platelets, each with one sharply bent median tooth and 2-3 pairs of lateral teeth.

Distribution : India : Maharashtra, Himachal Pradesh, Sikkim and Uttarakhand.

Remarks : This species is collected from freshwater bodies and wet mosses.

Genus *Trinema* Dujardin, 1841

1841. *Trinema* Dujardin, *Zooph. Infus.*, p. 249.

1915. *Trinema* : Cash, Wailes and Hopkinson, *The British Freshwater Rhizopoda and Heliozoa*, 3, p. 85.

Diagnosis : Test small, hyaline, oviform or elongate, compressed anteriorly, formed of circular siliceous platelets, aperture subterminal, circular or oval, invaginated.

31. *Trinema enchelys* (Ehrenberg, 1838) Leidy, 1878

1838. *Diffflugia enchelys* Ehrenberg (*partim*), *Infusionsth.*, p. 132, pl. 9, figs. 4 a-b.

1878. *Trinema enchelys* Leidy, *Proc. Acad. Philad.*, p. 172.

1915. *Trinema enchelys* : Cash, Wailes and Hopkinson, *The British Freshwater Rhizopoda and Heliozoa*, 3, p. 86, pl. 47, figs. 1-10, pl. 48, figs. 1-3, text figs. 1-3.

Material examined : 3 exs., Pench National Park, Nagpur, 28.ix.2007, freshwater, Coll. Bindu L. and party; 2 exs., Kanchad forest, Vada, 8.i.2006, freshwater, Coll. Bindu L. and party; 1 ex., Koltaz, 22.ix.2007, freemoss, Coll. Bindu L. and party.

Diagnosis : Test hyaline, elliptic, formed of siliceous circular platelets, scarcely overlapping, as well as smaller platelets of different sizes in between large ones; aperture circular, oblique, invaginated, bordered by toothed apertural platelets.

Distribution : India : Maharashtra, Andhra Pradesh, Arunachal Pradesh, Himachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, Tripura, Uttarakhand and West Bengal.

Remarks : This species is collected from freshwater amongst vegetation and moss.

32. *Trinema lineare* Penard, 1890

1890. *Trinema lineare* Penard, *Mem. Soc. Geneve*, 31, p. 187, pl. 11., Figs. 5-17.

1915. *Trinema lineare* : Cash, Wailes and hopkinson, *The British Freshwater Rhizopoda and Heliozoa*, 3, p. 91, pl. 47, figs. 11-21 and text fig. 153.

Material examined : 3 exs., Pench National Park, Nagpur, 28.ix.2007, Coll. Bindu L. and party; 1 ex., Ganesh Lake, Pune, 24.xi.2006, Bindu L. and party.

Diagnosis : Test hyaline, elliptic or elongate, formed of circular platelets of different sizes, aperture circular, oblique, invaginated, bordered by toothed apertural platelets.

Distribution : India : Maharashtra, Andhra Pradesh, Arunachal Pradesh, Assam, Himachal Pradesh, Sikkim, Manipur, Meghalaya, Mizoram, Nagaland, Tripura and West Bengal.

Remarks : This species is collected from mosses and freshwater bodies.

Genus *Tracheleuglypha* Deflandre, 1953

1953. *Tracheleuglypha* Deflandre, *Traite de zoologie*, 1(2), p. 133.

Diagnosis : Aperture terminal, bordered by a neck without apertural platelets.

33. *Tracheleglypha dentata* (Vejdowsky, 1832) Deflandre, 1928

1832. *Euglypha dentata* Vejdowsky, *Their. Org. Brunnenw. prag.*, p. 38.

1890. *Sphenodaria dentata* Penard, *Mem. Soc. Geneve*, 31, p. 185.

1928. *Tracheleuglypha dentata* (Vejdowsky) Deflandre. *Annales de Protistologie*, 1. pp. 37-43.

Material examined : 2 exs., Shahuwadi forest, Kolhapur, 3.xii.2006, Bindu L. and party; 1 ex., Lonavala, Pune, 25.xi.2006, Bindu L. and party.

Diagnosis : Test colourless, oviform, circular in transverse section, formed of circular or sub-circular platelets, regularly overlapping ; aperture circular, terminal, surrounded by chitinous hyaline collar, denticulate or laciniate; in some population such collar lacking.

Distribution : India : Maharashtra (present record), Arunachal Pradesh, Himachal Pradesh, Mizoram, Manipur, Nagaland, Tripura, Uttarakhand and West Bengal.

Remarks : This species is reported for the first time from Maharashtra; collected from moss and freshwater samples.

Phylum Ciliophora

Class KINETOFRAGMINOPHOREA

Order PROSTOMATIDA

Family PRORODONTIDAE

Genus *Proroden* Ehrenberg

Diagnosis : Ovoid to cylindrical; ciliation uniform, with sometimes longer caudal cilia; oral basket made up of double trichites which end deep in ectoplasm, oval in cross-section; contractile vacuole terminal; macronucleus massive, spherical or oval.

34. *Prorodon discolor* (Ehrenberg)

1835. *Holophrya discolor* Ehrenberg. *Abh. Preuss. Akad. Wiss.*, Berlin, p. 251.

1930. *Prorodon (Holophrya) discolor* Kahl, *Urtiere oder Protozoa*, (in : Dahl's *Tierwelt Dtsch.*) Jena, pt. 18, p. 76, fig. 8(4).

Material examined : 4 exs., Bor Wild Life Sanctuary, Nagpur, 25.ix.2007, Bindu L and party.

Diagnosis : Body oval, narrower posteriorly, mouth terminocentral, pharyngeal tube with trichites extending above one-fourth of the body; macronucleus single, rounded; micronucleus

hemispherical; contractile vacuole single and situated near posterior end.

Distribution : India : Maharashtra, Orissa and West Bengal.

Order PLEUROSTOMATIDA

Family AMPHILEPTIDAE

Body lanceolate and laterally compressed; slit-like cytostome located at the convex ventral border of the anterior part of the body. Under this family two genera are represented from the state.

35. *Loxophyllum levigatum* Sauerbey

1928. *Loxophyllum levigatum* Sauerbey, *Arch. protistenk.*, Jena, 62, p. 377.

Material examined : 2 exs., Bor Wildlife Sanctuary, Nagpur, 25.ix.2007, Bindu L and party.

Diagnosis : Body leaf-like, anterior end with distinct beak, posterior end rounded; body margin smooth; macronuclei 7-15 in number, globular and scattered; contractile vacuole single and located at posterior end on dorsal side.

Distribution : India : Maharashtra and West Bengal.

36. *Litonotus fasciola* (Ehrenberg)

1838. *Amphileptus fasciola* Ehrenberg, *Die Infusionsthierchen als vollkommene organismen*, Leipzig, p. 356, pl. 38, fig. 17.

Diagnosis : Body lanceolate, non contractile, neck not always sharply distinguished from body; macronucleus subcentral, consisting of two spherical lobes united to one another by a thread; contractile vacuole single and located near the posterior end of the body.

Distribution : India : Maharashtra, Rajasthan, Jammu and Kashmir and West Bengal.

Order KARYORELICTIDA

Family LOXODIDAE

Genus *Loxodes* Ehrenberg

Diagnosis : Leaf-like, flattened, anterior end with beak curved ventrally, right surface slightly

convex, uniform ciliation on several longitudinal rows, macronuclei two or more, 2-25 strongly refractile Muller's vesticles in dorsal region.

37. *Loxodes vorax* Stokes

1885. *Loxodes vorax* Stokes, *Amer. Mon. micr. J.*, 6, PP. 121-127.

Material examined : 3exs., Bor Wildlife Sanctuary, Nagpur, 25.ix.2007, Bindu L and party.

Diagnosis : Body leaf-like, flattened, anterior end beak-like and curved ventrally; posterior end rounded; macronuclei two in number and lying very close to each other.

Distribution : India, Maharashtra and West Bengal.

Order TRICHOSTOMATIDA

Family PLAGIOPYLIDAE

Genus *Plagiopyla* Stein

Diagnosis : Vestibulum, a broad ventrally opened groove from which body ciliation begins, vestibular cilia short excepting at the anterior end where a tuft of longer cilia present.

38. *Plagiopyla nasuta* Stein

1860. *Plagiopyla nasuta* Stein, *S. B. bohn. Ges. Wiss.*, Prague, p. 58.

Material examined : 3 exs., Bor Wildlife Sanctuary, Nagpur, 25.ix.2007, Bindu L and party.

Diagnosis : Body reniform or ovoid, narrower anteriorly; cytostome situated near median line at the end of peristome; cytopharynx long; single and terminal contractile vacuole; macronucleus round.

Distribution : India : Maharashtra, Orissa and West Bengal.

Order COLPODIDA

Key to the families dealt with

1(2).Body typically reniform, with distorted ciliary rows, no conspicuous ciliary tuft at anterior end COLPODIDAE

- 2(1) Body narrow-ovoid, ciliation uniform but sparse, with conspicuous anterior ciliary tuft
..... CYRTOLOPHOSIDIDAE

Family COLPODIDAE

Under this family a single genus has been collected from this state.

Genus *Colpoda* Muller

Diagnosis : Body kidney-shaped, cytostome present in the ventral depression, leading into peristomeal cavity and giving rise to a diagonal groove at dorsal side, a ciliated area present in the right edge of the cytostome.

39. *Colpoda cucullus* Muller

1773. *Colpoda cucullus* O. F. Muller, *Verminum terrest et Fluviatil S. animal infusor. etc. historia, Hafniae et Lipsiae*, 1 & II.

Material examined : 2 exs., Bor Wildlife Sanctuary, Nagpur, 25.ix.2007, Bindu L and party.

Diagnosis : Body typically kidney shaped, cytostome located about middle of the body; frontal dentations 8-10 and meridians 29-34; macronucleus oval; contractile vacuole single and posterior.

Distribution : India : Maharashtra, Andhra Pradesh, Assam, Karnataka, Jammu & Kashmir, Madhya Pradesh, Orissa, Punjab, Tamil Nadu, Uttar Pradesh and West Bengal.

40. *Colpoda maupasi* Enriques

1908. *Colpoda maupasi* Enriques, *Arch. Zool. Exp. Gen., Notes et Rev.* (4) 8, pp. 7-11, figs. 3-5, 9.

Material examined : 3 exs., Bor Wildlife Sanctuary, Nagpur, 25.ix.2007, Bindu L and party.

Diagnosis : Body oval and cylindrical, cytostome located at about one-fourth of the body from the anterior end, frontal dentations 6-7 and meridians 16-18, macronucleus spherical.

Distribution : India : Maharashtra, Kerala and West Bengal.

Family CYRTOLOPHOSIDIDAE

41. *Cyrtolophosis elongatus* (Schewiakoff)

1893. *Balantiophorus elongatus* Schewiakoff, *Mem. Acad. Sci. de st. Petersb.*, (7) 41, pp. 56-57. pl. 4, fig. 50.

Diagnosis : Body elongate and narrow with long sparsely scattered cilia not arranged in longitudinal rows; macronucleus oval and centrally located; contractile vacuole single and posterior.

Distribution : India : Maharashtra, Assam, Bihar, Karnataka, Jammu & Kashmir, Madhya Pradesh, Orissa, Punjab, Tamil Nadu, Uttar Pradesh and West Bengal.

42. *Cyrtolophosis minutus* (Schewiakoff)

1889. *Balantiophorus minutus* Schewiakoff, *Bertrage zur Kenntniss der holotriches Ciliaten. Biblioth. Zoology*, (Leuckart u. chun), 5, pp. 64-65, pl. 7, figs. 99-101.

Diagnosis : Body ovoid with narrow anterior and broadly rounded posterior end; short and uniform cilia arranged in distinct longitudinal rows; macronucleus spherical and central, contractile vacuole single and posterolateral.

Distribution : India : Maharashtra, Bihar, Punjab, Tamil Nadu, Uttar Pradesh and West Bengal.

Order CYRTOPHORIDA

Family CHILODONELLIDAE

Body with a distinct beak to the left, thigmotactic zone broad.

Genus *Chilodonella* Strand

Ovoid, dorsal surface convex, ventral surface flat and with ciliary rows, a cross row of bristles on anteriorly flattened dorsal surface.

43. *Chilodonella cucullulus* (Muller)

1883. *Kolpoda cucullulus* Muller, *Verminum terrest et fluviatil S. animal infusor., etc. historia, Hafniae et Lipsiae*, p. 158.

Diagnosis : Body dorso-ventrally flattened, cytopharynx long and straight, macronucleus oval, contractile vacuole many and scattered.

Distribution : India : Maharashtra, Jammu & Kashmir, Rajasthan and West Bengal.

44. *Chilodonella* sp.

Material examined : 2 exs., Kanchad forest, Vada, 8.i.2006, Bindu L and party.

Diagnosis : Body ovoid, dorsal surface convex, ventral surface flat and with ciliary rows, a cross rows of bristles on anteriorly flattened dorsal surface.

Distribution : India : Maharashtra and West Bengal.

Class OLIGOHYMENOPHOREA

Subclass HYMENOSTOMATIA

Order HYMENOSTOMATIDA

Family OPHRYOGLENIDAE

Body uniformly ciliated, peristome runs as a sickle-shaped ciliated cleft, perpendicular to surface of the body.

Genus *Ophryoglena* Ehrenberg

Body ellipsoidal with both ends rounded, preoral depression in the form of '6' due to an ectoplasmic membrane extending from the left edge.

45. *Ophryoglena flava* (Ehrenberg)

1833. *Bursaria flava* Ehrenberg, *Abhandl. D. konigl. Akad. d. Wissensch. zu Berlin*, p. 233.

Diagnosis : Body ellipsoidal, cytostome on ventral side and situated at about one-third of body length from anterior end; macronucleus elliptical, contractile vacuole two with long radiating canals.

Distribution : India : Maharashtra, Manipur, Meghalaya, Rajasthan and West Bengal.

Family PARAMECIDAE

Genus *Paramecium* Hill

Cigar-shaped, peristome long, broad and slightly oblique, cytopharynx moderately long, with a row of very fine cilia attached to its dorsal wall.

46. *Paramecium caudatum* Ehrenberg

1833. *Paramecium caudatum* Ehrenberg, *Abhandl. D. Konigl. Adad. d. Wissensch. zu Berlin*, pp. 268, 323, pl. 3, fig. 2.

Material examined : 2 exs., Khandala, Pune, 25.xi.2006, Bindu L and party; 2 exs., Vada, Mahabaleswar, 29.xi.2006; 2 exs., Kanchad forest, Vada, 8.i.2006, Bindu L and party.

Diagnosis : Cigar-shaped, anterior end broader and rounded and posterior end gradually tapering; micronuclei single and compact, lying close to massive and egg-shaped macronucleus; contractile vacuoles two.

Distribution : India : Maharashtra (present record), Manipur, Meghalaya, Kerala, Orissa, Rajasthan, Tripura Uttar Pradesh, Jammu & Kashmir and West Bengal.

Remarks : This species is reported for the first time from Maharashtra.

Family FRONTONIDAE

Genus *Frontonia* Ehrenberg

Key to the species

- 1(2) Body elongated or ovoid, rounded at both ends, macronucleus ellipsoid, with several micronucleus, inhabiting freshwater *F. leucas*
- 2(1) Body oval, flattened, macronucleus short, sausage shaped with single micronucleus, inhabiting moss *F. depressa*

47. *Frontonia depressa* (Stokes)

1886. *Colpoda depressa* stokes, *Ann. Mag. Nat. Hist.* (5) 17.

Material examined : 4 exs., 25.ix.2007, Bor Wildlife Sanctuary, Nagpur, 25.ix.2007, Bindu L and party.

Diagnosis : Body ovoid, flattened, body size small, contractile vacuole single with strong radiating canals and located below the middle, macronucleus short, sausage-shaped with single micronucleus.

Distribution : India : Maharashtra, Manipur, Sikkim and West Bengal.

48. *Frontonia leucas* (Ehrenberg)

1838. *Bursaria leucas* Ehrenberg, *Die Infusionsthierchen als Vollkommene organismen*, Leipzig, p. 329, pl. 34, fig. 8.

Material examined : 6 exs., Bor Wildlife Sanctuary, Nagpur, 25.ix.2007, Bindu L and party.

Diagnosis : Body elongated or ovoid, rounded at both ends, body size larger; contractile vacuole single with long radiating canals and located at the middle of the body; macronucleus ellipsoid with several micronuclei.

Distribution : India : Maharashtra, Manipur, Orissa, Arunachal Pradesh, Tripura, Meghalaya, Jammu & Kashmir and West Bengal.

Family UROCENTRIDAE

49. *Urocentrum turbo* (Muller)

1786. *Cercaria turbo* Muller, *Animalc. Infusoria fluvial. et. Marina etc. Hafniae et Lipsiae*, pp. 123-124, pl. 26, figs. 13-16.

Diagnosis : Body resembling two spheres, each encircled with a broad ciliary girdle, caudal tuft of cilia very conspicuous, no depressed prebuccal area, buccal cavity subequatorial in position; contractile vacuole single, with multiple collecting canals and posteriorly located; macronucleus horse-shoe shaped.

Distribution : India : Maharashtra, Kerala, Rajasthan and West Bengal.

Class POLYHYMENOPHOREA

Subclass SPIROTRICHIA

Order HYPOTRICHIDA

Family OXYTRICHIDAE

Genus *Oxytricha* Bory

1926. *Oxytricha* Bory, *Essai d'une Classification des Animaux Microscopiques*, Paris, P. 104.

1932. *Oxytricha* : Kahl, *Urtiere oder Protozoa (in Dahl's Tierwelt Dtsch)*, Jena, pt. 25, p. 599.

Diagnosis : Body ellipsoid and flexible, frontal

cirri eight, both ventral and anal cirri five, short or no caudal cirri, marginal cirri may or may not be continuous along posterior border; macronucleus bipartite, rarely single or in four parts.

Key to the species

1(2) Anterior half of the body broader than posterior half, posterior end pointed, body length around 250 µm *O. bifaria*

2(1) Posterior half of the body broader than anterior half, posterior region broadly rounded, body length around 150 µm
..... *O. fallax*

50. *Oxytricha bifaria* Stokes

1887. *Oxytricha bifaria* Stokes, *Ann. Mag. Nat. Hist.*, (5) 20, pp. 104-114.

1932. *Oxytricha bifaria* : Kahl, *Urtiere oder Protozoa (in Dahl's Tierwelt Dtsch)*, Jena, pt. 25, p. 602.

Material examined : 2 exs., Kanchad forest, Vada, 8.i.2006, Bindu L and party.

Diagnosis : Body ellipsoid, right side convex, left side flattened, anterior half broader than posterior half, posterior end of the body pointed while anterior end broadly rounded; arrangement of cirri as in the genus; macronucleus bipartite, contractile vacuole single and located near the middle of the body.

Distribution : India : Maharashtra (present record) and Meghalaya.

Remarks : This species is reported for the first time from Maharashtra and second report from India.

51. *Oxytricha fallax* Stein

1859. *Oxytricha fallax* Stein, *Der organismus der Infusionsthier*, Leipzig, 1, p. 189, pl. 12, figs. 12-15.

1932. *Oxytricha fallax* : Kahl, *Urtiere oder Protozoa (in Dahl's Tierwelt Dtsch)*, Jena, pt. 25, p. 602.

Diagnosis : Ellipsoidal, both left and right sides convex; posterior half broader than anterior; posterior region broadly rounded; arrangement of cirri is continuous, macronuclei usually in two parts; contractile vacuole single and located at

the anterior half of the body.

Distribution : India : Maharashtra (present record) Manipur, Tripura, Meghalaya, Rajasthan and West Bengal.

Remarks : This species is reported for the first time from Maharashtra.

52. *Pleurotricha grandis* Stein

1859. *Pleurotricha grandis* Stein, *Lotos*, 9, p.4.

Material examined : 3 exs., Kanchad forest, Vada, 8.i.2006, Bindu L. and party.

Diagnosis : Elliptical in shape and widest at little behind the middle; five ventral cirri stout; macronuclei two in number; contractile vacuole single and located close to the posterior angle of peristome.

Distribution : India : Maharashtra, Madhya Pradesh and West Bengal.

SUMMARY

A consolidated taxonomic account of 52 species of free living protozoa reported by earlier

workers and collected by the present authors from Maharashtra has been presented. These 52 species are distributed under 32 genera and 23 families. Amongst these 33 species are testacids and 19 species are ciliates. A total of 38 species collected during the present study are reported as new to Maharashtra and one species (*Amphizonella violacea*) is recorded for the first time from India.

ACKNOWLEDGEMENTS

The authors are grateful to the Director, Zoological Survey of India for extending necessary facilities for the work. The first author records the sincere thanks to the forest Department of Maharashtra for the help rendered during the survey. We are very much indebted to Dr. A.K. Das, Emeritus Scientist, Zoological Survey of India for the invaluable help rendered during the identification of specimens. The first author wishes to record the deep sense of gratitude to Dr. N.C. Nandi, Additional Director (Retd.), Zoological Survey of India for the suggestions, advice and various kinds of help rendered at different stages of the work.

REFERENCES

- Bhatia, B. L. 1936, *The fauna of British India including Ceylon and Burma*, Protozoa : Ciliophora, xxii + 393 pp., London (Taylor & Francis, Ltd.).
- Cash, J. and Hopkinson, J. 1905-1909 : *The British freshwater Rhizopoda and Heliozoa*, 1-2 (Ray Society, London).
- Cash, J and Wailes, G.H. 1915-1921. *The British freshwater Rhizopoda and Heliozoa*, 3-5 (Ray Society, London).
- Chattopadhyay, P. and Das, A.K. 2003. Morphology, morphometry and ecology of moss dwelling testate amoebae (Protozoa : Rhizopoda) of North and North-east India, *Mem. Zool. Surv. India*, 19(4) : 1-133.
- Corliss, J.O. 1969. *The ciliated protozoa*, xiv + 455 pp., Pergamon press.
- Das, A.K., Mondal, A.K. and Sarkar, N.C. 1993. Freeliving protozoa. *Zool. Surv. India, Fauna of West Bengal, State Fauna Series*, 3(Part 12) : 1-133.
- Das, A.K., Mondal, A.K., Tiwari, D.N. and Sarkar, N.C. 1995. Protozoa, *Zool. Surv. India, Fauna of Meghalaya, State Fauna Series*, 4(Part 10) : 1-103.
- Decloitre, L. 1956. Rhizopodes, *Bull. de l' I. F. A. N.*, 16, series A : 89-125.
- Decloitre, L. 1962, Le genre *Euglypha* Dujardin, *Arch. Protistenk.*, Jena, 106(1), pp. 51-100.

- Deflandre, G. 1928. Le genera *Arcella* Ehrenberg, *Arch. Protistenk*, Jena, **64**, pp. 152-287.
- Deflandre, G. 1929, Le genre *Centropyxis* Stein. *Arch. Protistenk.*, **67** : 322-375.
- Gauthier-Lievre, L. and Thomas, R. 1958. Les genres *Diffflugia*, *Pentagonia*, *Maghrebia* and *Hoogenraadia* (Rhizopodes testaces) en Afrique. *Arch. Protistenk.*, **103** : 241-370.
- Ghosh, E. 1923. Notes on *Arcella vulgaris* var. *gibbosa* West., *J. Roy. Micr. Soc.*, London, p. 73.
- Kahl, A. 1930-1935, Urtiere oder Protozoa. I. Wimpertiere oder Ciliate (Infusoria), Eine Bearbeitung der freilebenden and ectocommensalen infusorien der Erde, under Ausschluss der marinen Tintinnidae. In Dahl, F. *tierwelt Dtsch.*, 886 pp., Jena (G. Fischer).
- Kudo, R. R. 1966. *Protozoology 5th edn.*, pp. xi + 1-1174 (Charles C. Thomas, Illinois).
- Leidy, J. 1878. Species of *Euglypha*, *Trinena*, *Pamphagus* and *Cyphoderia*. *Pro Acad. Philad.*, : 171-173.
- Leidy, J. 1879. *freshwater Rhizopods of North America*. Rep. v.s. geol. Surv. Territ Monogr., **12** : 1-324.
- Levine, N.D., Corliss, J.O., Cox, G.E.F., Deroux, G., Grain, J., Honigberg, B.M., Leedsle, G.E., Loeblich, A.R., Lom, J., Lynn, D., Merinfelds, G.E., Page, F.C., Poljansky, G., Sprangue, V., Vavra, J. and Wallace, F. G. 1980. A newly revised classification of Protozoa, *J. Protozool.*, **27** : 37-58.
- Page, F.C. 1967a. Taxonomic critiria for limax amoebae with description of 3 new species of *Hartomannella* and *vahlkampfia*. *J. Protozool.*, **14** : 499-521.
- Penard, E. 1902. *Fauna Rhizopodique du Bassin du Leman*. 714 pp. Kundig, Geneve.
- Schewiakoff, W. 1893. *Ueber die Geographische Verbreitung der Susseasser Protozoen*. *Mem. Acad. Imp. Sci. St. Petersb.* Vol., **41**. 201 pp.
- Singh, B.N. 1952. Nuclear division in nine species of small freeliving amoebae and its bearing on the classification on the Order Amoebida. *Phil. Trans. R. Soc. (B)*, **236** : 405-461.
- Wenzel, F. 1953. Die ciliatin der moosarassen trockner Standorte. *Arch. Protistenk.*, **99** : 70-141.

FRESHWATER SPONGES

H.V. GHATE

Modern College of Arts Science and Commerce, Shivajinagar, Pune-411 005

INTRODUCTION

Phylum Porifera includes the animals commonly called as "Sponges". These are exclusively aquatic invertebrates found in almost all aquatic environments, though their greatest diversity is in marine biome. These animals have not reached tissue grade organization of body and hence are regarded as "Parazoa". These animals also do not have any form of symmetry seen in other animals. According to Manconi and Pronzato (2008) there are 45 genera of living freshwater sponges with a total of 219 species. The phylum includes more than 15,000 species.

Freshwater sponges are an interesting group of animals which can tolerate extreme chemico-physical conditions and have adapted to almost all kinds of water bodies. Freshwater sponges show considerable diversity of body shape and dimensions. From almost colorless white to yellow-brown and even dark green forms (due to associated symbionts) are met with. Sponges can filter and purify water because of continuous filter-feeding activity therefore important members of the freshwater ecosystems Manconi and Pronzato (2008). All the freshwater sponges are now included in new suborder Spongillina defined by Manconi and Pronzato (2002) under which there are 7 families; Spongillidae (with 21 valid genera) being one of them. Indian sponges belong to family Spongillidae (Gray, 1867).

The taxonomy of sponges largely depends on the skeletal architecture, size and shape of body and gemmule spicules. These spicules can be easily obtained by boiling a small piece of dry sponge in concentrated nitric acid.

Annandale (1911) was the first to put together all known freshwater sponges of the then British India. Annandale (1911) also discussed geographical distribution of various Indian species and gave region wise lists. Most of the freshwater sponges of Maharashtra state as we recognize today include species listed in the peninsular province

Since the Fauna of British India volume included adjoining regions to the present political India, it was necessary to list species found in the present Indian Territory. Soota (1991) listed 11 genera and 31 species known to be present in India. Prior to this work Khera & Chaturvedi (1976) listed Indian freshwater sponges and also gave details of type specimens present in the collections of Zoological Survey of India.

There is very little published work on freshwater sponges of Maharashtra. The earliest work is a short-note on Freshwater Sponges of Poona (Tonapi, 1964) which listed 4 species of which *Spongilla hemephydatia* [= *Radiospongilla hemephydatia* (Annandale, 1909)] has been noted as a doubtful record by Soota (1991). Recently, Patil and Talmale (2007) published a checklist of freshwater sponges of Maharashtra in which they included 20 species. Of these 20 species, 3 species were included twice giving the current as well as older taxonomic name. Deleting these 3 species the current number of freshwater sponge species in Maharashtra stands at 17.

The validity of names was further checked by referring to the world database of sponges (www.marinespecies.org/porifera/index.php). A recent complete description of all species of

freshwater sponges has been provided by Manconi and Pronzato (2002) along with excellent SEM images.

SYSTEMATIC LIST

Phylum PORIFERA

Family SPONGILLIDAE Gray, 1867

Genus *Spongilla* Lamarck, 1816

1. *Spongilla alba* Carter, 1849
2. *Spongilla lacustris* (Linnaeus, 1759)

Genus *Eunapius* Gray, 1867

3. *Eunapius carteri* (Bowerbank, 1863)

Genus *Stratospongilla* Annandale, 1909

4. *Stratospongilla bombayensis* (Carter, 1882)
5. *Stratospongilla gravelyi* (Annandale, 1912)
6. *Stratospongilla indica* (Annandale, 1908)
7. *Stratospongilla sumatrana* (Weber, 1890)

Genus *Corvospongilla* Annandale, 1911

8. *Corvospongilla burmanica* (Kirkpatrick, 1908)
9. *Corvospongilla caunteri* Annandale, 1911
10. *Corvospongilla lapidosa* (Annandale, 1908)
11. *Corvospongilla ultima* (Annandale, 1910)

Genus *Radiospongilla* Penney & Racek, 1968

12. *Radiospongilla cerebellata* (Bowerbank, 1863)
13. *Radiospongilla cinerea* (Carter, 1849)
14. *Radiospongilla crateriformis* (Potts, 1882)
15. *Radiospongilla indica* (Annandale, 1907)

Genus *Ephydatia* Lamouroux, 1816

16. *Ephydatia meyeri* (Carter, 1849)

Genus *Dosilia* Gray, 1867

17. *Dosilia plumosa* (Carter, 1849)

SUMMARY

17 species of 7 genera belonging to single family of freshwater sponges are reported from Maharashtra state.

ACKNOWLEDGEMENTS

The author is thankful to the authorities of Modern College, Pune for facilities and encouragement. He also expresses his gratitude to Dr. K. Venkatraman, Director, Zoological Survey of India, Kolkata and Dr. R.M. Sharma, Scientist-D & Officer-in-Charge, Zoological Survey of India, Pune for providing opportunity to contribute the study.

REFERENCES

- Annandale, N., 1911. The Fauna of British India, including Ceylon and Burma. Freshwater Sponges, Hydroids and Polyzoa. Taylor and Francis, London.
- Khera, S. and Y. Chaturvedi, 1976. Checklist of Indian Freshwater Sponges, with a Catalogue of Type – specimens in the collection of the Zoological Survey of India (Porifera: Spongillidae). *Rec. zool. surv. India, Miscellaneous Publication Occasional Paper*, No. 4 : 1-29.
- Manconi, R. and R. Pronzato, 2002. Suborder Spongillina subord. nov.: Freshwater Sponges. Pp. 921–1019. In Hooper, J.N.A. and R.W.M. van Soest (eds), *Systema Porifera : A Guide to the Classification of Sponges*, Vol. 1. Kluwer Academic/Plenum Publishers, New York.
- Manconi, R. and R. Pronzato, 2008. Global biodiversity of sponges (Porifera : Spongillina) in freshwater. *Hydrobiologia*, **595** : 27-33.
- Patil, S.G. and S.S. Talmale, 2005. New record of sponge (Porifera) from Maharashtra. *Bionotes*, **7**(3) : 87.
- Penney, J.T. and A.A. Racek, 1968. Comprehensive revision of a worldwide collection of freshwater sponges (Porifera : Spongillidae). *Bulletin of U.S. National Museum*, No. **272** : 184 pp.
- Tonapi, G.T. 1964. A note on the freshwater sponges of Poona. *Current Science*, **12** : 372-373.

NEMATODA

PADMA BOHRA

Desert Regional Centre, Zoological Survey of India, Jodhpur

INTRODUCTION

The State of Maharashtra has 9.68 crores population with 15 million hectare cultivable land out of which 15.4% is irrigated. The 65 percent of the land cultivated under kharif season is mostly dependent on rainfall. The state is an area of 12 lakh hectare under horticulture plantation.

Biotic stress is major constraint in achieving full yield potential of crop plants. The losses due to weeds, diseases and insects have been estimated to be around 40% in the developing or underdeveloped countries. Losses in respect of pest and diseases may reach Rs 60,000/- crores per annum in India. Considering cultivable area in Maharashtra, the annual losses could be approximately nearing Rs 6,000/- crores. Maharashtra state has enormous genetic resources of crop plants. This is true of horticultural crops where insect pests, diseases, weeds and nematodes reduce the potential yields. Root-Knot nematodes on vegetables, pulses, pomegranate, grape and poly house crops, citrus nematodes on citrus and burrowing nematode on banana are serious problems in the state.

The members of phylum Nematoda (Nematodes) are highly diversified and found in all kinds of habitats on the basis of their habitats and feeding habits, the nematodes can be divided in to following groups: Parasites of vertebrates, Parasites of invertebrates, Parasites of Plants, free living or Saprophagous and Predaceous. The parasites of plants, saprophagus and predaceous nematodes are also known as terrestrial nematodes because they are generally found in the soil. The

present paper is based on the compilation of all the known species of terrestrial nematodes, which include phytophagous, saprophagous and predeceous groups from Maharashtra. From economic point of view, the phytophagous nematodes are very important because they cause considerable damage to agricultural and horticultural crops. Most of the saprophagous nematodes help in maintaining eco-balance in the terrestrial fauna while some are being used as indicator of aquatic pollution. The predaceous nematodes act as agents of biological control of phytophagous nematodes.

During last four decades, commendable work has been done by nematologists on survey, distribution and taxonomy of plant and soil nematodes. Prof. S.M. Ali, a highly reputed and talented parasitologist, initiated studies with the help of his students on the taxonomy of plant and soil nematodes at Marathwada University, Aurangabad during 1968-73. Consequently Dareker and his associates (1979-1990); Khan, E *et al.* (1979-1982); Patil and Khan (1982); Prabha (1973); Suryawanshi (1971-1972); Siddiqi (1968-1970); Jairajpuri (1968-71) and others have made significant contribution towards describing species new to science and new zoogeographical records from the State.

The present paper reports 90 species belonging to 45 genera under 27 families of Orders Tylenchida (42 spp.); Aphelenchida (05 spp.); Dorylaimida (36 spp.); Mononchida (02 spp.); Rhabditida (05 spp.). Information about their host and localities have been furnished.

The present paper is an compilation of nematode fauna reported from earlier workers from Maharashtra State as revealed by the literature available on the subject. In some cases where literature is not available, the information about the Type/exact locality have not been mentioned.

Order TYLENCHIDA Orley, 1880

Suborder TYLENCHINA Chitwood in
Chitwood and Chitwood, 1950

Superfamily TYLENCHOIDEA Orley, 1880
(Chitwood & Chitwood, 1937)

Family TYLENCHIDAE Orley, 1880
Genus *Tylenchus* Bastian, 1865

1. *Tylenchus hayati* Khan, 1985
Genus *Basiria* Siddiqi, 1959
2. *Basiria pakhi* Hashim, 1985
3. *Basiria nasikensis* Darekar & Khan, 1979
4. *Basiria citri* (Javed, 1982) Hashim, 1985
Genus *Ecphyadophora* de Man, 1921
5. *Ecphyadophora quadralata* Corbett, 1964

Suborder HOPLOLAIMINA Chizhov &
Berezina, 1988

Superfamily HOPLOLAIMOIDEA Filipjev,
1934 (Paramonov, 1967)

Family HOPLOLAIMIDAE Filipjev, 1934
(Wieser, 1953)

Genus *Hoplolaimus* Daday, 1905

6. *Hoplolaimus indicus* Sher, 1963
7. *Hoplolaimus sheri* Suryawanshi, 1971
8. *Hoplolaimus pararobustus* (Schaermans & Stekhoven & Teunissen, 1938) Sheron & Cooman, 1963
Genus *Helicotylenchus* Steiner, 1945
9. *Helicotylenchus diagonicus* Perry in Perry, Darling & Thorne, 1959
10. *Helicotylenchus erytherinae* (Zimmermann, 1904) Golden, 1956
11. *Helicotylenchus goodi* Tikyani *et al*, 1969

12. *Helicotylenchus multicinctus* (Cobb, 1893) Golden, 1956

13. *Helicotylenchus paradihysteroid* Darekar & Khan, 1978

14. *Helicotylenchus ventroprojectus* Patil & Khan, 1987

15. *Helicotylenchus incisus* Darekar & Khan, 1978

16. *Helicotylenchus obtusicaudatus* Darekar & Khan, 1978

Genus *Varotylus* Siddiqi, 1986

17. *Varotylus ranapoi* (Darekar & Khan, 1982) Siddiqi, 1986

Family ROTYLENCHULIDAE Husain &
Khan, 1967 (Husain, 1976)

Genus *Rotylenchulus* Linford & Oliveira, 1940

18. *Rotylenchulus reniformis* Lindford & oliveira, 1940

Family PRATYLENCHIDAE Thorne, 1949
(Siddiqi, 1973)

Genus *Hirschmanniella* Luc & Goodey, 1964

19. *Hirschmanniella oryzae* (Van Breda de Haan, 1902) Luc & Goodey, 1964

20. *Hirschmanniella gracilis* (De Man, 1880) Luc & Goodey, 1963

21. *Hirschmanniella mucronata* (Das, 1960) Luc & Goodey, 1963

Genus *Radopholus* Thorne, 1949

22. *Radopholus similis* (Cobb, 1893) Thorne, 1949

Family MELOIDOGYNIDAE Skarbilovich,
1959 (Wouts, 1973)

Genus *Meloidogyne* Goeldi, 1892

23. *Meloidogyne arenaria* (Neal, 1889) Chitwood, 1949

24. *Meloidogyne hapla* Chitwood, 1949

25. *Meloidogyne incognita* (Kofoid & White, 1919) Chitwood, 1949

26. *Meloidogyne javanica* (Treub, 1885) Chitwood, 1949

27. *Meloidogyne indica* Whitehead, 1968

- Family HETERODERIDAE Filipjev & Schuurman & Stekhoven, 1941
 Genus *Heterodera* Schmidt, 1871
28. *Heterodera cajani* Koshy, 1967
 29. *Heterodera avenae* Wollenweber, 1924
- Superfamily DOLICHODOROIDEA Chitwood in Chitwood & Chitwood, 1950 (Siddiqi, 1986)
- Family TELOTYLENCHIDAE Siddiqi, 1980
 Genus *Tylenchorhynchus* Cobb, 1913
30. *Tylenchorhynchus brassicae* Siddiqi, 1961
 Gneus *Trophurus* Loof, 1956
31. *Trophurus marathwadensis* Suryawanshi, 1971
 Genus *Nagelus* Thorne & Malek, 1968
32. *Nagelus macrophasmidus* (Khan & Darekar, 1979) Siddiqi, 1986
- Family CRICONEMATIDAE Taylor (1936) (Thorne, 1949)
- Genus *Criconema* Hofmanner & Menzel, 1914
33. *Criconema (Criconema) dorgeski* (Darekar & Khan, 1982) Raski & Luc, 1985
 Genus *Macroposthonia* de Man, 1880
34. *Macroposthonia crassiorbus* Patil & Khan, 1983
 Genus *Criconemoides* Taylor, 1936
35. *Criconemoides mongomorgum* Darekar & Khan, 1979
 Genus *Hemicriconemoides* Chitwood & Birchfield, 1957
36. *Hemicriconemoides mehdii* Suryawanshi, 1971
 37. *Hemicriconemoides mangiferae* Siddiqi, 1961
 38. *Hemicriconemoides coccophillus* (Loss, 1949) Chitwood & Birch field, 1957
- Family HEMICYCLOIPHORIDAE SKarbilovich, 1959
 Genus *Hemicycliophora* de Man, 1921
39. *Hemicycliophora ekdavici* Darekar & Khan, 1981
 40. *Hemicycliophora punensis* Darekar & Khan, 1981
- Genus *Aulosphora* Siddiqi, 1980
41. *Aulosphora penetrans* (Thorne, 1955) Siddiqi, 1980
- Family TYLENCHULIDAE SKarbilovich, 1947 (Kirjanova, 1955)
 Genus *Tylenchulus* Cobb, 1913
42. *Tylenchulus semipenetrans* coss, 1913
 Order APHELENCHIDA Siddiqi, 1980
 Suborder APHELENCHINA Geraert, 1986
- Superfamily APHELENCHOIDEA Fuchs, 1937 (Thorne, 1949)
 Family APHELENCHIDAE Fuchs, 1937 (Steiner, 1949)
 Genus *Aphelenchus* Bastian, 1865.
43. *Aphelenchus avenae* Bastian, 1865
 Superfamily APHELENCHOIDEA Skarbilovich, 1947 (Siddiqi, 1980)
 Family APELENCHOIDIDAE Skarbilovich, 1947 (Paramonov, 1953)
 Genus *Aphelenchoides* Fiocher, 1894
44. *Aphelenchoides besseyi* Christe, 1942
 45. *Aphelenchoides goldeni* Suryawanshi, 1971
- Family SEINURIDAE Husain & Khan, 1967 (Baranovskaya, 1981)
 Genus *Seinura* Fuchs, 1931
46. *Seinura indica* Suryawanshi, 1971
 47. *Seinura aurangabadiensis* Suryawanshi, 1971
 Order DORYLAIMIDA Pearse, 1942
 Suborder DORYLAIMINA Pearse, 1936
- Superfamily DORYLAIMOIDEA De Man, 1876
 Family DORYLAIMIDAE De Man, 1876
 Genus *Thornenema* Andrassy, 1959
48. *Thornenema mauritianum* (Williams, 1959) Baqri & Jairajpuri, 1967
 Genus *Sicaguttur* Siddiqi, 1971
49. *Sicaguttur sartum* Siddiqi, 1971
 Family QUDSIANEMATIDAE Jairajpuri & Ahmad, 1965
 Genus *Discolaimium* Thorne, 1939
50. *Discolaimium arcuatum* Hussain & Siddiqi, 1967

51. *Discolaimium asji* Ali, Suryawanshi & Prabha, 1973
52. *Discolaimium sublatum* Heyns, 1963
53. *Discolaimium latum* Thorne, 1939
54. *Discolaimium brachyurum* Husain & Siddiqi, 1967
55. *Discolaimium upum* Baqri & Jairajpuri, 1968
Genus *Discolaimoides* Heyns, 1963
56. *Discolaimoides bulbiferus* (Cobb, 1906) Heyns, 1963
Genus *Latocephalus* Patil & Khan, 1982
57. *Latocephalus gracile* Patil & Khan, 1982
Genus *Oriverutus* Siddiqi, 1971
58. *Oriverutus mammillatus* (Darekar & Khan, 1982) Jairajpuri & Ahmad, 1982
Family NORDIIDAE Jairajpuri & A.H. Siddiqi, 1964
Genus *Longidorella* Thorne, 1939
59. *Longidorella suviswa* Patil & Khan, 1982
60. *Longidorella jaganathi* (Patil & Khan, 1982) Jairajpuri & Ahmad, 1982
Superfamily LONGIDOROIDEA Thorne, 1935
Family LONGIDORIDORIDAE Thorne, 1935
Genus *Longidorus* Micoletzky, 1922
61. *Longidorus conicaudatus* Khan, 1986
62. *Longidorus ishrati* Javed, 1983
63. *Longidorus pisi* Edward, Mishra & Singh, 1964
64. *Longidours elongates* (De Man, 1876) Micoletzky, 1922
Genus *Paralongidorus* Siddiqi, Hooper & Khan, 1963
65. *Paralongidorus citri* (Siddiqi, 1959) Siddiqi, Hooper & Khan, 1963
66. *Paralongidorus microlaimus* Siddiqi, 1964
Family XIPHINEMATIDAE Dalmasso, 1969
Genus *Xiphinema* Cobb, 1913
67. *Xiphinema basiri* Siddiqi, 1959
68. *Xiphinema elongatum* Schurmmans Stekhoven & Teunissen, 1938
69. *Xiphinema americana* Cobb, 1913
70. *Xiphinema insigne* Loos, 1949
Superfamily BELONDIRIOIDEA Thorne, 1939
Family BELONDIRIDAE Thorne, 1939
Genus *Belondira* Thorne, 1939
71. *Belondira eugeniae* Patil & Khan, 1982
72. *Belondira notabilis* Patil & Khan, 1982
73. *Belondira goldeni* Suryawanshi, 1972
74. *Belondira thornei* Suryawanshi, 1972
75. *Belondira rafiqi* Suryawanshi, 1972
76. *Belondira syedi* Suryawanshi, 1972
77. *Belondira sacchari* Suryawanshi, 1972
Family TYLENCHOLAIMIDAE Filipjev, 1934
Genus *Tylencholaimus* De Man, 1876
78. *Tylencholaimus suryawanshi* Ali & Chisty, 1972
Genus *Neomctadorylaimus*
79. *Neometadorylaimus* Coomans (Ali, Farooqui & Suryawanshi, 1971) Jairajpuri & Ahmad, 1992.
Family LEPTONCHIDAE Thorne, 1935
Genus *Tylencholaimellus* Cobb in M.V. Cobb, 1915
80. *Tylencholaimellus geraldii* Ali, Farooqi & Suryawanshi, 1970
81. *Tylencholaimellus acutus* Ali, Farooqi & Suryawanshi, 1970
Genus *Oostenbrinkeilla* Jairajpuri, 1965
82. *Oostenbrinkeilla oostenbrinki* Jairajpuri, 1965
Suborder NYGOLAIMINA Ahmad & Jairajpuri, 1979
Superfamily NYGOLAIMOIDEA Thorne, 1935
Family NYGOLAIMIDAE Thorne, 1935
Genus *Aquatides* Heyns, 1968
83. *Aquatides aquaticus* (Thorne, 1930) Thorne, 1974
84. *Aquaides thornei* (Schneider, 1937) Ahmad & Jairajpuri, 1982
Family MONONCHIDAE Chitwood, 1937
Genus *Mononchus* Bastian, 1865
85. *Mononchus aquaticus* Coetzee, 1968

Family MYLONCHULIDAE Jairajpuri, 1969
Genus *Mylonchulus* (Cobb, 1916) Altherr, 1153

86. *Mylonchulus contractus* Jairajpuri, 1976

Order RHABDITIDA Chitwood, 1933

Family ALIRHABDITIDAE Suryawanshi, 1971

Genus *Alirhabditis* Suryawanshi, 1971

87. *Alirhabditis indica* Suryawanshi, 1971

Family DIPLOGASTRIDAE Micoletzky, 1922

Genus *Acrostichus* Rahm, 1928

88. *Acrostichus indicus* (Suryawanshi, 1971)
Andrassy, 1984

Family NEODIPLOGASTRIDAE

Paramonov, 1952

Genus *Pareudiplogaster* Paramonov, 1952

89. *Pareudiplogaster aurangabaensis*
(Suryawanshi, 1971) Andrassy, 1984

Family MYOLAIMIDAE Andrassy, 1958

Genus *Myolaimus* Cobb, 1920

90. *Myolaimus maupasi* (Hnatesytsch, 1929)
Sanwal, 1960

1. *Tylenchus hayati* Khan, 1985

1985. *Tylenchus hayati* Khan. *Indian J. Nematol.*, **14** : 89-92.

Measurements (after Khan, 1985) : Females :
L = 0.83-0.93 mm; a = 30-40; b = 6.2-7.5;
c = 5.6-6.5; V = 59-60; Stylet = 15-17 μ m.

Males : L = 0.78-0.82 mm; a = 40-41; b = 6.5-6.9; c = 4.6-5.1; T = 46; Stylet = 14 μ m.

Description : Female : Lip region marked by 4-5 annules, continuous with body contour. Labial sclerotization absent. Lateral fields marked with four incisures, outer ones crenate. Esophagus tylenchoid. Vulva transverse slit. Female reproductive system prodelphic, ovary outstretched, spermatheca well developed, offset, filled with sperms. Post-uterine sac about $\frac{3}{4}$ long of corresponding body width. Tail 8.3-9.7 anal body width long, curved ventrally ending in pointed terminus.

Male : Gubernaculum slightly ventrally arcuate. Bursa adanal, outer margin crenate. Tail about

9.7-12.0 anal body-width long, slightly curved ventrally ending in a pointed terminus.

Type Habitat and locality : Collected from soil around roots of paddy (*oryza sativa* L.) around Elephata caves at Mumbai, Maharashtra.

2. *Basiria pakhi* Hashim, 1985

1983. *Basiria elegans* Patil & Khan. *Indian J. Nematol.*, **12** : 330-338.

1985. *Basiria pakhi* Hashim. *Nematologica.*, **30** : 238-241.

Measurements (after Patil & Khan, 1983) :
Females : L = 0.50-0.70mm; a = 40-50; b = 6-8;
c = 6-7; V = 60-65; Stylet = 11-12 μ m.

Males : L = 0.50-0.60mm; a = 38-44; b = 5.2-5.8; c = 5-6; T = 27-37; Stylet = 11-12 μ m; Spicule = 13-14 μ m; gubernaculum = 4-5 μ m.

Description : Females : Body slender tapering towards both ends. Lateral fields marked by four incisures. Lip region continuous with adjacent body. Stylet with rounded basal knobs. Vulva a transverse slit. Female reproductive system prodelphic. Ovary anteriorly outstretched. Posterior uterine sac rudimentary. Tail long filiform or one anal body-width long ending in a finely rounded terminus.

Male : Bursa distinctly crenate. Spicules paired, ventrally arcuate and cephalated. Gubernaculum trough-shaped.

Type habitat and locality : Collected from soil around rhizosphere of paddy (*oryza Sativa*) at digars, district Yavatmal, Maharashtra.

3. *Basiria nasikensis* Darekar & Khan, 1979

1979. *Basiria nasikensis* Darekar & Khan, *Indian J. Nematol.*; **7**: 148-153.

Measurements (after Darekar & Khan, 1979) :
Females : L = 0.6-0.7 mm; a = 40-50; b = 6-8; c = 5-7; V = 60-65; Stylet = 9-10 μ m.

Males : L = 0.58-0.67 mm; a = 60-67; b = 6.0-7.2; c = 5.6; T = 34-39; Spicules = 15-17 μ m; Gubernaculum = 3-4 μ m; Stylet = 8-10 μ m.

Description : Female : Body open 'C' shape upon fixation. Lip region smooth conoid, bluntly-

rounded anteriorly and slightly setoff from body. Labial sclerotization present. Stylet 9-10µm long with small basal knobs. Vulva transverse slit. Female reproductive system prodelphic. Posterior uterine- sac 10-15 µm long. Spermatheca oval filled with sperms. Tail 95-120 µm long or 10-11 anal body width long.

Male : Spicules paired, similar, ventrally arcuate, 15-17 µm long. Gubernaculum trough-shaped 3-4 µm.

Type habitat and locality : Collected from soil around roots of rhizosphere of wheat (*Triticum aestivum* L.) at Grape Research station, Pimpalgon, Basvant district Nasik, Maharashtra.

4. *Basiria citri* (Javed, 1982) Hashim, 1985

1982. *Neobasiria citri* Javed. *Indian J. Nematol.*, **12** : 107-110.

1985. *Basiria citri* (Javed, 1982) Hashim, 1985. *Nematologica*, **30** : 238-241.

Measurements (after Javed, 1982) : Females : L = 0.51-0.54 mm; a = 29-36; b = 4.8-5.1; c = 80.4-90.4; Stylet = 11-12 µm; V = 63-65 µm; tail = 57-62 µm; c' = 5.1-6.5.

Males : L = 0.45-0.48 mm; a = 39-43; b = 4.1-4.6; c = 7.4-8.8; Stylet = 11-12 µm; tail = 53-62; c' = 5.6-6.2.

Description : Females : Body cylindrical, tapering towards both extremities. Lip region elevated with striae narrow. Stylet with posteriorly directed basal knobs. Vulva post equatorial, ovary prodelphic, outstretched, oocytes arranged in a single row. Spermatheca oval. Post uterus sac about one, vulval width long. Tail elongate conoid, 5-7 times anal body-width long, ending in a rounded terminus.

Males : Spicules paired, 10.0-11.0 µm long. Gubernaculum small, 3-4 µm long, Bursa slightly more than half of the tail length, 31.0 µm long. Tail 5-7 times anal body width long with rounded terminus.

Type habitat and locality : Collected from soil around roots of *citrus sinensis* L. at Ramtake, Maharashtra, India.

5. *Ecphyadophora quadralate* Corbett, 1964

1964. *Ecphyadophora quadralate* Corbett. *Nemotologica*, **10** : 121-130

Measurements (after Corbett, 1964) : Females : L = 0.49-0.81; a = 68-107; b = 3.7-7.2; c = 5-13; V = 67-76; Stylet = 6.0-11.5 µm; excretory pore 73-119 µm.

Males : L = 0.50-0.86 mm; a = 71-122; b = 4.2-7.2; c = 6.3-13.0; spicules = 11-20 µm; gubernaculum = 2-5 µm.

Description : Females : Lip region with rounded, equidistant lobes, fine annulations up to labial plate. Lateral fields with three incisures. Femal reproductive system prodelphic. Post vulval uterine sac present. Spermatheca offset. Tails very long, filiform.

Male : Testis single, short. Bursa adanal, lobed projecting outward and backward. Spicules needle-like setose or tylenchoid. Gubernaculum present, fixed.

Habitat and locality : Collected from forest areas, Maharashtra.

Remarks : Raski et al (1982) while revising the family Ecphyadopheridae, studied the type material of *E. basiri*, *E. Tritici*, *E. goodeji* and *E. acuta* they synonymised all previous species with *E. quadralate*.

6. *Hoplolaimus indicus* Sher, 1963

1979. *Basirolaimus indicus* (Sher, 1963) Shamsi, *Nematol. Medit.*, **7** : 15-19.

1982. *Hoplolaimus arachidis* Maharaja & Das, *Proc. Indian Acad. Parasitol.*, **3** : 30-32.

1963. *Hoplolaimus indicus* Sher. *Nematologica*, **12** : 1-56.

Measurement : Females : L = 1.02-1.40 mm; a = 22-36; b = 7.5-9.7; c = 42-65; c' = 0.60-0.68; V = 52-57.

Males : L = 0.94-1.30 mm; a = 26-36; b = 7.9-10.1; c = 31-38; T = 50-55.

Description : Female : Lip region hemispheroid, marked by 3-4 annules. Stylet robust, 30-34 µm long; basal knobs tulip- shaped.

Female reproductive system amphidelphic. Epiptygma single or double. Spermatheca filled with sperms. Tail with 8-13 annules.

Male : Similar to female in general morphology. Spicules arcuate and cephalated, 37-48 μ m long. Gubernaculum 12-20 μ m long. Tail conoid. Bursa terminal.

Habitat and locality : Rhizosphere of various crops and plants.

Distribution : Rajasthan, West Bengal, Delhi, Himachal Pradesh, Bihar, Punjab, Haryana, U.P., Sikkim, etc.

Remarks : It is a widely distributed species.

7. *Hoplolaimus sheri* Suryawanshi, 1971

1971. *Hoplolaimus sheri* Suryawanshi. *Nemalogica.*, **17** : 393-406.

Measurements (after Baqri & Khera, 1976) : Females : L = 1.23-1.45; a = 28-40; b = 8.1-9.6; b' = 6.5-8.1; c = 49-60; V = 52-60;

Description : Female : Body ventrally arcuate or 'c' shaped upon fixation. Lateral field marked by an only single incisures. Lip region setoff from body, conical with a slight depression at apex, marked with four annules. Stylet 42-45 μ m long, robust with three distinct anteriorly pointed indented knobs. Oesophagus typical of the genus. Gonads amphidelphic. Spermatheca without sperma. Epiptygma single, attached anteriorly or posteriorly. Tail rounded 22-29 μ m long with 10-14 annules ventrally.

Male : Not Found.

Type habitat and locality : literature not available.

Distribution : Andaman and Nicobar.

8. *Hoplolaims pararobustus* (Schuurmans Stekhoven & Teunissen, 1938) Sheron Cooman, 1963

1958. *Hoplolaims pararobustus* Schuurmans Stekhoven & Teunissen. *Explor. Parc. Nat. Albert*, 229 pp.

Measurements : Females : L = 1.42-1.52 mm; a = 23-25; b = 8.8; c = 42-47; V = 57-62

Males : L = 1.04-1.19mm; c = 27-38; spicules = 52-57; gubernaculum = 22-26; capitulum = 15-18 μ m.

Description : Female : Body cylindrical, straight to slightly arcuate upon fixation. Cuticle distinctly annulated. Lip region hemispherical, setoff from body by a constriction. Stylet 38-49 μ m long, with tulip shaped basal knobs. Amphidelphic reproductive system. Spermatheca axial with sperms. Tail short, rounded, usually hemispherical with 7-15 annules.

Male : Body ventrally arcuate upon fixation. Lip region rounded, spicules ventrally arcuate, slightly cephalated, Gubernaculum trough-like. Bursa large with crenate margin.

Habitat and locality : Found associated with horticultural plants.

Distribution : India : Maharashtra, Rajasthan.

Elsewhere : Africa, Nigeria, Tanzania, Angola.

9. *Helicotylenchus digonicus* Perry in Perry, Darling & Thorne, 1959

1959. *Helicotylenchus digonicus* Perry in Perry, Darling & Thorne, *Univ. Wisconsin. Res. Bull.*, **207**: 1-24.

Measurements : Female : L = 0.49-0.90 mm; a = 24-26; b = 5.5-6.0; c = 50-55; V = 56-68.

Description : Female : Body in loose spiral shape. Lip region truncate with 4 annules. Stylet 22-30 μ m long, basal knobs flattened slightly indented anteriorly. Spermatheca offset without sperms. Phasmid at the level of anus. Tail curved dorsally with slight ventral projection.

Male : Not found.

Habitat and locality : Soil around roots of various plants. Phytophagous.

Distribution : Rajasthan, Gujarat, Antarctica.

10. *Helicotylenchus erythrinae* (Zimmermann, 1904) Golden, 1956

1904. *Helicotylenchus erythrinae* Zimmermann.

1956. *Helicotylenchus erythrinae* (Zimmermann, 1904) Golden. *Maryland Ag. Exp. Sta. Bull.*, A-85, 28 pp.

Measurements : Females : L = 0.73-0.88 mm; a = 23-26; b = 6.6-7.5; c = 29-32; c' = 1.3-1.5; V = 14-26 58-63 15-17

Description : Female : Body spirally curved. Lip region hemispherical, marked by 4-5 striae. Stylet 30-32 μ m long, basal knobs slightly anteriorly directed. Spermatheca functional. Tail 25-26 μ m long, tapering into a pronounced ventral projection. Phasmids 1-3 annules anterior to anus.

Male : Not found.

Habitat and localities : Soil around roots of various plants. Phytophagous.

Distribution : India: West Bengal, Rajasthan, Tamil Nadu and Gujarat.

Elsewhere : Los Angeles, California, Nigeria.

11. *Helicotylenchus goodi* Tikyani *et al.*, 1969

1969. *Helicotylenchus goodi* Tikyani *et al.* Zool. Anz., 182 : 420-423.

Measurements : Females : L = 0.64-0.84 mm; a = 21-28; b = 5.0-6.4; c = 70-80; V = 58-62

Description : Female : Lip region conoid-truncate, smooth. Stylet 23-25 μ m long with flat cupped anteriorly indented basal knobs. Lateral fields fused at one third of tail. Phasmids 0-13 annules anterior to anus. Tail hemispherical, with 13-19 annules, tail terminus annulated.

Male : Not found.

Habitat and locality : Soil around roots of various plants. Phytophagous.

Distribution : Rajasthan, Gujarat, Uttar Pradesh, West Bengal.

12. *Helicotylenchus multicinctus* (Cobb, 1893) Golden, 1956

1893. *Tylenchus multicinctus* Cobb, Macleay Mem. Vol. Linn. Soc. NSW., 252-308.

1956. *Helicotylenchus multicinctus* (Cobb, 1893) Golden, Maryland. Ag. Exp. Stn. Bull., A-85, 28 pp.

Measurements : Female : L = 0.73-0.87 mm; a = 30-36; b = 6.1-6.6; c = 44-50; c' = 0.60-1.00; V = ⁸⁻⁹ 60-66⁸⁻⁹.

Description : Female : Body spirally curved. Lip region hemispherical, marked by 3-5 striae. Stylet 25-29 μ m long, with anteriorly indented basal knobs. Tail dorsally curved with hemispherical terminus, 16-18 μ m long marked by 7-9 striae ventrally. Phasmids slightly anterior to anus.

Male : Not found.

Habitat and locality : Soil around roots of various plants. Phytophagous.

Distribution : Rajasthan, Gujarat, West Bengal, Orissa, North Andaman.

Elsewhere : Los Angeles, California, Colombia, Nigeria.

13. *Helicotylenchus paradihysteroides* Darekar & Khan, 1978.

1978. *Helicotylenchus paradihysteroides* Darekar & Khan. Indian J. Nematol., 8 : 132-139.

Measurements (after Darekar & Khan, 1978) : Females : L = 0.70-0.80 mm; a = 31-37; b = 5.8-6.7; c = 16-25; c' = 1.4-1.5; V = 62-70; Stylet = 23-25 μ m; o = 45-52.

Description : Female : Body spiral in shape upon fixation. Lateral fields marked by four incisures. Lip region conoid, truncate bearing 4-5 annules. Stylet 23-25 μ m long, with anteriorly cup shaped basal knobs. Oesophagus tylenchoid. Female reproductive system amphidelphic. Spermatheca spherical, slightly offset, without sperms. Tail dorsally convex, broadly rounded having a small terminal mucro bearing 11-13 annules on ventral side. Phasmids 4-5 annules anterior to anus.

Male : Not found.

Type habitat and locality : Collected from soil around roots of sugarcane, *Saccharum officinarum* L. at sugarcane Research Station, Padegaon district Pune, Maharashtra.

14. *Helicotylenchus ventroprojectus* Patil & Khan, 1982

1982. *Helicotylenchus ventroprojectus* Patil & Khan. Indian J. Nematol., 12 : 330-338.

Measurements (after Patil & Khan, 1982) :
Females : L = 0.60-0.70mm; a = 29-37; b = 4.6-5.7; c = 24-31; c' = 1.8-3.1; V = 57-66; Stylet = 26-28 μ m.

Description : Female : Lip region smooth, elevated, conoid truncate. Lateral fields marked by four incisures. Stylet knobs with anteriorly intended surface. Median bulb about 78 μ m from anterior end. Female reproductive system amphidelphic. Spermatheca without sperms. Phasmids at the level of anus. Tail slightly less than 2 anal body-width in length with 12-15 annules, indented terminally with pronounced notch and conspicuous ventral projection.

Male : Not found.

Type habitat and locality : Soil around roots of bamboo *Dendrocalamus strictus* from Tadoba forest, district Chandrapur, Maharashtra.

15. *Helicotylenchus incisus* Darekar & Khan, 1978.

1978. *Helicotylenchus incisus* Darekar & Khan. *Indian J. Nematol.*, 8 : 132-139.

Measurements (after Darekar & Khan, 1978) :

Female : L = 0.76-0.85mm; a = 29-32; b = 6.2-7.7; c = 58-68; c' = 0.67-0.73; V = 61-63; Stylet = 24-26 μ m.

Description : Female : Body open 'C' shaped upon fixation. Lateral fields marked by four incisures. Lip region smooth, conoid, truncate at apex. Stylet with cup shaped basal knobs. Vulva a transverse slit. Female reproductive system amphidelphic. Spermatheca spherical, without sperms. Tail short, subclavate with hemispherical terminus. Phasmids 15-19 μ m anterior to anus.

Male : Not found.

Type habitat and locality : Soil around rhizosphere of sugarcane, *Saccharum officinarum* L., at Grape Reserch Station, Pimpalgaon-Baswant, district-Nasik, Maharashtra.

16. *Helicotylenchus obtusicaudatus* Darekar & Khan, 1978

1978. *Helicotylenchus obtusicaudatus* Darekar & Khan. *Indian J. Nematol.*, 8 : 132-139.

Measurements (after Darker & Khan, 1978) :
Females : L = 0.67-0.88mm; a = 24-32; b = 5.0-7.6; c = 46-63; c' = 0.7-1.2; V = 59-64; Stylet = 23-25 μ m.

Description : Female : Body assumes open 'C' shape upon fixation. Lateral fields with four incisures. Lip region conoid, truncate, smooth. Stylet 23-25 μ m long, with flat basal knobs, intended laterally. Female reproductive system amphidelphic. Spermatheca spherical, without sperms. Phasmids 10-15 annules anterior to anus. Tail short, clavate with hemispherical terminus bearing indistinct striae.

Male : Not found.

Type habitat and locality : Collected from soil around the roots of *cyanodon dactylon* from fallow land at Agricultural Research Station, Vadgaon Maval, district- Pune, Maharashtra.

17. *Varotylus ranapoi* (Darekar & Khan, 1982) Siddiqi, 1986

1982. *Rotylenchus ranapoi* Darekar & Khan. *Indian J. Nematol.*, 12 : 183-185.

Measurements (after Darekar & Khan, 1982) :
Females : L = 0.50-0.65mm; a = 22-29; b = 4.8-5.4; c = 42-64; c' = 0.6-1.0; V = 58-61; Stylet = 20-23 μ m;

Description : Female : Body spiral in shape upon fixation. Lip region conoid-truncate, continuous with body indistinct striations. Cephalic frame work transverse slit. Spermatheca spheroid, setoff without sperms. Tail dorsally convex – abruptly conoid with a small ventral projection bearing 5-7 striae on ventral side of tail.

Male : Not found.

Type habitat and locality : Soil around roots of rhizosphere of potato (*Solanum tuberosum* L.) at Potato Experimental and Trial centre, Rajgurunagar, district- Pune, Maharashtra.

18. *Rotylenchulus reniformis* Linford & Oliveira, 1940

1940. *Rotylenchulus reniformis* Linford & Oliveira. *Proc. Helminth. Soc.*, 7 : 35-42.

Measurements (after Dasgupta *et al.* 1968) :
Females (immature) : L = 0.34-0.42mm; a = 22-27; b = 3.6-4.3; b' = 2.4-3.5; c = 14-17; c' = 2.6-3.4; V = 68-73; Spear = 16-18 μ m.; Females (mature) : L = 0.38-0.52mm; a = 4-5; V = 68-73.

Males : L = 0.38-0.43 mm; a = 24-29; b' = 2.8-4.8; c = 12-17; T = 35-45; Stylet = 12-15 μ m; spicules = 19-23mm; gubernaculum = 7-9 μ m;

Juveniles : L = 0.35-0.41mm; a = 20-24; c' = 3.5-4.1; c = 12-16; stylet = 13-15 μ m.

Description : Immature female : Body slender, open c-shaped. Lip region elevated; conoid, continuous with body. Cephalic framework heavily sclerotized. Stylet knobs rounded, sloping posteriorly. Oesophageal glands overlapping intestine ventrally and laterally. Ovaries immature. Tail tapering to narrow, rounded terminus and distinct hyaline portion.

Mature female : Obese, kidney-shaped, neck contour irregular. Vulva raised. Body beyond anus hemispherical, with a 5-9 μ m long slender terminal portion. Eggs laid in gelatinous matrix.

Male : Anterior region degenerate, stylet and oesophagus degenerate. Spicules elongate slender, ventrally arcuate; gubernaculum linear; bursa reduced, subterminal.

Habitat and locality : Soil around roots of various crops and fruit trees.

Remarks : *R. reniformis* is a sedentary and semi-endoparasite attacking several crops and fruit trees in India.

19. *Hirschmanniella oryzae* (Van Breda de Haan, 1902) Luc & Goodey, 1963

1902. *Hirschmanniella oryzae* Van Breda de Haan.

1963. *Nematologies*, 9 : 47 Luc & Goodey.

Measurements (after Jairajpuri & Baqri, 1991) : Females : L = 1.41-1.63mm; a = 50-67; b = 8.8-12.1; c = 15-19; V = 50-55.

Males : L = 1.01-1.40mm; a = 52-61; b = 9.1-11.3; c = 16-18; T = 50-51.

Description : Female : Body straight or slightly

curved. Lip region continuous with body, low flattened with rounded apex, marked by three to four striae. Reproductive system amphidelphic. Spermatheca with sperms. Intestine not overlapping rectum. Tail elongate conoid 4.3-6.5 anal body width long, with mucronate terminus. Phasmids located in the posterior half of tail.

Male : Spicules cephalated, slightly arcuate, 18-28 μ m long. Gubernaculum 7-9 μ m long. Bursa subterminal. Tail with a pointed ventral mucro.

Habitat and locality : Patel and his co-workers have reported this species from Kheda district.

Elsewhere : West Bengal, Bihar.

Remarks : *H. oryzae* is widely distributed and considered a key pest of rice in far east and tropical countries (including India).

20. *Hirschmanniella gracillis* (De Man, 1880) Luc & Goodey, 1963

1880. *Hirshmanniella gracilis* Mar, J.G. de. *Tijdschr. Nederl. Dierk. Ver.*, 2; 78-196

1963. *Hirshmanniella gracilis* Luc & Goodey. *Nematologies*, 9 : 471.

Measurements : Females : L = 1.43-1.96 mm; a = 42-62; b = 11.6-12.0; c = 16-21; V = 48-54.

Males : L = 1.22-1.18mm; a = 42-64; b = 10.4-13.7; c = 15.5-22.5; T = 50-52.

Description : Female : Body slightly curved ventrally. Lip region continuous with body, apex usually flattened, marked by 3-5 annules. Stylet robust, 20-24 μ m long, with rounded basal knobs. Female reproductive system amphidelphic. Spermatheca filled with spems. Tail elongate conoid, 3.5-6.0 anal body-width long, terminus with a pointed projection. Phasmids located in posterior half of tail, 21-41% of tail length from terminus.

Male : Spicules 28-36 μ m long. Gubernaculum 9-14 μ m long. Bursa subterminal. Tail slightly ventrally curved with terminus bearing a pointed ventral projection.

Habitat and locality : Soil around roots of rice plants. Plant parasitic.

Elsewhere : This is a widely distributed species in USA, Canada, Netherlands, Germany and India. In India *H. gracilis* has been established as key pest of rice in West Bengal.

21. *Hirschmanniella mucronata* (Das, 1960)
Luc & Goodey, 1963

1960. *Hirschmanniella mucronata* Das. *Z. Parasit. kde*, 19-553 : 605.

1963. *Hirschmanniella mucronata*. Luc & Goodey. *Nematologica*, 9-471.

Measurements (after Jairajpuri & Baqri, 1991)
: Females : L = 1.67-2.20 mm; a = 57-60; b = 11-14; c = 18-20; V = 49-53.

Males : L = 1.70-1.83 mm; a = 52-60; b = 12-14; c = 17-21; T = 51-22.

Description : Female : Body slightly ventrally curved. Lip region continuous, low, hemispherical, marked by 4-6 annules. Stylet robust, 24-29 µm long, basal knobs rounded, slightly sloping anteriorly. Female reproductive system amphidelphic. Spermatheca filled with sperms. Intestine slightly overlapping rectum. Tail terminus pointed, usually with a ventral projection or muco. Phasmids in posterior third of tail.

Male : Spicules 29-36 µm long. Gubernaculum 9-14 µm long. Bursa subterminal.

Habitat and locality : Soil around roots of rice plants, Plants parasitic.

Distribution : Andhra Pradesh, Orissa and Gujarat.

22. *Radopholus similis* (Cobb, 1893) Thorne, 1949

1893. *Radopholus similis* Cobb, 1893. *J. Wash. Acad. Sci.*, 3 : 432-444, Pl.

1949. *Radopholus similis* (Cobb, 1893) Thorne. *Proc. Helminth. Soc. Wash.*, 16 : 37-73.

1893. *Tylenchus similis*, Cobb, Macleay *Mem. Vol. Linn. Soc. NSW*, 252-308.

1936. *Roylenchus similis* (Cobb, 1893) Filipjev, *Proc. Helminth. Soc. Wash.*, 3 : 80-82.

Measurements (after Sher, 1963) : Females : L = 0.52-0.88 mm; a = 22-30; b = 4.7-7.4; C = 8-13; V 55-61.

Gravid : L = 0.61-0.74mm; V = 52-57.

Male : L = 0.59-0.76 mm; a = 31-44; b = 6.1-6.6; c = 8-10.

Description : Female : Lip region slightly marked from body, with 3-4 annules. Stylet 17-20 µm, with rounded and slightly anteriorly indented basal knobs. Reproductive system amphidelphic. Spermatheca spherical, filled with rod like sperms. Intestine indistinctly overlapping rectum. Tail elongate-conoid, with a narrow rounded or indented terminus.

Male : Lip region high, hemispherical, distinctly off set, marked with 3-5 annules in the posterior region, lateral lips distinctly smaller. Oesophagus and Stylet degenerate. Spicules 19-22 µm long. Gubernaculum 8-12 µm long, protrusible with distinct sharp clawlike titillate at distal end. Bursa coarsely crenate, enveloping about 2/3 of tail. Tail tapering to rounded or almost pointed terminus.

Habitat and locality : Migratory endoparasites of roots, sometimes sedentary and with slightly swollen females.

Distribution : Jammu, Andhra Pradesh, Tamil Nadu, Kerala, Gujarat, Rajasthan.

23. *Meloidogyne arenaria* (Neal, 1889)
Chitwood, 1948

1889. *Anguillula arenaria*, Neal *Bull., U.S. Bur. Ent. No.*, 20 : 1-31.

1947. *Meloidogyne arenaria* (Neal, 1889) Chitwood. *Proc. Helminth. Soc. Wash.*, 16 : 90-104.

Measurements (after Chitwood, 1949) : Females : L = 510-1000 µm; width = 400-600 µm; stylet = 14.4-15.8 µm... Males : L = 1270-2000 µm; a = 11-16; stylet = 20-24 µm. Second stage juvenile: L = 450-490 µm; a = 26-32; b = 7.2-7.8; c = 6.0-7.5; stylet = 10 µm.

Description (after Whitehead, 1868) : Female : Body pyriform, head with one annule behind head cap. Stylet with rounded basal knobs. Posterior cuticular pattern round to oval (with longer axis parallel to vulva). Dorsal arch low, usually compressed dorso-laterally. Striae fairly

widely separated and mostly smooth. No stippling or punctuate markings between anus and tail terminus. Male : Head low, a recorded truncate, cone shaped. Body narrowing slightly behind head. Stylet with rounded knobs. Spicules thin walled, tapering to subacute bifid termini, ventrolateral flange present. Gubernaculum simple, crescentic. Tail striated near terminus. Phasmids at cloacal level or anterior. Second stage juvenile: Head not offset, a truncate cone in lateral view with faintly separated annules behind the wide flat head cap. Stylet knobs fairly prominent, rounded. Tail narrow, tapering to subacute terminus.

Habitat and locality : Sedentary parasites of roots.

Elsewhere : West Bengal, Bihar, Uttar Pradesh, Haryana, Himachal Pradesh, Punjab, Delhi, Tamil Nadu, Maharashtra, Rajasthan.

24. *Meloidogyne hapla* Chitwood, 1949

1949. *Meloidogyne hapla* Chitwood. *Proc. Helminth. Soc. Wash.*, 16 : 90-104.

Measurements (after Whitehead, 1968) : Females : L = 419-845 μ m; width = 311-561 μ m; stylet = 10-13 μ m.

Males : L = 791-1432 μ m; a = 33.3-47.0 m; Spicules = 21.6-28.10 μ m; gubernaculum = 7.2-9.4 μ m.

Second stage juveniles : L = 312-355 μ m; a = 20.1-26.6; c = 7.3-10.2; tail = 33-48 μ m.

Description : Female : Body pyriform with short neck. Head with 2 annules behind head cap. Stylet knobs rounded, inconspicuous. Posterior cuticular pattern roughly circular, composed of closely spaced smooth or slightly wavy striae. Dorsal arch low. Tail with few striae distinct punctuations forming a stippled area between the anus and tail terminus.

Male : Head not off set, a truncate cone to hemispherical in outline, usually one annule behind head cap. Stylet slender, stylet knobs rounded. Lateral fields with 4 incisures. Tail terminus bluntly rounded. Phasmids at cloacal level. Spicule slightly curved. Gubernaculum crescentic.

Second stage juvenile : Head not set off, a truncate cone shape. Head cap followed by 3 annules on sub-lateral head sector, 1 annule on lateral head sectors. Stylet knobs rounded. Lateral fields with 4 incisures. Tail tip variable, sub acute or sometimes bifid.

Habitat and locality : Sedentary parasites of roots.

Elsewhere : Assam, Himachal Pradesh, West Bengal, Tamil Nadu, Rajasthan.

25. *Meloidogyne incognita* (Kofoid & White, 1919) Chitwood, 1949

1919. *Meloidogyne incognita* (Kofoid & White.)

1949. *Meloidogyne incognita* (Kofoid & White, 1919) Chitwood. *Proc. Helminth. Soc. Wash.*, 16 : 90-104.

Measurements (after Whitehead, 1968) : Females : L = 0.50-0.72 μ m; width = 331-520 μ m; stylet = 13-16 μ m.

Males : L = 1.10-1.95 μ m; a = 31-35; head height = 6.8-8.6; stylet = 23-27 μ m; spicules = 29-40 μ m; gubernaculum = 24.9-31.5 μ m.

Second stage juveniles : L = 0.33-0.40 mm; a = 24-31; b = 2.0-2.14; c = 6.4-8.4; stylet = 9-10 μ m.

Description : Female : Body spherical with projecting neck. Lip region bearing 2-3 striae behind head cap. Lateral fields not clear. Stylet knobs rounded. Posterior cuticular pattern highly variable, with striae closely spaced; wavy to zigzag, specially dorsally and laterally.

Male : Body slender, cuticle transversely striated. Lateral fields marked by four incisures. Lip region almost continuous with body, truncate, cone-shaped, marked by distinct striae. Stylet with flat concave basal knobs. Tail bluntly rounded with smooth terminus. Phasmids at cloacal level. Spicules curved. Gubernaculum crescent-shaped.

Second stage juvenile : Lateral fields marked by four incisures. Lip region continuous, truncate, cone-shaped in lateral view, marked by two striae in lateral view and three striae in dorsal or ventral view. Lip cap wide. Tail tapering to subacute terminus.

Habitat and localities : Sedentary parasites of roots.

Elsewhere : Himachal Pradesh, West Bengal, Delhi, Karnataka, Uttar Pradesh, Kerala, Tamil Nadu, Assam, Rajasthan, Haryana, Orissa, Bihar, Maharashtra, Madhya Pradesh.

26. *Meloidogyne javanica* (Treub, 1885)
Chitwood, 1949

1885. *Meloidogyne javanica* Treub.

1949. *Meloidogyne javanica* (Treub, 1885) Chitwood. *Proc. Helminth. Soc. Wash.*, **16** : 90-104.

Measurements (after Whitehead, 1968) : Females : L = 0.54-0.80 mm; width = 31-58 μ m; stylet = 14-18 μ m.

Males : L = 0.75-1.29 mm, a = 17.5-24.3; stylet = 20-23 μ m; spicules = 21-32 μ m; gubernaculum = 7.2-9.4 μ m.

Second stage juvenile : L = 0.38-0.45 mm; a = 27-36; b = 2.1-3.3; stylet = 9.4-11.4 μ m

Description : Female : Body almost spherical, with projecting neck, rounded posteriorly but lip region protruding slightly. Lateral fields marked by two incisures. Lip region slightly wider than adjoining body, marked by one stria behind head cap. Stylet slender with rounded basal knobs. Perineal pattern round or oval to pear-shaped, dorsal arch varying from rounded to moderate height, may be flattened dorsally, striae smooth to wavy.

Male : Lip region rounded in dorso-ventral view, continuous with body, the basal striae wider than first one. Lateral fields marked by four incisures. Stylet knobs rounded. Tail shape variable, digital in lateral view and bluntly rounded in ventral. Phasmids situated at cloacal level. Spicules slightly curved. Gubernaculum thin crescentic.

Second stage juvenile : Lip region continuous, truncate, cone-shaped in lateral view, marked by three striae behind head cap. Stylet knobs prominent. Lateral fields marked by four incisures. Tail tapering to subacute or finely rounded terminus.

Habitat & localities : Sedentary parasites of roots.

Elsewhere : Himachal Pradesh, West Bengal, Delhi, Karnataka, Uttar Pradesh, Rajasthan, Haryana, Bihar, Madhya Pradesh, Maharashtra.

27. *Meloidogyne indica* Whitehead, 1968

1968. *Meloidogyne indica* Whitehead. *Trans. Zool. Soc. London*, **31** : 279-285.

Measurement (after Whitehead, 1968) : Larvae: L = 381-448 μ m; c = 21.2-31.0; tail length = 13.0-20.1; d = 1.06-1.78; stylet = 10-14 μ m. Female : Width of stylet base = 4-5 μ m, width base head = 6-7 μ m; stylet = 12-1 μ m. Mature Female : Body saccate with fairly thick cuticle, neck short; head end divided into six sectors. Had with one annule behind head cap. Excretory pore about 20 annule (16-22) behind head; anterior margins of spear knobs either concave or backward slopping; cuticular pattern faint, composed of closely spaced, usually smooth, striae forming a distinct tail whorl with low, rounded dorsal arch, phasmids not as close to tail terminus.

Male : Lip region hemispherical or truncate-cone shape, not offset, with two annules behind head-cap, anterior annule longer than posterior. Lateral fields fully aerolated; tail rather long and apparently concave ventrally; phasmids opposite cloaca.

Larvae : Head not offset, low truncate-cone shaped. Stylet knobs fairly prominent rounded, anterior margins often back sloped; tail conoid terminus usually blunt, unstriated.

Habitat & locality : Sedentary parasites of roots.

28. *Heterodera cajani* Koshy, 1967

1967. *Heterodera cajani* Koshy. *Indian Phytopath.*, **20** : 272-274.

Measurements (after Yadav & Verma, 1983) : Cyst : L = 360-690 μ m; W = 175-500 μ m.

Male : L = 0.48-0.65 mm; a = 20.0-34.8; stylet = 21.0-26.0 μ m; spicule = 21-27 μ m; gubernaculum = 6.5-7.0 μ m.

Second stage juveniles : L = 345-515 μ m; a = 18-29; b = 3.2-5.2; c = 7.8-12.3; c = 2.7-6.1; stylet = 22-27 μ m; tail length = 31-52 μ m.

Description : Mature female : Adult lemon shaped, light to dark brown in colour. Vulva 35-53 μ m long slit. Ambifenstrate.

Male : Stylet 21-26 mm long, spicules 21-22 mm long. Gubernaculum 6.5-7.6 μ m long.

Second stage juvenile : Lateral fields marked by four incisures. Stylet well developed, 22-27 μ m long, with anteriorly directed basal knobs. Tail 31.5-52mm long, hyaline portion 14-30 mm.

Habitat & locality : Feeding induces a syncytium. Mature female/cyst found in soil.

Elsewhere : In India : Delhi, Himachal Pradesh, Haryana, Uttar Pradesh, Rajasthan, Maharashtra, Madhya Pradesh, Punjab, Tamil Nadu, Andhra Pradesh, Bihar, Karnataka, West Bengal.

29. *Heterodera avenae* Wollenweber, 1924

1924. *Heterodera avenae* Woollenweber

Measurements : Females : L = 0.55-0.77 mm; width = 0.36-0.50 mm.

Males : L = 1.07-1.59mm; a = 32-55; b = 7-12; b' = 5.5-6.8; c = subterminal; T = 40-50; stylet = 27-31 μ m; spicules = 33-38 μ m.

Second stage larvae : L = 0.52-0.61mm; width = 20-24 μ m; tail length = 45-70 μ m; stylet = 24-28 μ m.

Description : Female : Adult lemon-shaped, with prominent neck and vulval cone. Lip region annulated. Stylet straight to slightly arcuate, 26-32 μ m long; basal knobs rounded. Vulva 12-13 μ m long slit. Zig-zag rugose cuticular surface pattern. Subcrystalline layer conspicuous, sloughing off as the dark brown cyst is formed. Bullae prominent, crowded beneath vulval cone. Ambifenstrate. Most cysts contain 200-500 eggs. Average cyst size 0.71 $\times$ 0.50 mm.

Male : Lateral fields with four incisures, outer bands usually aerolated. Lip region rounded set off, marked with 4-6 annules; labial frame-work

heavily sclerotized. Spicules arcuate with notched end. Tail end usually twisted.

Second stage larvae : Lateral fields with four incisures. Lip region rounded, set off with 2-4 annules, stylet well developed with large anteriorly flattened concave basal knobs. Tail 3-4.5 anal body-width long, sharply pointed.

Host : Oats, wheat, barley, maize.

Distribution : Haryana, Punjab, Rajasthan, Jammu and Kashmir, Maharashtra.

30. *Tylenchorhynchus brassicae* Siddiqi, 1961

1961. *Tylenchorhynchus brassicae* Siddiqi. *Z. Parasitkde.*, 21 : 46-64.

Measurements : Female : L = 0.64 mm; a = 37; b = 4.8; c = 14; V = 55.

Male : L = 0.58 mm; a = 48; b = 4.1; c = 15; T = 49.

Description : Female : Cephalic region set off, sclerotization moderate. Labial annules 5. Stylet 17 μ m long; with rounded basal knobs. Spermatheca filled with sperms. Tail 15 μ m or 3.0 anal body width long, conoid with large conoid obtuse terminus. Phasmids located a little anterior to middle of tail.

Male : Spicules 21 μ m long, ventrally arcuate cephalated. Gubernaculum 10 μ m long. Bursa large with coarsely crenate margins, enveloping entire tail. Phasmids located at 1/3rd of tail length from cloaca.

Habitat and Locality : Soil around roots of various plants. Phytophagous.

Distribution : Delhi, Haryana, Maharashtra, Punjab, Uttar Pradesh, Rajasthan.

Elsewhere : U.K.

31. *Trophurus marathwadensis* Suryawanshi, 1971

1971. *Trophurus marathwadensis* Suryawanshi. *Nematologica*, 17 : 399-406.

Measurements (after Suryawanshi, 1971) : Females : L = 1.03-1.21 mm; a = 43-50; b = 6.2-7.4; c = 32-39; V = 54-57; stylet = 15-16 μ m.

Males : L = 1.07-1.11 mm; a = 56-60; b = 6.4-6.5; c = 26-27; spicules = 19-21 μ m; gubernaculum = 4.5-5.5 μ m.

Description : Female : Lip region continuous, conical, rounded anteriorly, smooth. Labial sclerotization relatively strong. Stylet knobs posteriorly sloping. Excretory pore at level of nerve ring. Post vulval uterine sac about one vulval body width long. Tail about 1.5 anal body width long, tapering in the posterior half to a bluntly rounded terminus with thick cuticle.

Male : Spicules 19-21 μ m long. Gubernaculum 4.5-5.5 μ m long.

Type habitat and locality : From rhizosphere of Cotton (*Gossypium herbaceum* L.) from Osmanabad, Marathwada.

32. *Nagelus macrophasmidus* (Khan & Darekar, 1979) Siddiqi, 1986

1979. *Nagelus macrophasmidus* Khan & Darekar. *Indian J. Nematol.*, 8 : 43-48.

Measurements (after Khan & Darekar, 1979) : Females : L = 0.76-0.99 mm; a = 34-43; b = 4.5-6.0; c = 14-17; c' = 4.0-4.6; V = 50-55; stylet = 24-26 μ m.

Description : Female : Body cylindrical. Lateral fields with six incisures. Lip region elevated cap-like broadly rounded, set off from body by a deep constriction, marked with 6-7 striae. Stylet with posteriorly sloping knobs. Vulva a transverse slit. Female reproductive system amphidelphic. Spermatheca packed with sperms. Phasmids prominent middle of the tail. Tail conoid ventrally arcuate bearing 60-70 annules, tail terminus striated.

Male : Not found.

Type habitat and locality : Collected from around rhizosphere of grapes (*Vitis vinifera* L.) from the Modibaug college of Agriculture, Pune, Maharashtra.

33. *Criconema (Criconema) dorgeski* (Darekar & Khan, 1982) Raski & Luc, 1985.

1982. *Nenocriconema dorgeski* Darekar & Khan. *Indian J. Nematol.*, 11 : 172-175.

1985. *Criconema (Criconema) dorgeski* (Darekar & Khan, 1982) Raski & Luc. *Revue de Nematol.*, 7 : 323-334.

Measurements (after Darekar & Khan, 1982) : Females : L = 0.4-0.6 mm; a = 6-10; b = 4-5; c = 8-10; V = 82-88; stylet = 64-72 μ m; R = 38-42; RSt = 6-9; Roes = 11-15; RV = 3-5; Ran = 2-4.

Description : Female : Body cylindrical almost straight to slightly ventrally arcuate upon fixation. Body annules 38-42, retrose (except first three) and marked by a fringe of continuous serration. Lip region consists of two distinct annules, both anteriorly directed, first annule broad 24-26 μ m wide second small 64-72 μ m long. Stylet knobs anchor shaped 9-10 μ m across. Vulva open. Spermatheca spherical packed with sperms. Anus a small pore on 2-4 annule from tail terminus. Female convex-conoid, clavate protruberance 9-11 μ m long on terminal tail annule.

Male : Not found.

Type habitat and locality : Collected around the roots of ber, *Ziziphus jujube* Mill at Khanadala jungle of Sahyadri Range, district Pune, Maharashtra.

34. *Macroposthonia crassiorbus* Patil & Khan, 1983

1983. *Macroposthonia crassiorbus* Patil & Khan. *Indian J. Nematol.*, 12 : 330-338.

Measurements (after Patil & Khan, 1983) : Females : L = 0.40-0.50 mm; a = 13-16; b = 4-5; c = 17-20; V = 91-95; stylet = 50-58 μ m; R = 88-92; Rst = 14-15; Roes = 24-25; Rex = 24-26; Rv = 5-6; Ran = 4-5;

Description : Female : Body slightly ventrally curved, tapering towards both ends. Body annules retrose (except first and second) with serrated margins. Stylet knobs 8 μ m across forwardly directed. Spermatheca not distinct. Vulva open. Anus one annule posterior to vulva. Tail conoid with rounded terminus having platelets.

Male : Not found.

Type habitat and locality : Collected from soil around roots of cotton (*Gossypium* sp.) in Karanja, district Akola, Maharashtra.

35. *Criconemoides mongomorgum* Darekar & Khan, 1979

1979. *Criconemoides mongomorgum* Darekar & Khan. *Indian J. Nematol.*, 7 : 148-153.

Measurements (after Darekar & Khan, 1979) : Females : L = 0.46-0.61 mm; a = 13-18; b = 3-5; c = 10-14; V = 88-92; stylet = 66-72 μ m; R = 63-70; Rv = 4-5; Ran = 3-4; RST = 10-13; Roes = 15-19.

Description : Female : Body cylindrical slightly ventrally arcuate, tapering regularly towards both extremities. Body annules retrose (except first) with finely crenate margin. Stylet 66-72 μ m long. Procorpus 19-20 μ m wide, valvular plates 5-7 μ m located slightly posterior to centre of bulb. Vulva simple. Female reproductive system prodelphic. Anus pore-like located two annules posterior to vulva, 3-4 annules anterior to tail terminus. Tail elongate-conoid with lobes projection at tip.

Male : Not found.

Type habitat and locality : Collected around root zone of cotton (*Gossypium hirsutum* L.) at Kopargaon, Agricultural Research Station, district Ahmednagar, Maharashtra.

36. *Hemicriconemoides mehdii* Suryawanshi, 1971

1971. *Hemicriconemoides mehdii* Suryawanshi. *Nematologica*, 17 : 399-406.

Measurements (after Suryawanshi, 1971) : Females : L = 0.39-0.54 mm; a = 13-20; b = 4.2-5.9; c = 17-24; V = 91-94; stylet = 48-59 μ m; R = 120-150; Rv = 10-14; Ran = 7-13; Rst = 13-20; Roes = 23-31; Rex = 28-36.

Description : Female : Lip region slightly offset. Stylet strong with anchor shaped knobs. Labial frame work strongly sclerotized. Excretory pore 3-4 annules posterior to oesophageal base. Vulva transverse, vulval sheath absent. Spermatheca rounded, containing sperms. Tail convex-conoid with pointed tip.

Male : Not found.

Type habitat and locality : Litcrahere not available

37. *Hemicriconemoides mangiferae* Siddiqi, 1961

1961. *Hemicriconemoides mangiferae* Siddiqi, *Proc. Helminth. Soc. Wash.*, 28 : 213-215.

Measurements : Females : L = 0.49-0.58mm; a = 16-19; b = 4.2-5.0; c = 16-19; V = 91-92; V1 = 35-42; VL/VB = 1.3-1.6.

Description : Female : Cuticular sheath attached to body at anterior end and vulval opening sometimes on tail. Lip region slightly setoff, with 2 annules; first annule smaller than second or about equal to second, angular, directed outward. Labial disc slightly elevated, rounded at top, inconspicuous in some specimens. Annules 3-4 μ m wide in middle of body. Stylet 78-81 μ m long. Stylet knobs 5-7 μ m across. Excretory pore 34-38 annules from anterior end. Vulval sheath lacking. Tail convex-conoid the last 3-4 annules narrow abruptly.

Male : Not found.

Habitat and Locality : Soil around roots of various plants. Phytophagous.

Distribution : Andaman Nicobar, West Bengal, Uttar Pradesh, Rajasthan.

Elsewhere : Nigeria, Phillipines, California.

38. *Hemicriconemoides cocophillus* (Loss, 1949) Chitwood & Birchfield, 1957

1949. *Cricomnemoides cocophillus* Loss. *J. Zool. Soc. India*, 1 : 17-22.

1957. *Hemicriconemoides cocophillus* (Loss, 1949) Chitwood & Birchfield, 1957.

Measurements : Females : L = 0.46-0.50 mm; a = 14-15; b = 4.0-5.0; c = 16-17; V = 91-92; v1 = 36-42; VL/VB = 1.2-1.7; R = 108-113; Rv = 9-10; Ran = 8-9; stylet = 50-57 μ m; prorhabdion = 40-47 μ m; Rex = 31-32.

Description : Female : Cuticular sheath attached to body at anterior end, may or may not be separated on tail. Head slightly set off; Labial annules 2-3; usually 2; first annule smaller than the second. Labial disc slightly elevated. Stylet 5-7 μ m posterior to base of stylet knobs. Vulval sheath well developed, present in both sheath and body cuticle. Tail convex-conoid to attenuated.

Male : Not found.

Habitat and Locality : Soil around roots of various plants. Phytophagous.

Distribution : India : Rajasthan, Haryana, Punjab.

Elsewhere : Australia.

39. *Hemicycliophora ekdavici* Darekar & Khan, 1981

1981. *Hemicycliophora ekdavici* Darekar & Khan. *Indian J. Nematol.*, **11** : 35-41.

Measurements (after Darekar & Khan, 1981) : Females : L = 0.90-1.10mm; a = 20-23; b = 6-8; c = 6.0-7.5; V = 83-90; stylet = 75-84 μ m; Rex = 32-38; Rv = 145-158; R = 178-205.

Description : Female : Body almost straight upon fixation. Cuticular sheath loosely fitting to the body. Body annules broad averaging 5 μ m wide at mid body region. Lip region rounded 22 μ m wide bearing two annules. Lateral fields absent. Stylet knobs 6 μ m wide, posteriorly slopping. Vulva located on 35th annule from tail, its lips modified, vulval sleeve distinct. Spermatheca spherical packed with sperms. Tail elongate conoid with a subacute terminus.

Male : Not found.

Type habitat and locality : Collected around the rhizosphere of *Ziziphus jujube* Mill located in the field of Railway Station at Igatpuri, district Nasik, Maharashtra.

40. *Hemicycliophora punensis* Darekar & Khan, 1981

1981. *Hemicycliophora punensis* Darekar & Khan. *Indian J. Nematol.*, **11** : 35-41.

Measurements (after Darekar & Khan, 1981) : Females : L = 0.8-1.0 mm; a = 19-25; b = 5.0-6.7; c = 5-7; V = 80-90; stylet = 56-70 μ m; Rex = 35-40; Rv = 120-130; R = 160-180.

Description : Female : Body almost straight, slightly ventrally arcuate in posterior third of body upon fixation. Cuticular sheath lightly fitting the body only attached to head and vulva. Longitudinal

lines about 40-50 near mid body, cephalic frame work moderately developed. Lip region marked by two annules. Stylet knobs 5 μ m wide slopping posteriorly. Vulva a marked discontinuity in the ventral wall, its lip modified elongate with distinct sleeve. Spermatheca spherical, filled with numerous small sized sperms. Tail elongate, conoid with subacute terminus.

Male : Not found.

Type habitat and locality : Collected around the rhizosphere of *Eugezia jambolixa* located in the field of Keshar Haribhau Khalde at Talegoan district Pune, Maharashtra.

41. *Aulosphora penetrans* (Thorne, 1955) Siddiqi, 1980

1955. *Hemicycliophora penetrans* Thorne. *Proc. Helminth Soc. wash.*, **22** : 1-16.

1980. *Aulosphora penetrans* (Thorn, 1955) Siddiqi. *Revue de Nematol.*, **3** : 179-199.

Measurements (after Darekar & Khan, 1981) : Females : L = 0.9-1.1mm; a = 25-29; b = 5-7; c = 5-4; V = 79-83; stylet = 75-80 μ m; Rex = 58-64; Rv = 235; R = 285-309.

Description : Female : Cuticular sheath fitting very tightly about the body anterior to vulva. Lateral field 1/5th-1/6th as wide as diameter of sheath at mid-body bearing double row of rectangular blocks. Longitudinal lines are about 20-30 (on mid body). Lip region 15-16 μ m wide bearing two annules of which second one is broader. Vulva located on 55th annule from the caudal terminus attached to the sheath through a long cuticular fold. Anus located approximately on 13-15 annules from vulva. Tail at first convex-conoid for half of its length then narrowing considerably to end in finely rounded terminus.

Male : Not found.

Habitat and locality : Soil around roots of *Ziziphus* sp. at district Nasik, Maharashtra.

42. *Tylenchulus semipenetrans* Cobb, 1913

1913. *Tylenchulus semipenetrans* Cobb. *J. Wash. Acad. Sci.*, **3** : 432-444, Pl.1.

Measurements : Mature Adult females : = 0.31-0.46 mm; width = 66-114 μ m; a = 3.5-6.4; b = 2.4-4.3; V = 88-93; stylet = 11-12 μ m.

Males : L = 0.34-0.38mm; a = 28-35; b = 2.9-3.7; c = 7.7-10.1; T = 25-36; stylet = 9-10 μ m; spicules = 15-18 μ m; gubernaculum = 3-4 μ m; tail = 35-45 μ m.

Second stage juvenile : L = 0.33-0.38 mm; a = 25-29; b = 3.0-3.7; c = 7-8; stylet = 9-10 μ m.

Common Name : Citrus Nematode.

Description : Female : Body translucent white 60-70% of body variably saccate, widest at excretory pore, narrowing abruptly at vulva and ending in a digitate terminus. Lip region hemispherical, smooth; labial sclerotization inconspicuous. Stylet knobs rounded. Procorpus cylindrical; metacarpus oval. Basal bulb elongate saccate. Excretory pore located at 78-84% from anterior end. Gonads convoluted, extending anteriorly to basal bulb. Anus and rectum invisible.

Male : Males with degenerated stylet and oesophagous. Excretory pore postequatorial. Spicules slender, arcuate. Tail slightly tapering to a broadly rounded tip.

Habitat and locality : The females are obligate parasites on the roots of various species of citrus.

Distribution : Most common in citrus producing states.

43. *Aphelenchus avenae* Bastian, 1865

1881. *Aphelenchus agricola* de Man, T. der. *Nederlandschedierk, Vereeniging*, 5 : 138-143.

1960. *Aphelnchus maximus* Das, Z. *Paasitenk*, 19 : 553-605.

Measurements : Females : L = 0.55-0.86 mm; a = 25-39; b = 4.9-6.9; c = 27-35; V = 74-78.

Males : L = 0.63-0.81 mm; a = 27-33; b = 5.5-5.9; c = 24-29; T = 48-57.

Description : Female : Lip region bluntly rounded to flattened, not offset from body, with 3-4 very faint annules Lateral fields marked by 10-14 incisures. Stylet 10-12 μ m long, slightly thickened at base. Oesophagus typical of the genus. Reproductive system mono-prodelphic.

Post uterine sac reaching about half way from vulva to anus. Tail bluntly rounded, 16-33 μ m long, about 0.7-1.0 anal body- width long.

Male : Spicules slender 28-30 μ m long. Gubernaculum 14-16 μ m long. Tail conical and enveloped by a bursa.

Habitat and locality : Soil-inhabiting.

Distribution : Throughout India, cosmopolitan in distribution.

44. *Aphelenchoides besseyi* Christie, 1942

1948. *Aphelenchoides oryzae* Yokoo, *Annals of the Phytopathology Society of Japan*, 13 : 40-43.

Measurements (after Allen, 1952) : Females : L = 0.66-0.75 mm; a = 32-42; b = 10.2-11.4; c = 17-21; V = 68-70.

Males : L = 0.44-0.72 mm; a = 36-47; b = 9-11; c = 14-19; T = 28-52; spicules = 18-21 μ m.

Description : (after Franklin & Siddiqi, 1973) : Female : Body slender. Lip region rounded, unstriated, slightly offset and wider than body at lip base. Labial framework slightly sclerotized. Stylet 10 μ m long, with slight basal swellings. Oesophagus typical of the genus. Reproductive system monoprodelphic. Spermatheca elongate oval usually packed with sperms. Post uterine sac narrow, inconspicuous, not containing sperms, 2.5-3.5 times anal body-width long. Tail conoid, 3.5-5.0 anal body width long. Terminus bearing a mucro of diverse shape, with three to four pointed processes.

Male : Spicules typical of the genus. First pair of ventromedian papillae adanal, second slightly behind middle of tail and third subterminal. Tail conoid, with terminal mucro having two to four pointed processes.

45. *Aphelenchoides goldeni* Suryawanshi, 1971

1971. *Aphelenchoides goldeni* Suryawanshi. *Nematologica*, 17 : 417-427.

Measurements (after Suryawanshi, 1971) : Females : L = 0.45mm; a = 25.3; b = 7.35; c = 6.1; c' = 7.0; V = 60; stylet = 14.5 μ m.

Description : Female : Body small, slightly attenuated anteriorly, narrowing posterior to anus. Lip region set off from body. Stylet 14.5 µm long with basal swelling. Genital tract monoprodelphic outstretched but reflexed. Post uterine sac 2 vulval body width long. Tail tapering gradually.

Male : Not found.

Type habitat and locality : Collected from soil around grass at Maharashtra.

Genus *Seinura*

Diagnosis : Small to long nematodes (0.3-1.1mm). Cephalic region high, offset. Stylet 10-27 µm long and slender, usually lacking basal knobs or swelling. Oesophagus typical of the genus. Vulva posterior at 70-80% of the body length. Genital tract monoprodelphic, outstretched. Post-uterine sac may be totally absent or well developed. Tail medium to medium long, tapering to a fine point. Male tail sharply reurved upon fixation. Spicules paired Ventrally Curved with a prominent, pointed rostrum and strongly developed, elongate apes. Bursa absent.

Remarks : Suryawanshi (1971) have described two species of genus *Seinura* Fuchs, 1931 from Maharashtra in *Nematologica*, 17 : 417-427.

46. *Seinura indica* Suryawanshi, 1971

47. *Seinura aurangabadensis* Suryawanshi, 1971

48. *Thornenema mauritianum* (Williams, 1959) Baqri & Jairajpuri, 1967

1958. *Thornenema viriosum* Williams, *Maurit. Sug. Ind. Res. Inst. Occ. Paper*, 2 : 9.

1965. *Thornnema africanum* Andrassy, *Opusc. Zool. Budapest*, 5 : 9-23.

Measurements : Females : L = 1.02-1.65 mm; a = 26-36; b = 5.2-6.0; c = 6.3-7.1; V = 32-43 10-13.

Description : Female : Lip region rounded, narrower than body, marked by a slight depression, moderately sclerotized. Odontostyle 13-16 µm long, aperture 4-5 µm. odontophore 22-25 µm. Basal expanded part of oesophagus occupies 38-46% of oesophageal length. Female reproductive

system mono-opisthodelphic. Tail filiform with smooth rounded terminus, 143-260 µm or 8-10 anal body-width long.

Male : Not found.

Habitat and locality : Soil inhabiting.

Distribution : Delhi, Rajasthan, West Bengal, Uttar Pradesh, Gujarat, Andaman and Nicobar Islands, Maharashtra.

49. *Sicaguttur sartum* Siddiqi, 1971

1973. *Sicaguttur indicum* Ali & Prabha, *Nematologica*, 19 : 481-490.

1980. *Sicaguttur longicaudatum* Baqri & Jana, *Nematologica*, 26 : 83-107.

Measurements : Females : L = 1.09-1.97 mm; a = 23-30; b = 5.5-6.6; c = 6.1-6.4; V = 8-9 36-42 9-11.

Description : Female : Lip region rounded, narrower than adjoining body, marked by depression. Labial sclerotization prominent. Odontostyle 15-18 µm; aperture 4-5 µm. odontophore 20-24 µm. Basal expanded part of oesophagus 42-44% of oesophageal length. Prerectum 80-97 µm or 2.0-2.5 anal body-width long. Tail 177-305 µm or 4.2-6.7 anal body-widths long, tapering to an acute or subacute tip.

Male : Not found.

Habitat and locality : Soil inhabiting.

Distribution : Rajasthan, West Bengal, Gujarat, Maharashtra.

50. *Discolaimoides bulbiferus* (Cobb, 1906) Heyns, 1963

1936. *Discolaimus bulbiferus* (Cobb, 1906) Throne & Swanger, *Capita Zool.*, 6 : 1-120pp.

Measurements : Females : L = 1.40-1.65 mm; a = 46-55; b = 4.0-5.2; c = 35-36; V = 8-10 45-53 8-10.

Description : Female : Lip region expanded, offset by constriction. Lateral glandular bodies 80-90 in entire length. Odontostyle 15-17 µm long; aperture about half of odontostyle length. Odontophore 22-25 µm long. Basal expanded part

of oesophagus occupies 52-60% of oesophageal length. Female reproductive system amphidelphic. Tail 40-45 μ m or 1.8 anal body-width long, conoid with rounded terminus.

Male : Not found.

Distribution : Rajasthan, West Bengal, Maharashtra, Gujarat.

51. *Disolaimoides arcuatum* Husain & Siddiqi, 1967

1967. *Disolaimoides arcuatum* Husain & Siddiqi, *Nematologica*, 13 : 210-216.

Measurements (after Husain & Siddiqi, 1967) : Females : L = 0.9-1.0mm; a = 29-33; b = 4.3-4.8; V = 48-50.

Description : Female : Body cylindrical, slightly arcuate. Lateral hypodermal glandular organs present. Lip region setoff odontostyle 7-8 μ m long; odontophore about 1.5 times odontostyle length. Female reproductive system amphidelphic. Prerectum and rectum about one anal body-width long. Tail elongate conoid, ventrally arcuate ending in a rounded terminus measuring 2.0-3.4 times anal body-width long.

Male : Not found.

Habitat and locality : Collected from soil around roots of Jute, *Corchorus* sp. And paddy, *oryza sativa* at shegaon Maharashtra.

52. *Discolaimium asji* Ali, Suryawanshi et al Prabha, 1973

1973. *Discolaimium asji* Ali, Suryawanshi et Prabha. *Nematologica*, 19 : 481-490.

Measurements (after Ali, Suryawanshi et al Prabha) : Females : L = 0.7-0.8 mm; a = 38-42; b = 3.8-4.3; c = 30-46; c' = 1.7; V = 47-51.

Description : Female : Body short. Odontostyle 6-7 μ m long. Odontophore 14-15 μ m. Lateral hypodermal glands about 75-80. Vulva transverse. Female reproductive system amphidelphic. Tail conoid with narrowly rounded tip.

Male : Not found.

Type habitat and locality : Literature not available.

53. *Discolaimium sublatum* Heyns, 1963

1963. *Discolaimium sublatum* Heyns. *Proc. Helminth. Sec. Washington*, 30 : 1-6.

Measurements (after Heyns, 1963) : Females : L = 0.8-0.9 mm; a = 26-33; b = 3.4-4.0; c = 39-51; c' = 1.0; V = 46-55.

Description : Female : Body shorter. Number of hypodermal glands about 25. Lip region setoff. Odontostyle 10-11 μ m long. Odontophore 15-16 μ m rod-like. Vulva transverse. Female reproductive system amphidelphic. Tail convex-conoid about one anal body diameter.

Male : Not found.

Habitat and locality : Reported from Maharashtra.

54. *Discolaimium latum* Thorne, 1939

1939. *Discolaimium latum* Thorne. *Capita Zool.*, 8 : 261

Measurements (after Thorne, 1939) : Female : L = 0.8 mm; a = 24; b = 4.3; c = 37; c' = 1.2; V = 54.

Male : L = 0.9 mm; a = 33; b = 4.5; c = 50.

Description : Female : Lip region half as wide as neck base. Odontostyle slightly shorter than lip region-width, the aperture occupying one-half of its length. Vulva transverse. Female reproductive system amphidelphic. Ovaries reflexed. Prerectum and rectum about one anal-body width long. Tail blunt, rounded.

Male : Five ventromedian supplements.

Habitat and locality : Maharashtra State.

Elsewhere : California, Utah, Texas, U.S.A.

55. *Discolaimium brachyurum* Husain & Siddiqi, 1967

1967. *Discolaimium brachyurum* Husain et Siddiqi. *Nematologica*, 13 : 210-216.

Measurements (after Hussain et Siddiqi, 1967) : Females : L = 1.1-1.7 mm; a = 30-33; b = 3.5-4.0; c = 61-65; c' = 0.8; V = 43-45.

Description : Female : Body medium-sized. Lateral chords with distinct subcuticular glands, about 30-65 on each side of body. Lip region setoff from adjacent body. Odontostyle 14-16 μm long. Odontophore rod-like. Vulva transverse. Female reproductive system amphidelphic. Prerectum short. Tail hemispheroid, broadly rounded, shorter than anal body-width.

Male : Not found.

Type habitat and locality : Literature not available.

56. *Discolaimium upum* Baqri & Jairajpuri, 1968

1968. *Discolaimium upum* Baqri & Jairajpuri. *Journal of Helminthology*, **42** : 243-246.

Measurements (after Baqri & Jairajpuri, 1968) : Females : L = 0.8-0.9mm; a = 36-42; b = 3.5-4.5; c = 41-47; c' = 1.5; V = 45-48.

Description : Female : Body slender upon fixation. Lateral hypodermal glands about 40 in entire body length. Odontostyle 11-12 μm long. Odontophore rod-like. Vulva transverse. Female reproductive system amphidelphic. Tail cylindroid with broadly rounded tip.

Male : Not found.

Habitat and locality : Literature not available.

57. *Latocephalus gracile* Patil & Khan, 1982

1982. *Latocephalus gracile* Patil & Khan. *Indian J. Nematol.*, **12** : 38-46.

Measurements : Females : L = 1.19 mm; a = 44.40; b = 4.28; c = 51-55; V = 38

Description : Female : Lip region expanded; 8 μm wide and 5 μm high. Odontostyle 9 μm long. Odontophore 20 μm long. Guiding ring 5 μm from anterior end. Basal expanded part of oesophagus occupies about 46% of neck region. Female reproductive system mono-opisthodelphic. Anterior uterine sac 10 μm . Prerectum about 45 μm and 3 anal body diameter long. Tail elongate conoid, 38 μm long or 2.5 anal body diameter long.

Male : Not found.

Type habitat and locality : Collected from soil around root of cotton, *Gossypium* sp. at Lakhpuri, district Akola, Maharashtra

Distribution : Maharashtra, Rajasthan, Gujarat.

58. *Oriverutus mammillatus* (Darekar & Khan, 1982) Jairajpuri & Ahmad, 1982

1982. *Mammillonema mammillatus* Darekar & Khan. *Indian Journal of Nematology*, **11** : 176-179.

Measurements (after Darekar & Khan, 1982) : Females : L = 1.16-1.20 mm; a = 45-47; b = 3.5-4.0; c = 19-20; V = 52-55.

Males : L = 1.15-1.18 mm; a = 54-56; b = 3.5-3.7; c = 15-16; T = 51-52.

Description : Female : Body J-shaped upon fixation. Lip region expanded, setoff by a constriction, labial papillae six, mammillate, projecting. Odontostyle attenuated 15-17 μm long. Odontophore 16-19 μm long. Oesophageal expansion gradual, expanded part occupies about 50% of oesophageal length. Female reproductive system amphidelphic. Ovaries reflexed. Prerectum about 4.5 anal body diameter long; rectum 19-22 μm long or about one anal body width long. Tail elongate, conoid, tapering to a finely rounded terminus.

Male : Spicules paired, 28-30 μm long, ventrally arcuate with lateral guiding pieces. An adanal pair and series of seven ventromedian supplements present. All supplements are mammillate. Tail elongate conoid about 3 anal body diameter long, tapering to a finely rounded terminus.

Type habitat and locality : Collected from soil around roots of pomegranate (*Punica granatum* L.) at Rahuri district, Ahmednagar, Maharashtra.

59. *Longidorella suviswa* Patil & Khan, 1982

1982. *Longidorella suviswa* Patil & Khan. *Indian J. Nematol.*, **12** : 47-52.

Measurements (after Patil & Khan, 1982) : Female : L = 0.65-0.80 mm; a = 21-32; b = 3-4; c = 13-21; c' = 2.3-3.2; V = 51-60; odontostyle = 38-44 μm ; odontophore = 31-38 μm .

Description : Female : Body short, plump, ventrally arcuate upon fixation. Lip region rounded, continuous with the neck contour. Odontostyle attenuated, 38-44 μm long; odontophore 33 μm long. Anterior part of oesophagus short. Posterior enlarged part of oesophagus is muscular and constricted from anterior part. Prerectum and rectum each about one anal body diameter long. Tail slightly less than three anal body diameter long. Tail elongate, conoid, slightly bent dorsally at tail tip, with finely rounded terminus.

Male : Not found.

Type habitat and locality : Collected from soil around the roots of Kutki (Lesser millet), Chikhaldha Hill station district Amaravati, Maharashtra.

60. *Longidorella jaganathi* (Patil & Khan, 1982) Jairajpuri & Ahmad, 1982

1982. *Enchodorella jaganathi* Patil & Khan. *Indian J. Nematol.*, 12 : 47-52.

Measurements (after Patil & Khan, 1982) : Female : L = 0.40-0.50 mm; a = 15-21; b = 2.7-3.3; c = 11-14; V = 54-60; odontostyle = 30-37 μm ; odontophore = 25-33 μm .

Description : Female : Body robust, ventrally arcuate upon fixation. Lip region slightly expanded, continuous with neck. Odontostyle attenuated 33-37 μm ; odontophore 26-33 μm long, without basal flanges. Oesophagus with an anterior tubular slender part and an expanded basal bulb. Prerectum 1.25-1.5 times the length of rectum. Rectum 1.5 anal body width long. Vulva transverse slit. Female reproductive system amphidelphic. Tail dorsally convex-conoid with pointed terminus.

Male : Not found.

Type habitat and locality : Collected from soil around the roots of Chilli *Capsicum annum* from Chikhaldha district Amaravati, Maharashtra.

61. *Longidorus conicaudatus* Khan, 1986

1986. *Longidorus conicaudatus* Khan *Indian J. Nematol.*, 16 : 185-193.

Measurements (after Khan, 1986) : Female : L = 5.0-6.0 mm; a = 81.5-93.0; b = 11.4-13.4; c = 92-117; V = 49-53; odontostyle = 80-100 μm ; odontophore = 65-80 μm ; T/ABD = 1.1-1.3.

Description : Female : Body open C-shape upon fixation. Lip region expanded. Amphidial pouches large sac-like asymmetrical bilobed. Guiding ring simple located at about two and half lip region width from anterior end. Vulva a transverse slit. Female reproductive system amphidelphic. Prerectum 22-26 μm long. Rectum one anal body width long. Tail dorsally convex-conoid measuring 41-45 μm in length with obtusely rounded terminus.

Male : Not found.

Habitat and locality : Nasik, Maharashtra.

62. *Longidorus ishrati* Javed, 1983

1983. *Longidorus ishrati* Javed. *Indian J. Nematol.*, 13 : 26-31.

Measurements (after Javed, 1983) : Female : L = 3.7-4.6 mm; a = 93-115; b = 10-13; c = 81-101; V = 46-48; odontostyle = 89-90 μm ; odontophore = 60-67 μm ; tail = 41-46; T/ABD = 1.4-1.6.

Description : Female : Body assumes an open C-shape upon fixation. Lip region continuous with body. Amphidial pouch with a constriction slightly anterior to its middle. Guiding ring located at 32 μm from anterior end or about three lip region width from anterior end. Odontostyle and odontophore junction without prongs. Vulva a transverse slit. Female reproductive system amphidelphic. Pre-rectum about 4-5 anal body width. Rectum one anal body width. Tail dorsally convex ending with rounded terminus.

Male : Not found.

Type habitat and locality : Collected from soil around the roots of *Tamarindus indicus* from Kamptee cant. District, Nagpur, Maharashtra.

63. *Longidorus pisi* Edward, Mishra & Singh, 1964

1964. *Longidorus pisi* Edward, Mishra & Singh, *Jap. J. Appl. Ent. Zool.*, 8 : 313-316.

Measurements : Female : L = 2.79-3.12 mm; a = 111-115; b = 10-11; c = 91-93; V = 53-54; odontostyle = 60-62 μ m; odontophore = 37-38 μ m.

Description : Female : Body long and slender, open C-shaped upon fixation. Lip region flattened anteriorly. Amphids large, pouch-like. Odontostyle 60-62 μ m long. Odontophore 37-38 μ m long. Guiding ring 30-32 μ m from anterior end. Prerectum 150-152 μ m or about 8.8 anal body-width long. Tail dorsally convex, ventrally flattened or very slightly concave, 30-34 μ m or about 2.0 anal body-width long, with rounded conoid terminus.

Male : Not found.

Habitat and locality : Soil around rhizosphere of roots of crops and other plants. Phytoparasites.

Distribution : Maharashtra, Rajasthan, Gujarat.

64. *Longidorus elongatus* (De Man, 1876)
Micoletzky, 1922

1876. *Dorylaimus elongates* De Man, *Tij. Der Neder Lansche Dierkundige Vereeniging*, 2 : 78-196.

1953. *Longidorus monhystera* Altherr. *Bull. De la Soc. Vaudoise des scie. Natur.*, 65 : 429-460.

Measurements : Females : L = 4.5-5.6 mm; a = 76-123; b = 9.7-12.5; c = 73-133; V = 45-52.

Description : Female : Body long and narrow, open C-shaped upon fixation. Lip region flattened anteriorly. Amphids large, pouch-like. Odontostyle 82-100 μ m long. Odontophore 35-65 μ m long. Guiding ring 30-32 μ m from anterior end. Prerectum 122-124 μ m or about 10 anal body diameter long. Tail dorsally convex, ventrally flattened or very slightly concave, 28-32 μ m or about 1.3 anal body-width long with roundly conoid terminus.

Habitat and Locality : Soil around rhizosphere of crops and other plants.

Distribution : Maharashtra, Gujarat, Rajasthan.

65. *Paralongidorus citri* (Siddiqi, 1959)
Siddiqi, Hooper & Khan, 1963

1959. *Xiphinema citri* siddiqi, *Proc. Helminth. Soc. Wash.*, 26 : 151-163.

1963. *Paralongidorus citri* (Siddiqi, 1959) Siddiqi, Hooper & Khan, *Nematologica*, 9 : 7-14.

Measurements : Females : L = 2.71-3.41 mm; a = 106-115; b = 12.5-13.9; c = 79-89; V = 50-54.

Description : Female : Lip region button-like, offset from body. Odontostyle 65-70 μ m long, aperture small. Guiding ring at 27-30 μ m or 2.7-3.0 lip width from anterior end. Odontophore 43-50 μ m long. Basal expanded part occupies 25-26% of neck region. Reproductive system amphidelphic. Prerectum 170-200 μ m or 11-12 anal body width long. Tail dorsally convex, conoid, 34-38 μ m or 1.9-2.0 anal body width long.

Male : Not found.

Habitat and locality : Soil around roots of rhizosphere of various crops and other plants.

Distribution : Maharashtra, Gujarat, Rajasthan.

66. *Paralongidorus microlaimus* Siddiqi, 1964

1964. *Paralongidorus microlaimus* Siddiqi, *Proc. Helminth. Soc. Wash.*, 31 : 133-137.

Measurements : Females : L = 3.27 mm; a = 91.0; b = 10.9; c = 109.2; V = 53.

Description : Female : Lip region offset from body. Odontostyle 76 μ m long. Odontophore 35 μ m long. Guiding ring 27 μ m from anterior end. Basal expanded part of oesophagus occupies 25% of neck region. Reproductive system amphidelphic. Prerectum 175 μ m or 6.4 anal body-width long. Tail 26 μ m or about one anal body-width long, rounded terminus.

Male : Not found.

Habitat and locality : Soil around roots of rhizosphere of various crops and other plants.

Distribution : Maharashtra, Gujarat, Rajasthan.

67. *Xiphinema basiri* Siddiqi, 1959

1971. *Xiphinema basiri* Loof & Yassin, *Nematologica*, 16 : 537-546.

1972. *Xiphinema basiri* Cohn & Sher, *J. Nematol.*, 4 : 36-65.

Measurements : Female : L = 2.01 mm; a = 44; b = 5.0; c = 41; c' = 1.6; V = 47.

Description : Female : Lip region rounded, offset from body. Odontostyle 106 μm . Odontophore 63 μm or nearly one half of the odontostyle length. The guiding ring at 80 μm or about 8 lip region width from anterior end. Female reproductive system amphidelphic. Z-organs present in the uteri. Prerectum 321 μm or about 13 anal body width long. Tail conoid, digitate, about 1.6 anal body width long.

Male : Not found.

Habitat and locality : Soil around rhizosphere of various crops and other plants.

Distribution : Maharashtra, Gujarat, Rajasthan.

68. *Xiphinema elongatum* Schuurmans Stekhoven & Teunissen, 1938

1949. *Xiphinema pratensis* Loos. *J. Zool. Soc. India*, 1 : 30-36.

1974. *Xiphinema elongatum* Heyns. *Phytophylactica*, 6 : 157-164.

Measurements : Female : L = 2.1-2.4 mm; a = 47-60; b = 5.4-6.7; c = 40-44; V = 43-47.

Description : Female : Lip region rounded, offset from body. Odontostyle 105-107 μm or about 8.7-8.9 head width long. Odontophore 57-59 μm long. Guiding ring at 90-95 μm or 2-3 anal body width long. Tail 45-56 μm or about 2.0-2.1 anal body width long, elongate conoid with subdigitate terminus.

Male : Not found.

Habitat and locality : Soil around roots of various crops and other plants.

Distribution : Rajasthan, Gujarat, Maharashtra,

69. *Xiphinema americanum* Cobb, 1913

1913. *Xiphinema americanum* Cobb. *J. Wash. Acad. Sci.*, 3 : 432-444.

Measurements : Females : L = 1.61-1.72 mm; a = 42; b = 5.4; c = 45-55; V = 50

Description : Female : Body C-shaped upon fixation. Lip region offset from body. Odontostyle 74-76 μm long. Odontophore 50-52 μm long. Fixed guiding ring at 63-66 μm or 6-8 lip region width

from anterior end. Basal expanded part of oesophagus 25-26% of neck region. Reproductive system amphidelphic, each sexual branch consists of a reflexed ovary. Tail short, convex-conoid 30-32 μm or 1.4-1.6 anal body width long.

Male : Not found.

Habitat and locality : soil around roots of various crops and other plants.

Distribution : Rajasthan, Gujarat, Maharashtra.

70. *Xiphinema insigne* Loos, 1949

1949. *Xiphinema insigne* Loos. *J. Zool. Soc. India*, 1 : 30-36.

Measurements : Females : L = 2.21-2.41 mm; a = 58-79; b = 6.1-7.0; c = 27-33; V = 30-33.

Description : Female : Lip region almost flat or rounded at apex, and slightly offset from body. Odontostyle 105-108 μm long. Fixed guiding ring 86-90 μm long. Basal expanded part of oesophagus 23-28% of neck length. Vulva transverse. Reproductive system amphidelphic, each sexual branch consisting of a reflexed ovary. Tail 72-81 μm , narrow, elongate conoid, 3.1-3.6 anal body width long.

Male : Not found.

Habitat and locality : Soil around roots of rhizosphere of various crops and other plants. Phytoparasites.

Distribution : Rajasthan, Gujarat, Maharashtra.

71. *Belondira eugeniae* Patil & Khan, 1982

1982. *Belondira eugeniae* Patil & Khan. *Indian. J. Nematol.*, 12 : 226-231.

Measurements (after Patil & Khan, 1982) : Females : L = 1.20-1.42 mm; a = 28-35; b = 4.0-4.5; c = 61-77; c' = 0.70-0.95; V = 35-38; odontostyle = 7-8 μm ; odontophore = 9-10 μm .

Male : L = 1.2-1.3 mm; a = 40-42; b = 4.4-4.5; c = 61-65; c' = 0.7-0.8; T = 48-50; spicules = 30-32 μm .

Description : Female : Body cylindrical, straight, tapering anteriorly. Lip region low, conoid-rounded,

continuous with body contour. Expanded part of oesophagus occupies 53% of total oesophagus length. Anterior uterine branch less than one vulva body width long. Posterior branch normal. Tail less than one anal body width long.

Male : Testis paired. Lateral guiding pieces present. A pair of ad-anal papillae located slightly anterior to latitude of cloaca. Two pairs of district ventro-median supplements.

Type habitat and locality : Soil around roots of Jamun, *Eugenia jambolina* at Tadoba district Chandrapur, Maharashtra.

72. *Belondira notabilis* Patil & Khan, 1982

1982. *Belondira notabilis* Patil & Khan *Indian Journal Nematol.*, 12 : 226-231.

Measurements (after Patil & Khan, 1982) : Females : L = 0.85-1.30 mm; a = 4.0-5.6; c = 33-40; c' = 1.3-1.8; V = 36-40; odontostyle = 7-8 μ m; odontophore = 7-8 μ m.

Males : L = 1.0-1.2mm; a = 55-65; b = 5.0-5.9; c = 33-38; c' = 1.4-1.7; odontostyle = 6-7 μ m; odontophore = 6-7 μ m; spicules = 24-26 μ m.

Description : Female : Body almost straight, tapering anteriorly. Lip region continuous with body contour. Basal bulb of oesophagus occupies 25% of oesophageal length. Anterior uterine branch rudimentary about 2 vulval body width long. Posterior branch normal. Prerectum about one anal body width long. Tail hemispherical, slightly clavate about 1.5 times anal body width in length.

Male : Testis two. Lateral guiding pieces present. Supplements consisting of an-adanal pair. Tail 1.5 times anal body width long.

Type habitat and locality : from soil around roots of santra *Citrus reticulate* at Katol district Nagpur, Maharashtra.

73. *Belondira goldeni* Suryawanshi, 1972

1972. *Belondira goldeni* Suryawanshi, *Nematologica*, 18 : 44-58.

Measurements (after Suryawanshi, 1972) : Females : L = 1.4 mm; a = 36.8; b = 36.8;

c = 48.2; V = 41; oesophagus 362 μ m; oesophageal bulb = 208 μ m; tail = 29 μ m; prerectum = 96 μ m.

Males : L = 1.25 mm; a = 35.7; b = 4.0; c = 39; T = 47 μ m; oesophagus = 311 μ m; oesophageal bulb = 182 μ m; tail = 32 spicules = 40 μ m.

Description : Female : Body almost straight, cylindrical, tapering anteriorly. Cephalic framework moderately sclerotized. Odontostyle 5.6 μ m long; aperture distinct; odontophore 6.4 μ m long. Basal bulb 56% of oesophageal length. Muscular sheath prominent. Vulva a transverse slit. Anterior uterine branch about one body width long. Posterior gonad normal, reflexed. Prerectum 3.2 anal body width long. Tail rounded, one anal body width long.

Male : Testis two, outstretched. Spicules slender, bent nearly to 90 angles, lateral guiding pieces present. One adanal pair of ventromedian supplements.

Type habitat and locality : Aurangabad, Maharashtra.

74. *Belondira thornei* Suryawanshi, 1972

1972. *Belondira thornei* Suryawanshi, *Nematologica*, 18 : 44-58.

Measurements (after Suryawanshi, 1972) : Females : L = 1.27-1.4 mm; a = 44-52; b = 6.6-8.0; c = 49-58; V = 33-39; oesophagus = 166-201 μ m; oesophageal bulb = 67-83 μ m; prerectum = 53-80 μ m; tail = 24-27.

Males : L = 1.3-1.2mm; a = 53-57; b = 6.0-6.2; c = 53-57; T = 34-37; tail = 21-24; spicules = 32-35 μ m.

Description : Female : Body cylindroids, straight. Lip region rounded, conoid amalgamated. Cephalic frame faintly sclerotized. Odontostyle 5-6 μ m; odontophore 7-8 μ m long. Vulva transverse. Anterior uterine branch about 1-2 body width long; filled with spermatozoa. Posterior gonad normal, reflexed 60-80%. Prerectum 2-5 anal body width long. Tail rounded, slightly clavate, 1.0-1.2 anal body width long.

Male : Spicules slightly arcuate, 32-35 μm long. Lateral guiding pieces present. Pair of ventro-median supplements.

Type habitat and locality : Collected from soil around roots of grass near Udgir, Osmanabad, Aurangabad, Maharashtra.

75. *Belondira rafiqi* Suryawanshi, 1972

1972. *Belondira rafiqi* Suryawanshi, *Nematologica*, **18** : 44-58.

Measurements (after Suryawanshi, 1972) : Females : L = 0.99-1.02 mm; a = 42.5-38.6; b = 5.3-5.7; c = 46.3-53.8; V = 36-37; oesophagous = 192-194 μm ; oesophageal bulb = 83-88 μm ; prerectum = 64-78 μm ; tail = 18-22 μm .

Description : Female : Body robust, cylindroids, tapering anteriorly. Lip region rounded. Cephalic frame work moderately sclerotized. Odontostyle small, 4 μm long, aperture distinct. Odontophore 6-8 μm long. Basal bulb about 43-46% of oesophageal length. Vulva transverse. Anterior uterine branch 1.7-2.0 anal body width long. Posterior gonad normal, reflexed. Prerectum 4 anal body width long. Tail clavate, about one anal body width long.

Male : Not found.

Type habitat and locality : Collected from soil around grass near Udgir, Osmanabad, Maharashtra.

76. *Belondira syedi* Suryawanshi, 1972

1972. *Belondira syedi* Suryawanshi, *Nematologica*, **18** : 44-58.

Measurements (after Suryawanshi, 1972) : Female : L = 1.4 mm; a = 36.8; b = 3.6; c = 73.6; V = 41; oesophagous = 385 μm ; oesophageal bulb = 221 μm ; prerectum = 102 μm ; tail = 19 μm .

Description : Female : Body cylindroids, tapering anteriorly. Lip region rounded, Cephalic sclerotization faint. Odontostyle 5 μm long. Odontophore 7 μm long. Basal bulb about 57% oesophageal length. Muscular sheath distinct. Vulva transverse. Anterior uterine branch about 1-7 body width long. Posterior gonad reflexed normal. Tail hemispherical, about two-third anal

body width long.

Male : Not found.

Type habitat and locality : Collected from soil around roots of *Cynodon dactylon* near Togari, Osmanabad, Maharashtra.

77. *Belondira sacchari* Suryawanshi, 1972

1972. *Belondira sacchari* Suryawanshi, *Nematologica*, **18** : 44-58.

Measurements (after Suryawanshi, 1972) : Females : L = 1.14 mm; a = 35.6; b = 5.1; c = 39.3; V = 37; oesophagous = 222 μm ; oesophageal bulb = 104 μm ; tail = 29 μm .

Description :Female : Lip region rounded, cylindrical, tapering in the lip region. Lip region rounded, conoid, cephalic frame work faint. Odontostyle 3.2 μm long. Odontophore 7.2 μm long. Basal bulb about 47% of oesophageal length, muscular sheath distinct. Anterior uterine branch about one body width long. Posterior gonad normal. Tail slightly clavate, a little more than one anal body width long.

Male : Not found.

Type habitat and locality : collected from soil around roots of Sugarcane, near Udgir, Osmanabad, Maharashtra.

78. *Tylencholaimus suryawanshii* Ali and Chisty, 1972

1972. *Tylencholaimus suryawanshii* Ali & Chisty. *Marathwada univ. J. Sci. sect (B) (Biol.sci)*, **11** : 283-285.

Measurements : Females : L = 0.71-0.75mm; a = 21-29; b = 3.8-4.7; V = 52-55.

Description : Female : Body slightly ventrally arcuate upon fixation, tapering gradually towards both ends. Inner cuticle striated. Lip region set off from body by constriction. Odontostyle 8-9 μm long; aperture 3-4 μm or one fourth of odontostyle length. Odontophore 10-11 μm with small basal thickenings. Basal expanded part of oesophagous occupies 40-43% of neck region. Vulva a transverse slit. Vagina 10-12 μm , extending inward about 1/4th-1/3rd of corresponding body width.

Female reproductive system amphidelphic; ovaries reflexed. Prerectum 42-45 μm or 2.2-2.3 anal body width long. Rectum 17-19 μm or 0.8-1.0 anal body width long. Tail 21-24 μm or 1.1-1.2 anal body width long with hemispheroid terminus.

Male : Not found.

Type habitat & locality : Collected from soil around root of rose from Marathwada University Campus.

79. *Neometadorylaimus coomansi* (Ali, Farooqui & Suryawanshi, 1971) Jairajpuri & Ahmad, 1992

Measurements : Females : L = 2.4-3.1 mm; a = 36-42; b = 4.1-5.1; c = 80-89; V = 55-58.

Female : Body medium sized, almost straight to slightly curved ventrally upon fixation, tapering towards both extremities. Cuticle thick, smooth. Lateral hypodermal chord one seventh of body diameter. Lip region setoff from adjacent body contour by a distinct constriction. Lips six, broadly rounded. Amphids stirrup-shaped. Odontostyle 23-24 μm long. Odontophore rod-like. Guide ring single, 6-7 μm posterior or 37-40% lip region diameter from anterior end. Reproductive system didelphic, amphidelphic. Uterus and oviduct separated by a sphincter. Vulva a horizontal slit. Vagina one third to a half of corresponding body diameter long; Pre-rectum more than one and rectum half anal body diameter long. Tail convex-conoid with a bluntly rounded terminus.

Male : Not found

Type habitat and locality : Soil around roots of groundnut at Udgir, district Osmanabad, Maharashtra, India.

80. *Tylencholaimellus geradii* Ali, Farooqi & Suryawanshi, 1970

1970. *Tylencholaimellus geradii* Ali et al., *Revista Parasitol.*, **31** : 79-82.

Measurements (after Ali et al. 1970) : Female : L = 0.339 mm; a = 19.2; b = 3.4; c = 13; V = 37.

Description : Female : Body ventrally arcuate,

tapering at both ends. Lip region setoff; labial disc present. Odontostyle typical of the genus, 8 μm long; odontophore 5.5 μm long. Vulva transverse; anterior uterine branch present; posterior gonad normal, reflexed. Prerectum about 2.5 anal body width long. Tail elongate conoid with blunt terminus, more than 2.5 anal body width long.

Male : Not found.

Type habitat and locality : Collected from soil around roots of *Cynodon dactylon* Pers. From Udgir, Osmanabad, Maharashtra, India.

81. *Tylencholaimellus acutus* Ali, Farooqui & Suryawanshi, 1970

1970. *Tylencholaimellus acutus* Ali et al. *Revista Parasitol.*, **31** : 79-82.

Measurements (after Ali et al., 1971) : Female : Body arcuate, tapering posteriorly to elongate conoid tail. Lip region slightly setoff. Odontostyle typical of genus, 8.5 μm long; odontophore 6.5 μm long. Oesophageal bulb slightly longer than neck width, constricted. Vulva transverse; gonad monodelphic, opisthodelphic, reflexed; anterior uterine branch absent. Prerectum about three body width long; tail slightly less than three anal body widths long.

Male : not found.

Type habitat and locality : Collected from soil around roots of grass, Aurangabad, India.

82. *Oostenbrinkella oostenbrinki* Jairajpuri, 1965

1965. *Oostenbrinkella oostenbrinki* Jairajpuri, *Proc. Helminth. Soc. Wash.*, **32** : 122-124.

Measurements (after Jairajpuri, 1965) : Females : L = 0.97-1.13 mm; a = 42-47; b = 5.9-7.2; c = 4.6-5.2; V = 24-28; odontostyle = 12 μm ; odontophore = 8 μm .

Male : L = 0.96-0.97 mm; a = 48; b = 5.8; c = 4.2-4.8.

Description : Female : Body almost straight upon fixation. Lip region setoff, except by the wide amphid aperture. Lip papillae amalgamated

and prominent labial disc present. Odontostyle dorsally convex, with ventral surface strongly curved. Odontophore thickened with prominent knobs. Female reproductive system opisthodelphic with short anterior uterine sac.

Male : Males with paired adanal supplements only.

Distribution : Maharashtra, Rajasthan.

83. *Aquatides aquaticus* (Thorne, 1930)
Thorne, 1974

1930. *Nygotaimus aquaticus* Thorne, *J. Agric. Res. U.S. Dept. Agric.*, **41** : 445-466.

1975. *Aquatides aquaticus* (Thorne, 1930) Thorne, *Tech. bull. Exp. Sta. South Dakota State Univ.*, **41** : 120

Measurements : Females : L = 1.80-2.06 mm; a = 39-42; b = 5.0-5.2; c = 81-82; V = 47-52.

Male : L = 2.04 mm; a = 40; b = 4.0; c = 56; T = 65.

Description : Female : Body almost straight upon fixation. Lip region continuous with body, labial papillae elevated. Tooth linear, 15-18 μ m or equal to lip region width. Basal expanded part of oesophagus occupies 45-48% of oesophageal length, enclosed in a conspicuous sheath forming basal pockets. Cardia glands well developed. Female reproductive system amphidelphic. Prerectum 65-75 μ m or 2-3 anal body width long. Tail 22-25 μ m long, shorter than anal body-width, convex-conoid or bluntly rounded.

Male : Spicules massive, arcuate, 50-58 μ m medially. Gubernaculum 9-10 μ m long. Lateral guiding pieces well developed, 11-13 μ m long. In addition to adanal pair, 5-6 ventromedian supplements present. Tail 36 μ m long, convex conoid.

Distribution : Maharashtra, Rajasthan, Gujarat.

84. *Aquatides thornei* (Schneider, 1937)
Ahmad & Jairajpuri, 1982

1937. *Nygotaimus thornei* Schneider. *Arch. Hydrobiol. Planktonk Suppl.*, **15** : 30-108.

1968. *Nygotaimus (Aquatides) thornei* (Schneider, 1937) Heyns., *Entomol. Mem. S. Africa*, **19** : 1-44.

Measurements : Females : L = 1.66-1.76 mm; a = 32-55; b = 4.1-4.5; c = 65-66; V = 47-49.

Male : L = 1.44 mm; a = 33; b = 4.0; c = 53; T = 52.

Description : Female : Lip region continuous with body. Labial papillae not elevated. Tooth linear, 12-13 μ m or equal to lip region width. Basal expanded part of oesophagus enclosed in a conspicuous sheath forming basal pockets. Cardia hemispherical. Cardia glands rounded. Female reproductive system amphidelphic. Prerectum 65-70 μ m or two anal body width long. Tail hemispheroid, slightly clavate, 25-27 μ m or about one anal body width long.

Male : Similar to female in general morphology. Spicules 45 μ m long, lateral guiding pieces 9 μ m long. Gubernaculum 8 μ m long. Ventromedian supplements 5. Tail hemispherical, 27 μ m long.

Distribution : Maharashtra, Rajasthan, Gujarat.

85. *Mononchus aquaticus* Coetzee, 1968

1968. *Mononchus aquaticus* Coetzee. *Nematologica*, **14** : 63-67.

Measurements : Female : L = 1.77 mm; a = 42.1; b = 5.7; c = 18.6; V = 55.

Description : Female : Lip region 21 μ m wide and 9 μ m high. Amphidial apertures 3 μ m wide, located at 8 μ m from anterior end. Buccal cavity 36x14 μ m. The apex of dorsal tooth at 24 μ m or 66% of buccal cavity from base. Female reproductive system amphidelphic. Tail elongate conoid with clavate tip, 94 μ m or 3.7 anal body width long. Caudal glands well developed, spinneret terminal.

Male : Not found.

Distribution : Maharashtra, Gujarat., Rajasthan.

86. *Mylonchulus contractus* Jairajpuri, 1970

1970. *Mylonchulus contractus* Jairajpuri. *Nematologica*, **16** : 434-456.

Measurements : Female : L = 0.95mm; a = 29; b = 3.5; c = 25; V = 56.

Description : Female : Body ventrally arcuate upon fixation, tapering towards both extremities. Cuticle 2 μm thick. Lip region 20 μm wide and 2 μm high. Buccal cavity $21 \times 12 \mu\text{m}$. Apex of dorsal tooth 15 μm from the base of stoma. Five transverse rows of denticles. Submedian teeth small. Rectum 20 μm long or less than one anal body width long. Female reproductive system amphidelphic; ovaries reflexed, intestine contracted dorsally in the region of gonads. Uterus small. Cuticularised pieces present at vulva-vagina junction. Tail 37 μm or one and half anal body width long, arcuate conoid with blunt terminus. Caudal glands grouped. Spinneret subdorsal.

Male : Not found.

Distribution : Maharashtra, Rajasthan, Gujarat.

87. *Alirhabditis indica* Suryawanshi, 1971

Measurements : L = 0.37-0.40 mm; a = 23-28; b = 4.0-4.4; c = 4.0-0; V = 51-535.

Male : L = 0.33-0.35mm; a = 24-31; b = 3.6-3.8; c = 4.6-5.0

Description : Female : Cuticle finely annulated. Annules 1 μm wide. Lateral field 1/5th of body diameter. Stoma 10-12 μm long. Corpus 1.3 times as long as isthmus. Excretory pore posterior to mid pharynx. Post vulval sac smaller than corresponding body diameter.

Male : Spicules 12 μm , gubernaculum 5.5 μm long. Female tail 10 times of anal body diameter long.

Type habitat and locality : Literature not available.

88. *Acrostichus indicus* (Suryawanshi, 1971)
Andrássy, 1984

Measurements (after Andrássy, 1984) : Females : L = 0.60-0.62; a = 27-29; b = 5.3-5.4; c = 2.5-3.0; V = 46-51.

Male : L = 0.46 mm; a = 24; b = 4.4; c = 3.3.

Description : Female : Cuticle finely annulated. Lip region continuous. Stoma 1.5 times as long as labial diameter, with a dorsal tooth. Pharynx

muscular with valuated median bulb, narrow isthmus and ovoid basal bulb. Post vulval uterine sac as long as corresponding body diameter.

Male : Spicules 20-23 μm long. Gubernaculum 4-5 μm long.

Type habitat and locality : Literature not available.

89. *Pareudiplogaster aurangabadensis*
(Suryawanshi, 1971) Andrassy, 1984

Measurements after Andrassy 1904 : Female : L = 0.8mm; a = 27; b = 5.9; c = 2.3; V = 36.

Male : L = 0.640.72 mm; a = 26-32; b = 5.6-6.6; c = 2.5-2.9

Body 0.8mm long. Cuticle annulated. Lip region continuous. Stoma with a massive dorsal tooth and a small subventral teeth. Body at posterior end of pharynx twice as wide as labial diameter. Female amphidelphic. Spicules 34 μm long. Gubernaculum 18-21 μm . Tail 15 anal body diameter long.

Type habitat and locality : Literature not available.

90. *Myolaimus maupasi* (Hnatewytsch, 1929)
Sanwal, 1960

Measurements : Female : L = 0.46-0.68 mm, a = 18-28, b = 3.7-4.5; c = 7.1-10; V = 50-55

Male : L = 0.40-0.45mm; a = 25-29; b = 3.3-3.7; c = 64

Cuticle finely annulated. Stoma 1.5 times as long as broad. Amphid oval shape, small, situated at mid stoma. Anterior pharyngeal part 1.4-1.5 times longer than posterior one. Excretory pore at mid isthmus. Rectum 2 anal body diameter long. Postvulval sac smaller than body diameter. Tail curved dorsally.

Male : Similar to female in general morphology. Spicules and gubernaculum absent. Bursa with 4+1+2 bursal papillae.

Type habitat and locality : Literature not available.

SUMMARY

The paper reports 90 species of plant and soil nematodes from Maharashtra State. In all, 17 taxa have been described as new to science from Maharashtra State.

ACKNOWLEDGEMENT

The author is grateful to the Director, Zoological Survey of India, Kolkata for providing necessary facilities for the preparation of the paper.

REFERENCES

- Ali, S.M. and Joshi, P.M. 1972. A report on *Nygolaimus (Aquatides) thornei* Schneider, 1937 (Nematoda: Nygolaimidae) from Marathwada. India. *Marathwada Univ. J. Sci. Sect. B (Biol. Sci.)*, **11** : 367-369.
- Ali, S.M. and Prabha, M.J. 1971. A case of an abnormal oesophagus in a juvenile specimen of *Thornenema baldum*. *Nematologica* (1970), **16** : 601-602.
- Ali, S.M. and Prabha, M.J. 1974. Studies on the genera *Sicaguttur* Siddiqi, 1970 and *Indodorylaimus* n. gen. (Nematoda : Dorylaimoidea). *Nematologica* (1973), **19** : 481-490.
- Ali, S.M. and Suryawanshi, M.V. 1971. A report of *Dorylaimoides arcuicaudatus* Baqri and Jairajpuri, 1969 (Nematoda: Leptonchidae) from Marathwada, India. *Marathwada Univ. J. Sci., Sect. B. (Biol. Sci.)*, **11** : 313-315.
- Ali, S.M., Farooqui, M.N. and Suryawanshi, M.V. 1969. A report on bivulvarity in *Dorylaimoides teres* Thorne and Swanger, 1936 (Dorylaimoidea: Leptonchidae) from Marathwada, India. *Revista Parasitol.*, **30** : 63-65.
- Ali, S. M.; Farooqui, M.N. and Suryawanshi, M.V. 1970. Two new species of *Tylencholaimellus* N.A. Cobb in M.V. Cobb, 1915 (Dorylaimoidea: Leptonchidae) from Marathwada, India. *Revista Parasitol.*, **31** : 179-182.
- Ali, S.M.; Farooqui, M.N. and Suryawanshi, M.V. 1971. *Myolaimus indicus* n.sp. and *Metadorylaimus coomansi* n.sp. (Dorylaimida : Tylencholaimidae) from Marathwada, India. *Nematologica* (1970), **16** : 577-583.
- Ali, S.M.; Farooqui, M.N. and Suryawanshi, M.V. 1971. Report of males of *Thornenema baldum* and *T. mauritianum*. *Nematologica*, **17** : 172-173.
- Ali, S.M.; Suryawanshi, M.V and Prabha, M.J. 1973. Studies on the genus *Discolaimium* Thorne, 1939 (Nematoda: Dorylaimoidea) with descriptions of two new species and a discussion on the validity of *Discolaimoides* Heyns, 1963. *Nematologica*, **19** : 195-204.
- Darekar, K.S. and Khan, E. 1982. *Rotylenchus ranapoi* sp.n. (Nematoda : Hoplolaimidae) from Maharashtra. *Indian J. Nematol.*, **12** : 183-185.
- Darekar, K.S. and Khan, E. 1981. *Seshadriella* (Tylenchida : Nematoda), a new nematode genus from Maharashtra. *Biovigyanam*, **7** : 85-87.
- Darekar, K.S. and Khan, E. 1979. Soil and plant parasitic nematodes from Maharashtra, India. III. *Basiria nasikensis* n.sp. and *Criconemoides mongomorgum* n.sp. (Tylenchida : Nematoda). **7** : 148-152.
- Darekar, K.S. and Khan, E. 1979. Soil and plant parasitic nematode from Maharashtra. India. VII. *Indokochinema conicauda* n. gen., n. sp. and Kochinematidae n. fam (Dorylaimida : Nematoda). *Indian J. Nematol.* (1978), **8** : 140-143.

- Darekar, K.S. and Khan, E. 1980. Two new species of *Helicotylenchus* Steiner, 1945 (Tylenchida : Nematoda) from Maharashtra, India. *Nematol. Medit.*, **8** : 1-7.
- Darekar, K.S. and Khan, E. 1981. Soil and plant parasitic nematodes from Maharashtra, India : Two new species of *Hemicyliophora* de Man, 1921. (Tylenchida: Nematoda). *Indian J. Nematol.*, **11** : 35-41.
- Darekar, K.S. and Khan, E. 1981. Soil and plant parasitic nematodes from Maharashtra, India VIII. *Mammillonema mammillatus* gen. n., sp. n. (Dorylaimida : Nematoda). *Indian J. Nematol.*, **11** : 176-179.
- Darekar, K.S. and Khan, E. 1982. *Xiphinema tugewai* sp. n. and *Longidorus paramirus* sp.n. (Longidoroidea : Nematoda) from Maharashtra, India. *Indian J. Nematol.*, **12** : 153-157.
- Darekar, K.S. and Khan, E. 1979. Soil and plant parasitic nematodes from Maharashtra, India. VI. Three new species of *Helicotylenchus* Steiner, 1945 (Tylenchida; Nematoda). *Indian J. Nematol.* (1978), **8** : 132-139.
- Darekar, K.S. and Khan, E. 1981. *Nenocriconema dorgeski* gen. n.sp. n. (Nematoda : Criconematidae) from Maharashtra. India. *Indian J. Nematol.*, **11** : 172-175.
- Husain, S.I. and Khan, A.M. 1976. Four new tylenchid nematodes from north India. *Indian J. Nematol.* (1975), **5** : 49-55.
- Husain, S.I. and Khan, A.M. 1977. *Boleodorus filiformis* nomen novum for *B. acutus* Husain and Khan, 1974. *Indian J. Nematol.* (1975), **5** : 246.
- Jairajpuri, M.S. 1968. Descriptions of *Tylenchus (Filenchus) citri* and *Longidorella opisthodelphis* (Nematoda). *Labdev J. Sci. Technol.*, **6B** : 83-85.
- Jairajpuri, M.S. 1971. On the synonymy of *Telotylenchus* Siddiqi, 1960, with *Trichotylenchus* Whitehead, 1959 (Nematoda : Tylenchida). *Indian J. Nematol.*, **1** : 3-6.
- Khan, E. and Darekar, K.S. 1979. Soil and plant-parasitic nematodes from Maharashtra, India. V. *Tylenchorhynchus punensis* n.sp. and *Merlinius macrophasmidus* n.sp. (Nematoda: Tylenchida). *Indian J. Nematol.* (1978), **8** : 43-48.
- Khan, E. and Darekar, K.S. 1979. Soil and plant-parasitic nematodes from Maharashtra. India. IV. Two new species of *Telotylenchus* Siddiqi, 1960 (Tylenchida : Nematoda). *Indian J. Nematol.* (1978), **8** : 13-18.
- Khan, M.L. 1982. Species of *Basiria* Siddiqi, 1959, associated with fruit trees in India (Nematoda: Tylenchinae). *Indian J. Nematol.*, **12** : 99-106.
- Khan, M.L. and Khan, S.H. 1982. Three new species of the genus *Orientylus* Jairajpuri & Siddiqi, 1977 associated with fruit trees in India (Rotylenchoidinae: Nematoda). *Indian J. Nematol.*, **12** : 111-117.
- Nandkumar, C. and Khera, S. 1969. *Paurodontus aberrans* n. sp. (Nematoda: Tylenchida) with a note on a special branch of the oviduct. *Indian J. Helminth.*, **21** : 1-15.
- Nandkumar, C. and Khera, S. 1970. A new nematode species, *Pratylenchus mulchandi* from millets of Rajasthan. *Indian Phytopath.* (1969), **22** : 359-363.
- Nandkumar, C. and Khera, S. 1970. *Helicotylenchus indicus* Siddiqi, 1963 with certain remarks on the genus *Helicotylenchus* Steiner, 1945 and some of its species. *Indian J. Helminth.*, **22** : 6-52.

- Patil, K.J. and Khan, E. 1982. Taxonomic studies on nematodes of Vidarbha region of Maharashtra, India. I. The family Discolaimidae (Dorylaimida) with proposition of two new genera. *Indian J. Nematol.*, **12** : 38-46.
- Patil, K.J. and Khan, E. 1982. Taxonomic studies on nematodes of Vidarbha region of Maharashtra, India. II. Two new species belonging to the family Nordiidae (Dorylaimida : Nematoda). *Indian J. Nematol.*, **12** : 47-52.
- Patil, K.J. and Khan, E. 1982. Taxonomic studies on nematodes of Vidarbha region of Maharashtra, India. V. Two new species of the genus *Belondira* Thorne, 1939 (Dorylaimida: Belondiroidea). *Indian J. Nematol.*, **12** : 226-231.
- Phukan, P.N. and Sanwal, K.C. 1980. Two new species of *Aglenchus* and record of *Cephalenchus leptus* (Tylenchidae : Nematoda) from Assam. *Indian J. Nematol.*, **10** : 28-34.
- Phukan, P.N. and Sanwal, K.C. 1981. Two new species of *Macroposthonia* de Man, 1980 (Criconematidae:Nematoda) from Assam. *Indian J. Nematol.* (1980), **10** : 135-140.
- Prabha, M.J. 1973. Two species of *Longidorus* from Marathwada region. *Nematologica*, **19** : 62-68.
- Prasad, S.K. and Chawla, M.L. 1965. *Thornenema delhiensis*, a new species from Delhi with a key to the species of *Thornenema* (Dorylaimidae : Nematoda). *Indian J. Ent.*, **27** : 140-143.
- Suryawanshi, M.V. 1971. Studies on the genus *Longidorella* Thorne, 1939 (Nematoda: Nordiidae) from Marathwada, India, with descriptions of two new species. *Marathwada Univ. J. Sci.*, **10** : 75-83.
- Suryawanshi, M.V. 1972. Five new species of *Belondira* Thorne, 1939 and *Porternema goodi* n. gen., n.sp. (Nematoda: Belondiroidea) from Marathwada Univ. *J. Sci., Sec. B. (Biol. Sci.)*, **11** : 63-66.
- Verma, R.S. 1977. Note on the *Diphtherophora alami* – a new species of nematode from the Uttar Pradesh. *Indian J. Agric. Res.*, **11** : 57-58.
- Suryawanshi, M.V. 1972. *Paraxonchium shamimi* sp.n. (Nematoda, Dorylaimoidea) from Marathwada, India. *Acta Parasitol. Polonica*, **20**(12/25) : 195-198.

LAND AND FRESHWATER MOLLUSCA

S.G. PATIL and S.S. TALMALE

Zoological Survey of India, Western Regional Centre, Sector 29, Vidyanagar
Rawet Road, P.C.N.T. Post, Pune-411 044

INTRODUCTION

Phylum Mollusca includes soft bodied animals of which some are covered with hard structure called shell. Mollusca occur in various habitats and are divided into freshwater, marine and terrestrial forms. Out of these some land Mollusca are harmful to plants which are pestiferous and make considerable damage to the various plants. The freshwater Molluscs play significant role in aquatic ecosystem and some of them are edible, which are sold in the market. Species like *Bellamya bengalensis*, *Pila globosa*, *Lamellidens marginalis* are proved to be food for many aquatic animals and man. Some of the Mollusca such as *Lamellidens marginalis* and *Lamellidens corrianus* have been used to produce pearls in some parts of India. Shells of some of the Mollusca are used for making buttons and also help in manufacture of poultry food. However, some of them are intermediate hosts of some parasites (*Pila globosa*, *Lymnaea* etc.).

Maharashtra State as per biogeographic classification has three distinctive zone, like West Coast, Western Ghats and Deccan plateau. This State is located between Latitude 15°.8'-22°.1' North and Longitude 72°.6'- 80°.9' East and the total area is spread over 3,07,690 sq.kms. with coast line of 720 kms. in the West. The Molluscan fauna of this state has not been studied thoroughly and the available information on the freshwater and Land Mollusca of this state is scattered. Perusal of literature shows that few workers like Blanford (1863, 1870, 1880), Preston (1915), Annandale (1919), Annandale & Prashad (1919), Annandale

& Rao (1925), Hora (1926), Tonapi and Mulherkar (1963), Tonapi (1971), Subba Rao & Mitra (1979), Subba Rao (1989), Surya Rao *et al.* (2002), Patil (2003, 2004 a, b 2005 a,b 2006), Patil and Ramakrishna (2004, 2005) and Patil & Talmale (2003, 2005), Patil *et al.* (2006) made contributions on the Molluscan fauna of Maharashtra. However, this information is scattered and there is no authentic list of freshwater and land Mollusca of Maharashtra. An attempt has been made here to give a consolidated checklist of land and freshwater mollusc species reported from Maharashtra State.

The present paper depicts altogether 160 species belonging to 65 genera, under 30 families. This list of land and freshwater Mollusca of Maharashtra State is given on the basis of past and present records and from the recent surveys made in this area. The key given in the text is based on Ramakrishna and Dey (2007) and Mitra *et al.* (2004) for Freshwater and Land Mollusca respectively.

SYSTEMATIC LIST

FRESHWATER MOLLUSCA

Phylum MOLLUSCA

Class GASTROPODA

Order MESOGASTROPODA

Superfamily VIVIPAROIDEA

Family VIVIPARIDAE (Pond snails)

Subfamily BELLAMYINAE

Genus *Bellamya* Jousseaume, 1886

1. *Bellamya bengalensis* form *typica* (Lamarck)

2. *Bellamya bengalensis* form *doliaris* (Gould)
3. *Bellamya bengalensis* form *incrassatus* Annandale
4. *Bellamya bengalensis* form *annandalei* (Kobelt)
5. *Bellamya bengalensis* form *eburnea* (Annandale)
6. *Bellamya bengalensis* form *mandiensis* (Kobelt)
7. *Bellamya dissimilis* (Muller)
Family AMPULLARIDAE
Genus *Pila* (Bolten) Roeding, 1798
8. *Pila globosa* (Swainson)
9. *Pila virens* (Lamarck)
- Subgenus *Turbinicola* Annandale & Prashad, 1921
10. *Pila* (*Turbinicola*) *saxea* (Reeve)
Superfamily LITTORINOIDEA
Family LITTORINIDAE
Subfamily BEMBICIINAE
Genus *Cremnoconchus* Blanford, 1869
11. *Cremnoconchus* (*Cremnoconchus*) *syhadrensis* (Blanford)
12. *Cremnoconchus* (*Lissoconchus*) *carinatus* (Layard)
13. *Cremnoconchus* (*Lissoconchus*) *conicus* (Blanford)
Family BITHYNIIDAE
Genus *Bithynia* Leach, 1818
Subgenus *Digoniostoma* Annandale, 1920
14. *Bithynia* (*Digoniostoma*) *cerameopoma* (Benson)
15. *Bithynia* (*Digoniostoma*) *pulchella* (Benson)
16. *Bithynia* (*Digoniostoma*) *evezardi* (Blanford)
Genus *Gabbia* Tryon, 1865
17. *Gabbia orcula* Frauenfeld
18. *Gabbia orcula* var. *producta* (Nevill)
19. *Gabbia stenothyroides* (Dohrn)
Family STENOTHYRIDAE
Genus *Stenothyra* Benson, 1856
20. *Stenothyra minima* (Sowerby)
- Superfamily CERITHIOIDEA
Family THIARIDAE
Subfamily THIARIINAE
Genus *Thiara* Roding, 1786
Subgenus *Thiara* s. str.
21. *Thiara* (*Thiara*) *scabra* (Muller)
22. *Thiara* (*Thiara*) *scabra* var. *elegans* (Benson)
23. *Thiara* (*Thiara*) *rudis* (Lea)
Subgenus *Sermyla* H & A Adams
24. *Thiara* (*Sermyla*) *riqueti* (Grateloup)
Genus *Faunus* Montfort, 1810
25. *Faunus ater* (Linnaeus)
Genus *Melanoides* Olivier, 1804
26. *Melanoides tuberculata* (Mueller)
Genus *Tarebia* H & A Adams, 1854
27. *Tarebia granifera* (Lamarck)
28. *Tarebia lineata* (Gray)
Family PLEUROCERIDAE
Subfamily MELANATRIINAE
Genus *Sulcospira* Troschel, 1858
29. *Sulcospira* (*Sulcospira*) *hugeli* (Philippi)
Subfamily PALUDOMINAE
Genus *Paludomus* Swainson, 1840
Subgenus *Paludomus* s. st.
30. *Paludomus* (*Paludomus*) *obesus* (Philippi)
31. *Paludomus* (*Paludomus*) *tanschauricus* (Gmelin)
Subgenus *Stomatodon* s. st.
32. *Paludomus* (*Stomatodon*) *stomatodon* Benson
Subclass PULMONATA
Order BASOMMATOPHORA
Superfamily LYMNÆOIDEA
Family LYMNÆIDAE
Genus *Lymnaea* Lamarck, 1799
33. *Lymnaea* (*Pseudosuccinea*) *acuminata* form *typica* Lamarck
34. *Lymnaea* (*Pseudosuccinea*) *acuminata* form *brevissima* (Annandale & Rao)

35. *Lymnaea (Pseudosuccinea) acuminata* form *chlamys* Benson
36. *Lymnaea (Pseudosuccinea) acuminata* form *gracilior* Martens
37. *Lymnaea (Pseudosuccinea) acuminata* form *patula* Troschel
38. *Lymnaea (Pseudosuccinea) acuminata* form *rufescens* Gray
39. *Lymnaea (Pseudosuccinea) luteola* form *typica* Lamarck
40. *Lymnaea (Pseudosuccinea) luteola* form *australis* Annandale & Rao
41. *Lymnaea (Pseudosuccinea) luteola* form *impura* Troschel
42. *Lymnaea (Pseudosuccinea) luteola* form *ovalis* Gray
43. *Lymnaea (Pseudosuccinea) luteola* form *succinea* Deshayes
44. *Lymnaea pinguis* Dohrn
Genus ***Radix*** Montfort, 1810
45. *Radix auricularia* (Linnaeus)
Superfamily PHYSOIDEA
Family PHYSIDAE
Genus ***Physa*** Draparnaud, 1801
46. *Physa acuta* Draparnaud
Superfamily PLANORBOIDEA
Family PLANORBIDAE
Subfamily PLANORBINAE
Genus ***Gyraulus*** Charpentier, 1837
47. *Gyraulus convexiusculus* (Hutton)
48. *Gyraulus labiatus* (Benson)
49. *Gyraulus rotula* (Benson)
Family BULLINIDAE
Subfamily BULININAE
Genus ***Indoplanorbis*** Annandale & Prashad, 1921
50. *Indoplanorbis exustus* (Deshayes)
Family ANCYLIDAE
Subfamily FERRISSINAE
Genus ***Ferrissia*** Walker, 1903
51. *Ferrissia tenuis* (Bourguignat)
52. *Ferrissia verruca* (Benson)
- Class BIVALVIA
Subclass PALEOHETERODONTA
Order TRIGOINOIDA
Superfamily UNIONOIDEA
Family UNIONIDAE
Subfamily UNIONINAE
Genus ***Arcidopsis*** Simpson, 1900
53. *Arcidopsis footei* (Theobald)
Subfamily AMBLEMIDAE
Genus ***Lamellidens***, Simpson, 1900
54. *Lamellidens consobrinus* (Lea)
55. *Lamellidens corrianus* (Lea)
56. *Lamellidens lamellatus* (Lea)
57. *Lamellidens marginalis* (Lamarck)
58. *Lamellidens marginalis* var. *cylindrica* (Hanley & Theobald)
Genus ***Parreysia*** Conrad, 1853
Subgenus ***Parreysia*** s. st.
59. *Parreysia (Parreysia) annandalei* Preston
60. *Parreysia (Parreysia) corrugata* Mueller
61. *Parreysia (Parreysia) corrugata* (Mueller) sub sp. *laevirostris* (Benson)
62. *Parreysia (Parreysia) corrugata* (Mueller) subsp. *nagpoorensis* (Lea)
63. *Parreysia (Parreysia) favidens* (Benson)
64. *Parreysia (Parreysia) favidens* var. *marcens* (Benson)
65. *Parreysia (Parreysia) rajahensis* (Lea)
Subgenus ***Radiatula*** Simpson, 1900
66. *Parreysia (Radiatula) caerulea* (Lea)
67. *Parreysia (Radiatula) cylindrica* Annandale and Prashad
68. *Parreysia (Radiatula) khadakvaslaensis* (Ray)
69. *Parreysia (Radiatula) shurtleffiana* (Lea)
Superfamily MUTELOIDEA
Family ETHERIIDAE
Genus ***Pseudomulleria*** Anthony, 1907
70. *Pseudomulleria dalyi* E.A. Smith

Subclass HETERODONTA

Order VENEROIDA

Superfamily CORBICULOIDEA

Family CORBICULIDAE

Genus *Corbicula* Mergerle von Muhlfield71. *Corbicula krishnaea* Ray72. *Corbicula peninsularis* Prashad73. *Corbicula regularis* Prime74. *Corbicula striatella* DeshayesGenus *Polymesoda* Rafinesque, 1820Subgenus *Geloina* Fray, 184275. *Polymesoda (Geloina) erosa* (Solander)

Family PISIDIIDAE

Genus *Pisidium* PfeifferSubgenus *Afropisidium* Kuiper, 196276. *Pisidium (Afropisidium) clarkeanum* G. & H. NevillGenus *Sphaerium* Scopoli, 177777. *Sphaerium indicum* Deshayes

Order SYSTELLOMMATOPHORA

Family VERONICELLIDAE

Genus *Laevicaulis* Simroth, 191378. *Laevicaulis alte* (Ferussac)Genus *Semperula* Grimpe & Hoffman, 192479. *Semperula birmanica* (Theobald)Genus *Sarasinula* Grimpe & Hoffman, 192480. *Sarasinula plebeja* (Fischer)

LAND MOLLUSCA

Phylum MOLLUSCA

Class GASTROPODA

Subclass PROSOBRANCHIA

Order MESOGASTROPODA

Family CYCLOPHORIDAE

Subfamily CYCLOPHORINAE

Genus *Cyclophorus* Montfort, 181081. *Cyclophorus (Annularia) aurantiacus* (Schumacher)Subgenus *Glossostylus* Kobelt & Moellendorff, 189982. *Cyclophorus (Glossostylus) indicus* (Deshayes)83. *Cyclophorus (Glossostylus) stenomphalus* PfeifferSubgenus *Litostylus* Kobelt & Moellendorff, 189984. *Cyclophorus (Litostylus) involvus* (Mueller)Genus *Cyathopoma* Blanford, 1861Subgenus *Cyathopoma* s. st.85. *Cyathopoma (Cyathopoma) deccanense* Blanford

Family DIPLOMMATINIDAE

Subfamily DIPLOMMATININAE

Genus *Nicida* Blanford, 186886. *Nicida liricincta* BlanfordGenus *Opisthostoma* Blanford, 186187. *Opisthostoma fairbanki* Blanford

Family POMATIASIDAE

Subfamily CYCLOTOPSINAE

Genus *Cyclotopsis* Blanford, 186488. *Cyclotopsis semistriata* (Sowerby)

Subclass PULMONATA

Order STYLOMMATOPHORA

Family PUPILLIDAE

Subfamily PUPILLINAE

Genus *Pupoides* Pfeiffer, 185489. *Pupoides tutulus* (Reeve)

Family VERTIGINIDAE

Subfamily GASTROCOPTINAE

Genus *Gastrocopta* Wollaston, 187890. *Gastrocopta bathyodon* (Benson)

Subfamily NESOPUPINAE

Genus *Pupisoma* Stoliczka, 187391. *Pupisoma evezardi* (Blanford)

Family CERASTUIDAE

Genus *Cerastua* Strand, 192892. *Cerastua abyssinicus* (Pfeiffer)93. *Cerastua densus* (Pfeiffer)

94. *Cerastua distans* (Pfeiffer)
 95. *Cerastua jerdoni* (Reeve)
 96. *Cerastua jerdoni* var. *redfieldi* (Pfeiffer)
 97. *Cerastua fairbanki* (Pfeiffer)
 98. *Cerastua moussonianus* (Petit)

Genus *Edouardia* Gude, 1914

99. *Edouardia orbus* (Blanford)

Genus *Rachis* Albers, 1850

100. *Rachis punctatus* (Anton)
 101. *Rachis bengalensis* Lamarck
 102. *Rachis praetermissus* Blanford

Family SUBULINIDAE

Subfamily SUBULININAE

Genus *Subulina* Beck, 1837

103. *Subulina octona* (Bruguiere)
 Genus *Glessula* Von Martens, 1850
 104. *Glessula arthuri* (Benson)
 105. *Glessula brevis* (Pfeiffer)
 106. *Glessula chessoni* (Benson)
 107. *Glessula ceylanica* (Pfeiffer)
 108. *Glessula gemma* (Reeve)
 109. *Glessula lyrata* Blanford
 110. *Glessula illustris* var. *tumida* Godwin-Austen
 111. *Glessula notigena* (Benson)
 112. *Glessula pulla* Blanford
 113. *Glessula rugata* Blanford
 114. *Glessula dikrangense* Godwin-Austen
 115. *Glessula singhurensis* Blanford
 116. *Glessula tornensis* Blanford
 117. *Glessula hebes* (Blanford)
 118. *Glessula textilis* (Blanford)

Genus *Lamellaxis* Strebel and Pfeffer, 1882

Subgenus *Allopeas* H.B. Baker, 1935

119. *Lamellaxis (Allopeas) gracile* (Hutton)

Subfamily RUMININAE

Genus *Zootecus* Westerlund, 1887

120. *Zootecus chion* (Pfeiffer)
 121. *Zootecus insularis* (Ehrenberg)

Family ACHATINIDAE

Genus *Achatina* Lamarck, 1799

Subgenus *Lissachatina* Bequaert, 1951

122. *Achatina (Lissachatina) fulica fulica* (Bowdich)

Family STREPTAXIDAE

Subfamily STREPTAXINAE

Genus *Streptaxis* Gray, 1837

123. *Streptaxis scalptus* Blanford

Family SUCCINEIDAE

Subfamily SUCCINEINAE

Genus *Succinea* Draparnaud, 1810

124. *Succinea raoi* Subba Rao and Mitra
 125. *Succinea collina* Hanley & Theobald
 126. *Succinea tornadri* Rao

Genus *Camptonyx* Benson, 1858

Subgenus *Lithotis* Blanford, 1861

127. *Camptonyx (Lithotis) rupicola* Blanford
 128. *Camptonyx (Lithotis) tumida* Blanford

Subfamily CATINELLINAE

Genus *Indosuccinea* Rao, 1924

129. *Indosuccinea khandalla* Rao
 130. *Indosuccinea semiserica* (Gould)

Genus *Quickia* Odhner, 1950

131. *Quickia bensoni* (Pfeiffer)
 132. *Quickia gravelyi* (Rao)

Family HELICARIONIDAE

Subfamily HELICARIONINAE

Genus *Eurychlamys* Godwin-Austen, 1899

133. *Eurychlamys platychamys* Blanford

Genus *Pseudaustenia* Cockerell, 1891

134. *Pseudaustenia atra* Godwin-Austen

Subfamily SESARINAE

Genus *Kaliella* Blanford 1863

135. *Kaliella barrackporensis* Pfeiffer
 136. *Kaliella bullula* (Hutton)

Genus *Sivella* Blanford, 1883

137. *Sivella billeana* (Moerch)

Family ARIOPHANTIDAE

Subfamily ARIOPHANTINAE

Genus *Ariophanta* Desmoulins, 1829138. *Ariophanta bajadera* (Pfeiffer)139. *Ariophanta laevipes* (Muller)Genus *Cryptozona* Morch, 1872140. *Cryptozona semirugata* (Beck)141. *Cryptozona (Xestina) belangeri* var. *bombayana* (Pfeiffer)142. *Cryptozona bistrialis* (Beck)Genus *Euplecta* Semper, 1870143. *Euplecta subdecussata* Pfeiffer

Subfamily GIRASIINAE

Genus *Mariaella* Gray, 1855144. *Mariaella dussumieri* Gray

Subfamily MACROCHLAMYDINAE

Genus *Macrochlamys* Benson, 1832145. *Macrochlamys pedina* (Benson)146. *Macrochlamys indica* (Godwin & Austen)147. *Macrochlamys petrosa* (Hutton)148. *Macrochlamys petasus* (Benson)149. *Macrochlamys (Eurychlamys) platychlamys* Blanford150. *Macrochlamys infausta* Blanford151. *Macrochlamys tenuicula* (H. Adams)

Subfamily DURGELLINAE

Genus *Sitala* H. Adams, 1856152. *Sitala denselirata* Preston

Family CAMAENIDAE

Subfamily CAMAENINAE

Genus *Chloritis* Beck, 1838153. *Chloritis leithi* Gude154. *Chloritis propinqua* (Pfeiffer)Genus *Landouria* Godwin-Austen, 1918155. *Landouria hengdanensis* Godwin-AustenGenus *Trachia* Albers, 1860156. *Trachia asperella* (Pfeiffer)157. *Trachia crassicostata* (Benson)Genus *Planispira* Beck, 1837158. *Planispira footei* Stoliczka159. *Planispira proxima* (Ferussac)

Family BRADYBAENIDAE

Genus *Bradybaena* Beck, 1837160. *Bradybaena scalpturita* (Benson)

SYSTEMATIC ACCOUNT

A) FRESHWATER MOLLUSCA

Key to the families of the Order
Mesogastropoda (Freshwater)

1. Shell limpet shaped, without spiral coil
..... ANCYLIDAE
- Shell spirally coiled 2
2. Shell without operculum 3
- Shell with operculum 6
3. Shell discoidal or when extended sinistrally
coiled 4
- Shell dextrally coiled LYMNAEIDAE
4. Shell sinistrally coiled; columnar axis twisted;
animals with triangular tentacles
..... PHYSIDAE
- Shell discoidal or extended; columellar axis
not twisted; animals with filiform tentacles
..... 5
5. Shell discoidal (disc shaped); large, aperture
ear shaped BULLINIDAE
- Shell discoidal or planispiral; small with small
aperture PLANORBIDAE
6. Operculum with concentric lines 7
- Operculum with spiral lines 8
7. Shell pyramidal; whorls regularly increasing;
operculum horny; animals with gills only,
labial palps absent VIVIPARIDAE
- Shell globose; bodywhorl inflated and larger
than spire; operculum calcareous animals with
gills and labial palps AMPULARIDAE
8. Shell turreted or globose; mantle broader
fringed and with brood pouch 9
- Shell globose or conical, mantle broader not
fringed, without brood pouch 10

9. Shell elongate, turreted; columellar callus indistinct; operculum oblong with a terminal nucleus THIARIDAE
- Shell either roundly ovate or elongate, turreted; columellar callus distinct; operculum round with usually central or subcentral nucleus PLEUROCERIDAE
10. Animal with gill, generally found in stagnant freshwaters and often extending into brackish waters 11
- Animal with both gill and branchial chamber, found in hill streams LITTORINIDAE
11. Operculum calcareous and concentric, as large as aperture; verge bifurcate BITHYNIIDAE
- Operculum corneous, smaller than aperture; verge not bifurcate STENOTHYRIDAE

Phylum MOLLUSCA

Class GASTROPODA

Order MESOGASTROPODA

Superfamily VIVIPAROIDEA

Family VIVIPARIDAE (pond snails)

Subfamily BELLAMYINAE

Genus *Bellamyia* Jousseaume, 18861. *Bellamyia bengalensis* form *typica* (Lamarck)

1822. *Paludina bengalensis* Lamarck, *Hist. nat. Anim. Sans. Vert.*, 6(2) : 174.
1921. *Vivipara bengalensis* : Annandale, *Rec. Indian Mus.*, 22 : 267.
1989. *Bellamyia bengalensis* form *typica* : Subba Rao, *Handbook : Freshwater molluscs of India*, : 45.
2007. *Bellamyia bengalensis* form *typica* : Ramakrishna and Dey, *Handbook on Indian Freshwater mollusks* : 79-80. Publ. : Director, Zool. Surv. India, Kolkata.

Diagnostic characters : Shell thin, spire and body whorl of about equal height. Whorls gradually increasing, less rounded and with rather straight sides. Aperture subcircular with a narrow black margin. Dark bands variable and irregular, alternating broad and narrow bands.

Material examined / Source : Surya Rao *et al.* (2002); Patil and Talmale (2005b); Patil (2005,

2006); Patil *et al.* (2006); Patil and Ramakrishna (2004, 2005).

Distribution : Common throughout India. Maharashtra : Amravati Dist. : Melghat tiger Reserve; Aurangabad Dist. : Nathsagar Wetland; Chandrapur Dist. : Tadoba-Andhari Tiger Reserve; Mumbai Suburban Dist. : Sanjay Gandhi National Park, Borivali; Nagpur Dist. : Pench National Park; Pune Dist. : Ujani Wetland.

Elsewhere : Myanmar.

2. *Bellamyia bengalensis* form *doliaris* (Gould)

1843. *Paludina doliaris* Gould, *Proc. Boston Soc. Nat. Hist.*, 1 : 144.
1989. *Bellamyia bengalensis* form *doliaris* : Subba Rao, *Handbook : Freshwater mollusks of India*, : 47.
2007. *Bellamyia bengalensis* form *doliaris* : Ramakrishna and Dey, *Handbook on Indian Freshwater mollusks* : 83-84. Publ., : Director, Zool. Surv. India, Kolkata.

Diagnostic characters : Shell smaller and more conical, last whorl distinctly biangulate.

Material examined / Source : Surya Rao *et al.* (2002); Patil and Talmale (2005b); Patil (2005, 2006).

Distribution : India : Maharashtra : Amravati Dist. : Melghat tiger Reserve; Mumbai Suburban Dist. : Sanjay Gandhi National Park, Borivali; Pune Dist. : Ujani Wetland, West Bengal.

Elsewhere : Myanmar.

Remarks : Shell with two spiral ridges or thickened dark bands on the body whorl.

3. *Bellamyia bengalensis* form *incrassatus* Annandale

1921. *Vivipara bengalensis* phase *incrassata* Annandale, *Rec. Indian Mus.*, 22 : 277, pl. II, fig. 3.4.
1979. *Viviparus bengalensis* form *incrassatus* : Subba Rao and Mitra, *Rec. zool. Surv. India*, 75 : 1-37.

Material examined / Source : Subba Rao and Mitra (1979); Patil and Talmale (2005b).

Distribution : India : Maharashtra : Pune; Andhra Pradesh.

Elsewhere : Mesopotamia.

4. *Bellamya bengalensis* form *annandalei*
(Kobelt)

1908. *Vivipara anandalai* Kobelt, *Nachar. Malak. Geseu.*, Frankfurt, 60 : 161-162.
1989. *Bellamya bengalensis* form *annandalei* : Subba Rao, Handbook : *Freshwater mollusks of India*, : 46.
2007. *Bellamya bengalensis* form *annandalei*: Ramakrishna and Dey, *Handbook on Indian Freshwater mollusks*: 80-81. Publ., : Director, Zool. Surv. India, Kolkata.

Diagnostic characters : Shell usually thinner, Translucent with steady increasing whorls which are less rounded.

Material examined / Source : Patil (2006); Patil and Ramakrishna (2004, 2005); Patil and Talmale (2005b); Patil *et al.* (2006).

Distribution : India : Maharashtra : Aurangabad Dist. : Nathsagar Wetland; Chandrapur Dist. : Tadoba-Andhari Tiger Reserve; Mumbai Suburban Dist. : Sanjay Gandhi National Park, Borivali; Nagpur Dist. : Pench National Park. Andhra Pradesh, Bihar, Goa, Orissa, Rajasthan, Tamil Nadu and West Bengal.

5. *Bellamya bengalensis* form *eburnea*
(Annandale)

1921. *Viviparus bengalensis* race *eburnean* Annandale, *Rec. Indian Mus.*, 22 : 274, pl. 2, Fig. 1-2.
1989. *Bellamya bengalensis* form *eburnea* : Subba Rao, Handbook : *Freshwater mollusks of India*, : 47.
2007. *Bellamya bengalensis* form *eburnea* : Ramakrishna and Dey, *Handbook on Indian Freshwater mollusks*: 80-81. Publ., : Director, Zool. Surv. India, Kolkata.

Diagnostic characters : Shell narrow with smaller aperture, whorls much less inflated with distinct flattening below the sutures. Body whorl showing a tendency to become biangulate.

Material examined/Source : Patil and Talmale (2005b); Patil and Ramakrishna (2004, 2005); Patil *et al.* (2006).

Distribution : India : Maharashtra : Aurangabad Dist. : Nathsagar Wetland; Chandrapur Dist. : Tadoba-Andhari Tiger Reserve; Nagpur Dist. :

Pench National Park; Andhra Pradesh, Orissa and West Bengal.

6. *Bellamya bengalensis* form *mandiensis*
(Kobelt)

1909. *Viviparus bengalensis* var. *mandiensis* Kobelt, in Martini Chemnitz, *Conch.Cab.*, 2 : 414, Pl. 77, figs. 8-9.
1989. *Bellamya bengalensis* form *mandiensis*: Subba Rao, Handbook : *Freshwater mollusks of India*, : 46.
2007. *Bellamya bengalensis* form *mandiensis*: Ramakrishna and Dey, *Handbook on Indian Freshwater mollusks*: 87-88. Publ., : Director, Zool. Surv. India, Kolkata.

Material examined/Source : Subba Rao (1989); Patil and Talmale (2005b).

Distribution : India : Maharashtra, Bihar, Gujarat, Madhya Pradesh, Punjab, Rajasthan, Uttar Pradesh and West Bengal.

7. *Bellamya dissimilis* (Mueller)

1774. *Nertia dissimilis* Mueller, *Hist. Verm. Terr. Fluv.*, 2 : 184.
1960. *Viviparus dissimilis* : Styamurti, *Bull. Madras Govt. Mus.*, 6(4) : 33-34.
1989. *Bellamya dissimilis* : Subba Rao, Handbook : *Freshwater mollusks of India*, : 48-49.
2007. *Bellamya dissimilis* : Ramakrishna and Dey, *Handbook on Indian Freshwater mollusks* : 90-91. Publ., : Director, Zool. Surv. India, Kolkata.

Diagnostic characters : Shell small, high and narrow, spire swollen, suture deeply impressed, without dark spiral bands. Body whorl subangulate at the periphery.

Material examined/Source : Patil and Ramakrishna (2004, 2005); Patil and Talmale (2005b); Patil *et al.* (2006).

Distribution : India : Common throughout including Maharashtra (Aurangabad Dist. : Nathsagar Wetland; Chandrapur Dist. : Tadoba-Andhari Tiger Reserve; Nagpur Dist. : Pench National Park).

Elsewhere : Bangladesh, Myanmar, Pakistan, Malaysia, Sri Lanka.

Family AMPULLARIDAE

Genus *Pila* (Bolten) Roeding, 17988. *Pila globosa* (Swainson)

1822. *Ampullaria globosa* Swainson, *Zool. Illustrations*, Vol., 2(1) : pl. cxix.
1989. *Pila globosa* : Subba Rao, *Handbook : Freshwater mollusks of India*, : 58.
2007. *Pila globosa* : Ramakrishna and Dey, *Handbook on Indian Freshwater mollusks* : 98-99. Publ., : Director, Zool. Surv. India, Kolkata.

Diagnostic characters : Shell globose with an inflated body whorl and depressed spire. Suture shallow, coloured bands present inside the aperture. The surface is very smooth and glossy. The colour of the shell is brownish olive with irregular red-brown conspicuous spiral bands. It shows remarkable variation in shape and elevation of the spire and body whorl.

Material examined/Source : Tonapi and Mulherkar (1963); Subba Rao (1989); Patil (2005, 2006); Patil and Ramakrishna (2004, 2005); Patil and Talmale (2005b); Patil *et al.* (2006).

Distribution : Throughout India except South India and Punjab. Maharashtra : Amravati Dist. : Melghat tiger Reserve; Aurangabad Dist. : Nathsagar Wetland; Chandrapur Dist. : Tadoba-Andhari Tiger Reserve; Mumbai Suburban Dist. : Sanjay Gandhi National Park, Borivali; Nagpur Dist. : Pench National Park.

Remarks : Many larval trematodes were recorded from this species.

9. *Pila virens* (Lamarck)

1822. *Ampullaria virens* Lamarck, *Hist. nat. anim. Sans. Vert.*, 6(2) : 179.
1989. *Pila virens* : Subba Rao, *Handbook : Freshwater mollusks of India*, : 60.
2007. *Pila virens*: Ramakrishna and Dey, *Handbook on Indian Freshwater mollusks* : 98-99. Publ., : Director, Zool. Surv. India, Kolkata.

Diagnostic characters : Suture canaliculated with a distinct carination of the whorls on the outside, spire prominent and conical.

Material examined/Source : Subba Rao (1989);

Patil and Ramakrishna (2005); Patil and Talmale (2005b); Patil *et al.* (2006).

Distribution : Maharashtra (Aurangabad Dist. : Nathsagar Wetland; Chandrapur Dist. : Tadoba-Andhari Tiger Reserve) and South India.

Remarks : This species is variable in its colour. The shape of spine also varies and difficult to separate from its closely related species, *Pila globosa*.

Subgenus *Turbinicola* Annandale & Prashad, 1921

10. *Pila (Turbinicola) saxea* (Reeve)

1856. *Ampullaria saxea* Reeve, *Conch. Icon.*, 10, *Ampullaria*, pl. xxii, fig. 108.
1925. *Turbinicola saxea* : Prashad, *Mem. Indian Mus.*, 8 : 87, pl. xiv, figs. 10-12.
1989. *Turbinicola saxea* : Subba Rao, *Handbook : Freshwater mollusks of India*, : 61.
2007. *Pila (Turbinicola) saxea*: Ramakrishna and Dey, *Handbook on Indian Freshwater mollusks* : 106-107. Publ., : Director, Zool. Surv. India, Kolkata.

Diagnostic characters : Shell oblong-ovate, rather solid, with a narrow umbilicus. The collumellar callus of the shell is flattened and with the outer lip it forms a continuous margin, enabling the shell to come into much closer contact with the substratum.

Material examined / Source : Subba Rao and Mitra (1979); Subba Rao (1989); Patil and Talmale (2005b); Patil (2006).

Distribution : Maharashtra : Mumbai Suburban Dist. : Sanjay Gandhi National Park, Borivali; Pune Dist. : Khandalla; Nashik Dist. : Igatpuri and South India in Western Ghats.

Superfamily LITTORINOIDEA

Family LITTORINIDAE

Subfamily BEMBICIINAE

Genus *Cremnoconchus* Blanford, 186911. *Cremnoconchus (Cremnoconchus) syhadrensis* (Blanford)

1863. *Cremnobates syhadrensis* Blanford, *Ann. Mag. Nat. Hist.*, (3)12 : 184.
1869. *Cremnoconchus syhadrensis* : Blanford, *Ann. Mag. Nat. Hist.*, (4)3 : 343.

1989. *Cremnoconchus syhadrensis* : Subba Rao, *Handbook : Freshwater mollusks of India*, : 109.

2007. *Cremnoconchus syhadrensis*: Ramakrishna and Dey, *Handbook on Indian Freshwater mollusks*, : 111. Publ., : Director, Zool. Surv. India, Kolkata.

Material examined/Source : Subba Rao and Mitra (1979); Subba Rao (1989); Patil and Talmale (2005).

Distribution : India : Western Ghats; Maharashtra : Pune Dist. : Khandala; Nashik Dist. : Igatpuri.

12. *Cremnoconchus (Lissoconchus) carinatus* (Layard)

1854. *Anculotus carinatus* Layard, *Proc. Zool. Soc. Lond.*, : 94.

1870. *Cremnoconchus carinatus* : Blanford, *J. Asiat. Soc. Beng.*, 39(2) : 12.

1989. *Cremnoconchus (Lissoconchus) carinatus*: Subba Rao, *Handbook : Freshwater mollusks of India*, : 63.

2007. *Cremnoconchus (Lissoconchus) carinatus* : Ramakrishna and Dey, *Handbook on Indian Freshwater mollusks*, : 112. Publ., : Director, Zool. Surv. India, Kolkata.

Material examined/Source : Subba Rao (1989); Patil and Talmale (2005); Ramakrishna and Dey (2007).

Distribution : India : Maharashtra : Satara dist. : Mahabaleshwar hills.

13. *Cremnoconchus (Lissoconchus) conicus* (Blanford)

1870. *Cremnoconchus conicus* Blanford, *J. Asiat. Soc. Beng.*, 39(2) : 10.

1989. *Cremnoconchus (Lissoconchus) conicus* : Subba Rao, *Handbook : Freshwater mollusks of India*, : 64.

2007. *Cremnoconchus (Lissoconchus) conicus* : Ramakrishna and Dey, *Handbook on Indian Freshwater mollusks*, : 112-113. Publ., : Director, Zool. Surv. India, Kolkata.

Material examined/Source : Subba Rao (1989); Patil and Talmale (2005b).

Distribution : India : Maharashtra : Pune Dist. : Torna hills.

Family BITHYNIIDAE

Genus *Bithynia* Leach, 1818

Subgenus *Digoniostoma* Annandale, 1920

14. *Bithynia (Digoniostoma) cerameopoma* (Benson)

1830. *Paludina cerameopoma* Benson, *Gleanings in Science*, 2 : 125.

1989. *Digoniostoma cerameopoma*: Subba Rao, *Handbook : Freshwater mollusks of India*, : 79.

2007. *Bithynia (Digoniostoma) cerameopoma* : Ramakrishna and Dey, *Handbook on Indian Freshwater mollusks*, : 118-119. Publ., : Director, Zool. Surv. India, Kolkata.

Diagnostic characters : Shell oblong-ovate, whorls five, regularly and rather rapidly increasing, sculpture with very fine, weak spiral striae and weak growth lines. Sutures well impressed. Operculum calcareous. Concave, nucleus sub central.

Material examined/Source : Patil and Ramakrishna (2004); Patil and Talmale (2005b).

Distribution : India : Maharashtra : Nagpur Dist. : Pench National Park, Assam, Bihar, Madhya Pradesh, Punjab, Rajasthan.

Elsewhere : Pakistan.

15. *Bithynia (Digoniostoma) pulchella* (Benson)

1836. *Paludina pulchella* Benson, *J. Asiat. Soc. Beng.*, 5 : 746.

1989. *Digoniostoma pulchella* : Subba Rao, *Handbook : Freshwater mollusks of India*, : 80.

2007. *Bithynia (Digoniostoma) pulchella* : Ramakrishna and Dey, *Handbook on Indian Freshwater mollusks*, : 120-121. Publ., : Director, Zool. Surv. India, Kolkata.

Diagnostic characters : Shell elongate, spire longer than the body whorl, sutures depressed, umbilicus almost closed, and aperture oval.

Material examined/Source : Tonapi (1971); Patil and Ramakrishna (2004, 2005); Patil and Talmale (2005b); Patil *et al.* (2006).

Distribution : Throughout India. Maharashtra : Aurangabad Dist. : Nathsagar Wetland; Chandrapur Dist. : Tadoba-Andhari Tiger Reserve;

Nagpur Dist. : Pench National Park, Pune Dist. : Pune.

Elsewhere : Myanmar, Malaya Peninsula.

16. *Bithynia (Digoniostoma) evezardi* (Blanford)

1880. *Bythinia evezardi* Blanford, *J. Asiat. Soc. Beng.*, **49**(2) : 220.

1989. *Sataria evezardi* : Subba Rao, *Handbook : Freshwater mollusks of India*, : 75.

2007. *Bithynia (Digoniostoma) evezardi* : Ramakrishna and Dey, *Handbook on Indian Freshwater mollusks*, : 119-120. Publ., : Director, *Zool. Surv. India*, Kolkata.

Material examined/Source : Subba Rao (1989); Patil and Talmale (2005b).

Distribution : Maharashtra : Pune Dist. : Khandalla; Satara Dist., : Mahabaleshwar.

Genus *Gabbia* Tryon, 1865

17. *Gabbia orcula* Frauenfeld

1862. *Bithynia orcula* Frauenfeld, *Verhandl. Zool. Bot. Geschaft*, : 1154.

1989. *Gabbia orcula* : Subba Rao, *Handbook : Freshwater mollusks of India*, : 76.

2007. *Gabbia orcula* : Ramakrishna and Dey, *Handbook on Indian Freshwater mollusks*, : 123. Publ., : Director, *Zool. Surv. India*, Kolkata.

Diagnostic characters : Shell globosely conic, smooth, almost imperforate, four whorls, slightly rounded. Body whorl swollen, suture deep, columellar margin not much reflected.

Material examined/Source : Subba Rao (1989); Patil and Ramakrishna (2005); Patil and Talmale (2005b).

Distribution : Maharashtra : Aurangabad Dist. : Nathasagar Wetland, Assam, Bihar, Punjab, Rajsthan, Uttar Pradesh, West Bengal.

18. *Gabbia orcula* var. *producta* (Nevill)

1884. *Bithynia orcula* var. *producta* Nevill, *Handlist Moll. Indian Mus.*, **2** : 37.

1989. *Gabbia orcula* var. *producta* : Subba Rao, *Handbook : Freshwater mollusks of India*, : 77.

2007. *Gabbia orcula* var. *producta* : Ramakrishna and Dey, *Handbook on Indian Freshwater mollusks*, : 124. Publ., : Director, *Zool. Surv. India*, Kolkata.

Material examined/Source : Subba Rao (1989); Patil and Talmale (2005b).

Distribution : Maharashtra, Andhra Pradesh, Assam, Bihar, Punjab, Rajsthan, Uttar Pradesh, West Bengal.

19. *Gabbia stenothyroides* (Dohrn)

1857. *Bithynia stenothyroides* Dohrn, *Proc. Zool. Soc. Lond.*, : 123.

1989. *Gabbia stenothyroides* : Subba Rao, *Handbook : Freshwater mollusks of India*, : 77.

2007. *Gabbia stenothyroides* : Ramakrishna and Dey, *Handbook on Indian Freshwater mollusks*, : 124. Publ., : Director, *Zool. Surv. India*, Kolkata.

Material examined/Source : Tonapi and Mulherkar (1963); Subba Rao (1989); Patil and Talmale (2005b).

Distribution : Maharashtra : Pune Dist. : Pune, Nilgiris, South Arcot, Tiruchirapalli, Madras;

Elsewhere : Sri Lanka.

Family STENOthyRIDAE

Genus *Stenothyra* Benson, 1856

20. *Stenothyra minima* (Sowerby)

1837. *Nematura minima* Sowerby, *Ann. Mag. Nat. Hist.* (Charlesworth's series) **1** : 217, fig. 22b.

1921. *Stenothyra minima* : Annandale and Prashad, *Rec. Indian Mus.*, **22** : 129.

1989. *Stenothyra minima* : Subba Rao, *Handbook : Freshwater mollusks of India*, : 77.

2007. *Stenothyra minima* : Ramakrishna and Dey, *Handbook on Indian Freshwater mollusks*, : 137. Publ., : Director, *Zool. Surv. India*, Kolkata.

Material examined/Source : Subba Rao (1989); Ramakrishna and Dey (2007).

Distribution : Maharashtra : Mumbai Dist. : Mumbai; Gujrat, Orissa.

Elsewhere : Sri Lanka.

Superfamily CERITHIOIDEA

Family THIARIDAE

Subfamily THIARIINAE

Genus *Thiara* Roding, 1786Subgenus *Thiara* s. str.21. *Thiara (Thiara) scabra* (Muller)

1774. *Buccinum scabrum* Mueller. *Hist. Verm. Ten Fluv.*, 2 : 136.
1973. *Thiara (Thiara) scabra* Pace, *Malac Review Suppl.*, 1 : 52, pl. 12, fig. 1, 2 pl. 13 fig. 3.
1989. *Thiara (Thiara) scabra* : Subba Rao, *Handbook : Freshwater mollusks of India*, : 96.
2007. *Thiara (Thiara) scabra* : Ramakrishna and Dey, *Handbook on Indian Freshwater mollusks*, : 153. Publ., : Director, Zool. Surv. India, Kolkata.

Diagnostic characters : Whorls regularly increasing in size, sutures distinct, whorls often shouldered above and rounded below the row of spines. Shell sculptured with characteristic vertical ribs bearing prominent spines directed obliquely outward, surface with rough spiral striations.

Material examined/Source : Tonapi and Mulherkar (1963); Subba Rao and Mitra (1979); Surya Rao *et al.* (2002); Patil and Ramakrishna (2004, 2005); Patil and Talmale (2005b); Patil (2005, 2006).

Distribution : India : Maharashtra : Amaravati Dist. : Melghat Tiger Reserve; Aurangabad Dist. : Nathsagar Wetland; Mumbai Suburban Dist. : Sanjay Gandhi National Park, Borivili; Nagpur Dist. : Pench National Park; Pune Dist. : Pune, Ujani Wetland, Kerala, Madhya Pradesh, Pondicherry, Tamil Nadu, West Bengal.

Elsewhere : Indonesia, Java, Mauritius, Seychelles, Timor.

22. *Thiara (Thiara) scabra* var. *elegans* (Benson)

1836. *Melania elegans* Benson, *J. Asiat. Soc. Beng.*, 5 : 782.
1963. *Melania (Plotia) scabra* var. *elegans* : Tonapi and Mulherkar, *J. Bombay nat. Hist. Soc.*, 60 : 110.
1979. *Thiara scabra* var. *elegans* : Subba Rao and Mitra, *Rec. zool. Surv. India*, 75 : 22.

Material examined/Source : Tonapi and

Mulherkar (1963); Subba Rao and Mitra (1979); Patil and Talmale (2005b).

Distribution : India : Maharashtra : Pune; Tamil Nadu, West Bengal, Uttar Pradesh; Punjab.

Elsewhere : Persia.

23. *Thiara (Thiara) rudis* (Lea)

1850. *Melania rudis* Lea, *Proc. Zool. Soc. Lond.*, 1850 : 186.
1956. *Thiara rudis* : Benthem Jutting, *Treubia*, 23(2) : 389, fig. 83.
2007. *Thiara (Thiara) rudis* : Ramakrishna and Dey, *Handbook on Indian Freshwater mollusks*, : 152. Publ., : Director, Zool. Surv. India, Kolkata.

Material examined/Source : Ramakrishna and Dey (2007).

Distribution : India including Maharashtra.

Elsewhere : Indonesia, Mynmar, Philippines, Sri Lanka.

Subgenus *Sermyla* H & A Adams24. *Thiara (Sermyla) riqueti* (Grateloup)

1840. *Melania requeti* Grateloup, *Act. Soc. Linn. Boardaeux*, 11 : 433. pl. 3, fig. 28.
1973. *Thiara (Melanoides) riqueti* : Pace, *Mal. Riview supplement*, 1 : 64, pl. 12, fig.,4, pl. 13, fig. 5.
1989. *Thiara (Sermyla) riqueti* : Subba Rao, *Handbook of freshwater Molluscs of India*, : 102.
2007. *Thiara (Sermyla) riqueti*: Ramakrishna and Dey, *Handbook on Indian Freshwater mollusks*, : 154-155. Publ., : Director, Zool. Surv. India, Kolkata.

Material examined/Source : Patil and Talmale (2005); Ramakrishna and Dey (2007).

Distribution : India : Maharashtra (Mumbai) and Kerala.

Elsewhere : South East Asia, Australia, China, Japan, Malaysia, Philippines and Taiwan.

Genus *Faunus* Montfort, 181025. *Faunus ater* (Linnaeus)

1758. *Strombus ater* Linnaeus, *Syst. Nat. ed.*, 10 : 746.
1956. *Faunus ater* : Van Benthem Jutting, *Treubia*, 23(2) : 380, fig. 78.

1989. *Faunus ater* : Subba Rao, *Handbook : Freshwater mollusks of India*, : 109.

2007. *Faunus ater*: Ramakrishna and Dey, *Handbook on Indian Freshwater mollusks*, : 155. Publ., : Director, Zool. Surv. India, Kolkata.

Material examined/Source : Tonapi and Mulherkar (1963); Patil and Talmale (2005b).

Distribution : India : Maharashtra : Pune Dist. : Pune, Goa, Nocobars.

Elsewhere : Philippines, Mauritius, Malay Archipelago, New Guinea, New Ireland and Sri Lanka.

Genus *Melanoides* Olivier, 1804

26. *Melanoides tuberculata* (Mueller)

1774. *Nerita tuberculata* Muller, *Hist. Verm. Verm. Terr. Fluv.*, 2 : 191.

1936. *Melania pyramis* : Benson, *J. Asiat. Soc. Beng.*, 5 : 354.

1976. *Melanoids (Melanoides) tuberculata* : Starmuchlar, *Ann. Natur. Hist. Mus. Wien. Wien*, 80 : 591.

1989. *Thiara (Melanoides) tuberculata* : Subba Rao, *Handbook : Freshwater mollusks of India*, : 103.

2007. *Melanoides tuberculata*: Ramakrishna and Dey, *Handbook on Indian Freshwater molluscs*, : 161. Publ., : Director, Zool. Surv. India, Kolkata.

Diagnostic characters : Shell with high spire and moderately large body whorl. Spire five times the height of the aperture. Whorls 10-14, moderately convex, evenly rounded, dark red-brown dots and flames.

Material examined/Source : Tonapi and Mulherkar (1963); Subba Rao and Mitra (1979); Surya Rao *et al.* (2002); Patil (2005, 2006); Patil and Ramakrishna (2004, 2005); Patil and Talmale (2005b); Patil *et al.* (2006).

Distribution : Throughout India except Kashmir. Maharashtra : Amaravati Dist. : Melghat Tiger Reserve; Aurangabad Dist. : Nathasagar Wetland; Chandrapur Dist. : Tadoba-Andhari Tiger Reserve; Mumbai Suburban Dist. : Sanjay Gandhi National Park, Borivili; Nagpur Dist. : Pench National Park; Pune Dist. Pune, Ujani Wetland.

Elsewhere : Australia, North and South Africa, China, Pacific Islands.

Remarks : Widely distributed.

Genus *Tarebia* H & A Adams, 1854

27. *Tarebia granifera* (Lamarck)

1822. *Melania granifera* Lamarck, *Hist. nat. Anim. Sans. Vert.*, 6(2) : 167.

1973. *Thiara (Tarebia) granifera* : Pace, *Mal. Review. Supplement*, 1 : 62, pl. 12, fig. 3, pl. 13, fig. 4.

1989. *Thiara (Tarebia) granifera* : Subba Rao, *Handbook of Freshwater Molluscs of India*, p. 101.

2007. *Tarebia granifera* : Ramakrishna and Dey, *Handbook on Indian Freshwater molluscs*, : 168-169. Publ., : Director, Zool. Surv. India, Kolkata.

Material examined/Source : Ramakrishna and Dey (2007).

Distribution : Maharashtra, Andaman and Nicobar Islands, Andhra Pradesh, Bihar, Jharkhand, Madhya Pradesh, Manipur, Meghalaya, Mizoram, Tripura, West Bengal

Elsewhere : Formosa, Malagasy, Malaysia, Myanmar, Pacific Islands, Philippines, Taiwan.

28. *Tarebia lineata* (Gray)

1828. *Helix lineata* Gray. *In woods's Index Test supp.*, p 24, fig. 68. Type locality : Ganges.

1915. *Thiara (Tarebia) lineata* Preston. *Fauna of British India. Mollusca (Freshwater Gastropoda : Pelecypoda)*, : 34.

1989. *Thiara (Tarebia) lineata* : Subba Rao, *Handbook : Freshwater mollusks of India*, : 101.

2007. *Tarebia lineata* : Ramakrishna and Dey, *Handbook on Indian Freshwater molluscs*, : 169-170. Publ., : Director, Zool. Surv. India, Kolkata.

Diagnostic characters : Shell elongate, conical, rows of nodules less distinct, rather obsolete on the lower whorls, dark spiral lines distinct, apex acute.

Material examined/Source : Subba Rao (1989); Surya Rao *et al.* (2002); Patil and Ramakrishna (2005); Patil and Talmale (2005b); Patil (2006); Patil *et al.* (2006).

Distribution : India : Maharashtra : Aurangabad

Dist. : Nathsagar Wetland; Chandrapur Dist. : Tadoba-Andhari Tiger Reserve; Mumbai Suburban Dist. : Sanjay Gandhi National Park, Borivili; Pune Dist. : Ujani Wetland, Andhra Pradesh, Assam, Bihar, Madhya Pradesh, Uttar Pradesh, West Bengal.

Elsewhere : Bhutan, Myanmar, Sri Lanka.

Family PLEUROCERIDAE

Subfamily MELANATRIINAE

Genus *Sulcospira* Troschel, 1858

29. *Sulcospira (Sulcospira) huegeli* (Philippi)

1841. *Melania huegeli* Philippi, *Abbild. Beschreib. Conch.*, 1 : 61, pl. 2, fig. 8.
1989. *Sulcospira huegeli* : Subba Rao, *Handbook : Freshwater mollusks of India*, : 107.
2007. *Sulcospira huegeli* : Ramakrishna and Dey, *Handbook on Indian Freshwater molluscs*, : 174-175. Publ., : Director, Zool. Surv. India, Kolkata.

Material examined/Source : Tonapi and Mulherkar (1963); Subba Rao and Mitra (1979); Patil and Talmale (2005b).

Distribution : India : Maharashtra : Pune Dist. : Pune; Assam, Karnataka, Kerala, Meghalaya.

Subfamily PALUDOMINAE

Genus *Paludomus* Swainson, 1840

Subgenus *Paludomus* s. st.

30. *Paludomus (Paludomus) obesus* (Philippi)

1842. *Melania obesa* Philippi, *Abbild. Beschreib. Conch.*, 2 : 170.
1989. *Paludomus obesus* : Subba Rao, *Handbook : Freshwater mollusks of India*, : 115.
2007. *Paludomus (Paludomus) obesus* : Ramakrishna and Dey, *Handbook on Indian Freshwater molluscs*, : 182-183. Publ., : Director, Zool. Surv. India, Kolkata.

Diagnostic characters : Shell globose, elongated and eroded spire. Whorls depressed around the upper part. Body whorl more than 2/3rd of the length, yellowish brown to olive.

Material examined / Source : Subba Rao and Mitra (1979); Subba Rao (1989); Patil (2005); Patil and Talmale (2005b); Ramakrishna and Dey (2007).

Distribution : India : Maharashtra : Amaravati Dist. : Melghat Tiger Reserve; Ahmednagar Dist. : Ahmednagar, Pune Dist. : Khandala, Mumbai Dist. Mumbai, Ratnagiri Dist : Ratnagiri.

31. *Paludomus (Paludomus) tanschauricus* (Gmelin)

1791. *Helix tanschaurica* Gmelin, *Syst. Nat. ed.*, 13 : 3655.
1989. *Paludomus (Paludomus) tanschauricus* : Subba Rao, *Handbook : Freshwater mollusks of India*, : 118.
2007. *Paludomus (Paludomus) tanschauricus* : Ramakrishna and Dey, *Handbook on Indian Freshwater molluscs*, : 189-190. Publ., : Director, Zool. Surv. India, Kolkata.

Material examined/Source : Subba Rao (1989); Patil and Talmale (2005b); Ramakrishna and Dey (2007).

Distribution : India : Maharashtra : Pune Dist. : Pune, Andhra Pradesh, Kerala, Tamil Nadu.

Elsewhere : Northern Sri Lanka.

Subgenus *Stomatodon* s. st.

32. *Paludomus (Stomatodon) stomatodon* Benson

1862. *Paludomus (Stomatodon) stomatodon* Benson, *Ann. Mag. Nat. Hist.*, (3)10 : 415.
1989. *Paludomus (Stomatodon) stomatodon* : Subba Rao, *Handbook : Freshwater mollusks of India*, : 122.
2007. *Paludomus (Stomatodon) stomatodon* : Ramakrishna and Dey, *Handbook on Indian Freshwater molluscs*, : 191-192. Publ., : Director, Zool. Surv. India, Kolkata.

Material examined/Source : Tonapi and Mulherkar (1963); Patil and Talmale (2005b).

Distribution : India : Western Ghats, Maharashtra : Pune Dist. : Pune, Kerala

Subclass PULMONATA

Order BASOMMATOPHORA

Superfamily LYMNAEOIDEA

Family LYMNAEIDAE

Genus *Lymnaea* Lamarck, 1799

33. *Lymnaea (Pseudosuccinea) acuminata* form. *typica* Lamarck

1822. *Limnaea acuminata* Lamarck, *Hist. Nat. Anim. Sans. Vert.*, 6(2) : 160.

1925. *Limnaea acuminata* : Annandale and Rao, *Rec. Indian Mus.*, 27 : 177.
1989. *Lymnaea acuminata* form *typica* : Subba Rao, *Handbook : Freshwater mollusks of India*, : 127.
2007. *Lymnaea acuminata* form *typica* : Ramakrishna and Dey, *Handbook on Indian Freshwater molluscs*, : 198-199. Publ., : Director, Zool. Surv. India, Kolkata.

Diagnostic characters : Shell thin, ovate, spire short, acuminate, body whorl much inflated, a little angular above, with a large aperture.

Material examined/Source : Subba Rao and Mitra (1979); Patil and Ramakrishna (2004, 2005); Patil and Talmale (2005b); Patil (2006); Patil *et al.* (2006).

Distribution : Throughout India : Maharashtra : Aurangabad Dist. : Nathsagar Wetland; Chandrapur Dist. : Tadoba-Andhari Tiger Reserve; Mumbai Suburban Dist. : Sanjay Gandhi National Park, Borivali; Nagpur Dist. : Pench National Park; Pune Dist. : Pune.

Elsewhere : Bangladesh, Myanmar, Pakistan.

34. *Lymnaea (Pseudosuccinea) acuminata* form *brevissima* (Annandale & Rao)

1925. *Limnaea brevissima* Annandale and Rao, *Rec. Indian Mus.*, 27 : 182.
1989. *Lymnaea acuminata* form *brevissima*: Subba Rao, *Handbook : Freshwater mollusks of India*, : 127.
2007. *Lymnaea acuminata* form *brevissima* : Ramakrishna and Dey, *Handbook on Indian Freshwater molluscs*, : 199-200. Publ., : Director, Zool. Surv. India, Kolkata.

Material examined/Source : Subba Rao (1989); Patil and Talmale (2005b).

Distribution : Maharashtra : Nagpur Dist. : Nagpur.

35. *Lymnaea (Pseudosuccinea) acuminata* form *chlamys* Benson

1836. *Lymnaea chlamys* Benson, *J. Asiat. Soc. Beng.*, 5 : 744.
1989. *Lymnaea acuminata* form *chlamys*: Subba Rao, *Handbook : Freshwater mollusks of India*, : 127.
2007. *Lymnaea acuminata* form *chlamys*: Ramakrishna and Dey, *Handbook on Indian Freshwater molluscs*, : 200-201. Publ., : Director, Zool. Surv. India, Kolkata.

Material examined/Source : Subba Rao (1989); Ramakrishna and Dey (2007).

Distribution : Through out India including Maharashtra.

36. *Lymnaea (Pseudosuccinea) acuminata* form. *gracilior* Martens

1881. *Limnaea acuminata* var. *gracilior* Martens, *Conch. Mittheil.*, 1 : 77.
1989. *Lymnaea acuminata* form *gracilior*: Subba Rao, *Handbook : Freshwater mollusks of India*, : 127.
2007. *Lymnaea acuminata* form *gracilior*: Ramakrishna and Dey, *Handbook on Indian Freshwater molluscs*, : 201-202. Publ., : Director, Zool. Surv. India, Kolkata.

Material examined/Source : Anandale and Rao (1925); Subba Rao and Mitra (1979); Mitra and Dey (1992); Patil and Talmale (2005b); Ramakrishna and Dey (2007).

Distribution : Throughout India : Maharashtra : Nagpur Dist. : Nagpur; Pune Dist. : Pune, Assam, Bihar, Jharkhand, Kerala, Orissa, Uttar Pradesh, West Bengal.

Elsewhere : Myanmar.

37. *Lymnaea (Pseudosuccinea) acuminata* form. *patula* Troschel

1836. *Limnaea patula* Troschel, *Arch. Naturgesch.*, 3 : 167.
1989. *Lymnaea acuminata* form *patula*: Subba Rao, *Handbook : Freshwater mollusks of India*, : 127.
2007. *Lymnaea acuminata* form *patula*: Ramakrishna and Dey, *Handbook on Indian Freshwater molluscs*, : 204-205. Publ., : Director, Zool. Surv. India, Kolkata.

Diagnostic characters : Shell narrower than in *typica*, spire relatively large, anterior extremity of aperture tapering.

Material examined / Source : Subba Rao and Mitra (1979); Patil and Talmale (2005b); Ramakrishna and Dey (2007).

Distribution : Throughout India : Maharashtra : Nagpur Dist. : Pench National Park; Pune Dist. : Pune.

Elsewhere : Myanmar, Nepal, Pakistan.

**38. *Lymnaea (Pseudosuccinea) acuminata*
form. *rufescens* Gray**

1822. *Limnaea rufescens* Gray, in Sowerby's *Genera of Shells*, 1 : pl. 178, fig. 2.
1829. *Lymnaea (Pseudosuccinea) acuminata* form *tonapii* : Ray and roychowdhuri, *Proc. Zool. Soc. Calcutta*, 22(1) : 47-48.
1989. *Lymnaea acuminata* form *rufescens* : Subba Rao, *Handbook : Freshwater mollusks of India*, : 127.
2007. *Lymnaea acuminata* form *rufescens*: Ramakrishna and Dey, *Handbook on Indian Freshwater molluscs*, : 205-206. Publ., : Director, *Zool. Surv. India*, Kolkata.

Diagnostic characters : Shell narrower than in typical form, spire longer, aperture uniformly less expanded. Shell reddish in colour.

Material examined / Source : Subbra Rao and Mitra (1979); Surya Rao *et al.* (2002); Patil (2005); Patil and Ramakrishna (2005); Patil and Talmale (2005b); Ramakrishna and Dey (2007); Patil *et al.* (2006).

Distribution : Throughout India : Maharashtra : Amaravati Dist. : Melghat Tiger Reserve; Aurangabad Dist. : Nathsagar Wetland; Chandrapur Dist. : Tadoba-Andhari Tiger Reserve; Pune Dist. : Pune, Ujani Wetland.

Elsewhere : Bangladesh, Myanmar, Pakistan.

**39. *Lymnaea (Pseudosuccinea) luteola* form.
typica Lamarck**

1822. *Limnaea luteola* Lamarck, *Hist. Nat. Anim. Sans. Vert.*, 6(2) : 160.
1989. *Lymnaea (Pseudosuccinea) luteola* form *typica*: Subba Rao, *Handbook : Freshwater mollusks of India*, : 129.
2007. *Lymnaea (Pseudosuccinea) luteola* form *typica* : Ramakrishna and Dey, *Handbook on Indian Freshwater molluscs*, : 209-210. Publ., : Director, *Zool. Surv. India*, Kolkata.

Diagnostic characters : Shell less inflated, thin and glossy, relatively smaller and laterally compressed, spire gradually tapering and more produced, aperture narrow.

Material examined / Source : Surya Rao *et al.* (2002); Patil and Ramakrishna (2004, 2005); Patil and Talmale (2005b); Patil (2005, 2006); Patil *et al.* (2006).

Distribution : Throughout India; Amaravai Dist. : Melghat Tiger Reserve; Maharashtra : Aurangabad Dist. : Nathsagar Wetland; Chandrapur Dist. : Tadoba-Andhari Tiger Reserve; Mumbai Suburban Dist. : Sanjay Gandhi National Park, Borivali; Nagpur Dist. : Pench National Park; Pune Dist. : Ujani Wetland.

Elsewhere : Bangladesh, Myanmar, Nepal, Pakistan.

**40. *Lymnaea (Pseudosuccinea) luteola* form.
australis Annandale & Rao**

1925. *Limnaea (Pseudosuccinea) luteola* form *australis* Anandale and Rao, *Rec. Indian Mus.*, 27 : 184-185.
1989. *Lymnaea (Pseudosuccinea) luteola* form *australis*: Subba Rao, *Handbook : Freshwater mollusks of India*, : 129.
2007. *Lymnaea (Pseudosuccinea) luteola* form *australis*: Ramakrishna and Dey, *Handbook on Indian Freshwater molluscs*, : 210. Publ., : Director, *Zool. Surv. India*, Kolkata.

Diagnostic characters : Shell smaller than *typica*, spire comparatively longer, last whorl well rounded, suture shallow.

Material examined / Source : Subba Rao and Mitra (1979); Patil (2005); Patil and Ramakrishna (2004, 2005); Patil and Talmale (2005b).

Distribution : Throughout India. Maharashtra : Amaravati Dist. : Melghat Tiger Reserve; Aurangabad Dist. : Nathsagar Wetland; Nagpur Dist. : Pench National Park; Pune Dist. : Pune; Satara Dist. : Satara.

Elsewhere : Bangladesh, Myanmar, Pakistan, Sri Lanka.

**41. *Lymnaea (Pseudosuccinea) luteola* form
impura Troschel**

1837. *Limnaea impura* Troschel, *Arch. Naturgesch.*, 3 : 172.
1989. *Lymnaea (Pseudosuccinea) luteola* form *impura*: Subba Rao, *Handbook : Freshwater mollusks of India*, : 129.
2007. *Lymnaea (Pseudosuccinea) luteola* form *impura*: Ramakrishna and Dey, *Handbook on Indian Freshwater molluscs*, : 211. Publ., : Director, *Zool. Surv. India*, Kolkata.

Diagnostic characters : Shell smaller than *typica*, spire comparatively longer, last whorl well rounded, suture shallow.

Material examined / Source : Subba Rao and Mitra (1979); Patil and Talmale (2005b); Patil *et al.* (2005).

Distribution : India : Maharashtra : Chandrapur Dist. : Tadoba Andhari Tiger Reserve; Pune Dist. : Pune, Andhra Pradesh, Assam, Himachal Pradesh, Kerala, Nagaland, Orissa.

Elsewhere : Myanmar, Sri Lanka.

42. *Lymnaea (Pseudosuccinea) luteola* form *ovalis* Gray

1822. *Limnaea ovalis* Gray, in Sowerby's *Gen. Rec. Foss. Shells*, : pl. 178.
1989. *Lymnaea (Pseudosuccinea) luteola* form *ovalis* : Subba Rao, *Handbook : Freshwater mollusks of India*, : 129.
2007. *Lymnaea (Pseudosuccinea) luteola* form *ovalis* : Ramakrishna and Dey, *Handbook on Indian Freshwater molluscs*, : 212. Publ., : Director, Zool. Surv. India, Kolkata.

Material examined/Source : Ramakrishna and Dey (2007).

Distribution : Common throughout India including Maharashtra.

Elsewhere : East Indies, Myanmar, Sri Lanka.

43. *Lymnaea (Pseudosuccinea) luteola* form *succinea* Deshayes

1834. *Limnaea succinea* Deshayes, *Voy. Belang. Zool.*, P. 418.
1989. *Lymnaea (Pseudosuccinea) luteola* form *succinea*: Subba Rao, *Handbook : Freshwater mollusks of India*, : 129.
2007. *Lymnaea (Pseudosuccinea) luteola* form *succinea* : Ramakrishna and Dey, *Handbook on Indian Freshwater molluscs*, : 213. Publ., : Director, Zool. Surv. India, Kolkata.

Diagnostic characters : Shell larger than in preceeding species, last whorl much inflated without any compression, spire short and abruptly acuminate.

Material examined/Source : Subba Rao and Mitra (1979); Patil and Ramakrishna (2004); Patil and Talmale (2005b); Patil *et al.* (2006); Ramakrishna and Dey (2007).

Distribution : India : Maharashtra : Chandrapur Dist. : Tadoba Andhari Tiger Reserve; Mumbai Suburban Dist. : Andheri; Nagpur Dist. : Pench National park; Pune Dist. : Pune, Andhra Pradesh, Jharkhand, Kashmir, Kerala, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh.

Elsewhere : Java.

44. *Lymnaea pinguis* Dohrn

1858. *Limnaea pinguis* (Dohrn), *P. Z. S.*, p. 134.
1915. *Lymnaea (Gulnaria) pinguis*: : Preston, *Fauna of British India. Mollusca*, (Freshwater Gastropoda : Pelecypoda) : 113.
1963. *Limnaea pinguis* : Tonapi and Mulherkar, *J. Bombay nat. Hist. Soc.*, 60(1) : 112.

Material examined/Source : Preston (1915); Tonapi and Mulherkar (1963); Patil and Talmale (2005b).

Distribution : India : Maharashtra (Mumbai, Pune); Tamil Nadu.

Genus *Radix* Montfort, 1810

45. *Radix auricularia* (Linnaeus)

1758. *Helix auricularia* Linnaeus, *Syst. Nat. ed.*, 10 : 774.
1925. *Lymnaea auricularia* : Annandale and Rao, *Rec. Indian Mus.*, 27 : 158.
1989. *Lymnaea (Radix) auricularia* : Subba Rao, *Handbook : Freshwater mollusks of India*, : 134.
2007. *Radix auricularia* : Ramakrishna and Dey, *Handbook on Indian Freshwater molluscs*, : 219. Publ., : Director, Zool. Surv. India, Kolkata.

Material examined / Source : Tonapi and Mulherkar (1963); Patil and Talmale (2005b).

Distribution : India : Maharashtra : Pune Dist. : Pune, Kashmir.

Elsewhere : Europe as far south as Spain and Italy, Northern Asia, Afghanistan.

Superfamily PHYSOIDEA

Family PHYSIDAE

Genus *Physa* Draparnaud, 180146. *Physa acuta* Draparnaud

1805. *Physa acuta* Draparnaud, *Histoire naturelle des mollusques terrestres et fluviales de la France, paris* : 55.
1980. *Physa acuta* : Brown, *Freshwater Snails of Africa and their Medical importance*, : 212.
2007. *Physa acuta* : Ramakrishna and Dey, *Handbook on Indian Freshwater molluscs*, : 227-228. Publ., : Director, Zool. Surv. India, Kolkata.

Material examined/Source : Ramakrishna and Dey (2007).

Distribution : India : Maharashtra : Pune Dist., : Pune, Delhi.

Elsewhere : North America, introducing in Europe, Africa and South East Asia : Pakistan.

Superfamily PLANORBOIDEA

Family PLANORBIDAE

Subfamily PLANORBINAE

Genus *Gyraulus* Charpentier, 183747. *Gyraulus convexiusculus* (Hutton)

1849. *Planorbis convexiusculus* Hutton, *J. Asiat. Soc. Beng.*, 18(2) : 657.
1956. *Gyraulus convexiusculus* : Benthem Jutting, *Treubia*, 23(2) : 463.
1989. *Gyraulus convexiusculus* : Subba Rao, *Handbook : Freshwater mollusks of India*, : 142.
2007. *Gyraulus convexiusculus*: Ramakrishna and Dey, *Handbook on Indian Freshwater molluscs*, : 234-235. Publ., : Director, Zool. Surv. India, Kolkata.

Diagnostic characters : Maximum diameter, rarely exceeds 5mm, whorls 4 or 5 rounded, suture well defined peripheri subangulate, closely and obliquely striate, umbilicus wide all the whorl distinctly seen above, aperture ovate lunate.

Material examined / Source : Tonapi and Mulherkar (1963); Subba Rao and Mitra (1979); Patil and Talmale (2005b); Ramakrishna and Dey (2007); Patil (2005, 2006); Patil and Ramakrishna (2004, 2005); Patil *et al.* (2006).

Distribution : Common throughout in India : Maharashtra : Amaravati Dist. : Melghat Tiger Reserve; Aurangabad Dist. : Nathsagar Wetland; Chandrapur Dist. : Tadoba Andhari Tiger Reserve; Mumbai Suburban Dist. : Sanjay Gandhi National Park, Borivali; Nagpur Dist. : Pench National Park.

Elsewhere : Iran to Philippines and Japan.

48. *Gyraulus labiatus* (Benson)

1850. *Planorbis labiatus* Benson, *Ann. Mag. Nat. Hist.*, (2)5 : 350.
1925. *Gyraulus labiatus* : Annandale, *Rec. Indian Mus.*, 27 : 109.
1989. *Gyraulus labiatus*: Subba Rao, *Handbook : Freshwater mollusks of India*, : 155.
2006. *Gyraulus labiatus*: Ramakrishna and Dey, *Handbook on Indian Freshwater molluscs*, : 237-238. Publ., : Director, Zool. Surv. India, Kolkata.

Material examined/Source : Subba Rao (1989); Patil and Talmale (2005b); Ramakrishna and Dey (2007).

Distribution : India : Maharashtra : Pune Dist. : Khandala, Andhra Pradesh, Himachal Pradesh, Madhya Pradesh, Mizoram, Tamil Nadu, Tripura, Uttar Pradesh, West Bengal.

Elsewhere : Myanmar.

49. *Gyraulus rotula* (Benson)

1850. *Planorbis rotula* Benson, *Ann. Mag. Nat. Hist.*, 5 : 351.
1915. *Planorbis* (*Gyraulus*) *rotula* : Preston, *Fauna Brit. India, Mollusca*, (Freshwater Gastropoda and Pelecypoda), p. 122.
1989. *Gyraulus rotula*: Subba Rao, *Handbook : Freshwater mollusks of India*, : 157.
2007. *Gyraulus rotula*: Ramakrishna and Dey, *Handbook on Indian Freshwater molluscs*, : 240-241. Publ., : Director, Zool. Surv. India, Kolkata.

Material examined/Source : Subba Rao (1989); Patil and Talmale (2005b); Ramakrishna and Dey (2007).

Distribution : India : Maharashtra, Uttar Pradesh.

Elsewhere : Sri Lanka, Thailand.

Family BULLINIDAE

Subfamily BULININAE

Genus *Indoplanorbis* Annandale & Prashad, 192150. *Indoplanorbis exustus* (Deshayes)

1834. *Planorbis exustus* Deshayes, in Belanger, *Voy. Indes-Orientales*, p. 417, pl. 1, figs. 11-13.
1956. *Indoplanorbis exustus* : Benthem Jutting, *Treubia*, 23(2) : 471.
1989. *Indoplanorbis exustus* : Subba Rao, *Handbook : Freshwater mollusks of India*, : 142.
2007. *Indoplanorbis exustus*: Ramakrishna and Dey, *Handbook on Indian Freshwater molluscs*, : 253-254. Publ., : Director, Zool. Surv. India, Kolkata.

Diagnostic characters : Shell large, thick, discoidal, sinistral, rounded at periphery, aperture ear-shaped, suture deeply impressed.

Material examined/Source : Subra Rao and Mitra (1979); Surya Rao *et al.* (2002); Patil (2005); Patil and Ramakrishna (2004); Patil and Talmale (2005b); Patil *et al.* (2006); Ramakrishna and Dey (2007).

Distribution : Widely distributed in India : Maharashtra : Amaravati Dist. : Melghat Tiger Reserve; Aurangabad Dist. : Nathsagar Wetland; Chandrapur Dist. : Tadoba Andhari Tiger Reserve; Nagpur Dist. : Pench National Park; Pune Dist. : Pune, Ujani Wetland. *Elsewhere* : Bangladesh, Iran, Pakistan, Persia, Sri Lanka, Myanmar, Malaya, Indo-China, Tibet, Thailand, Vietnam, Sumatra, Java, Celebes.

Family ANCYLIDAE

Subfamily FERRISSINAE

Genus *Ferrissia* Walker, 190351. *Ferrissia tenuis* (Bourguignat)

1862. *Ancylus tenuis* Bourguignat, *Spicil. Malac.*, 1861 : 208.
1921. *Ancylus (Ferrissia) tenuis* : Annandale and Prashad, *Rec. Indian Mus.*, 22 : 592.
2007. *Ferrissia tenuis*: Ramakrishna and Dey, *Handbook on Indian Freshwater molluscs*, : 257. Publ., : Director, Zool. Surv. India, Kolkata.

Material examined/Source : Subra Rao (1989); Ramakrishna and Dey (2007).

Distribution : India : Maharashtra, South India, Nilgiri Hills.

52. *Ferrissia verruca* (Benson)

1855. *Ancylus verruca* Benson, *Ann. Mag. Nat. Hist.*, (2)15 : 12.
1989. *Ferrissia verruca* : Subba Rao, *Handbook : Freshwater mollusks of India*, : 139.
2007. *Ferrissia verruca*: Ramakrishna and Dey, *Handbook on Indian Freshwater molluscs*, : 258. Publ., : Director, Zool. Surv. India, Kolkata.

Material examined/Source : Subra Rao (1989); Ramakrishna and Dey (2007).

Distribution : India : Throughout India including Maharashtra.

**Key to the families of class Bivalvia
(Freshwater)**

1. Shell internally non nacreous2
- Shell internally nacreous3
2. Shell thick and large; ligament very strong and external; hinge straight with three cardinal teeth and strong serrated anterior and posterior lateral teeth CORBICULIDAE
- Shell thin and small; ligament not very strong and internal; hinge curved with two small cardinal teeth and smooth lateral teeth PISIDIIDAE
3. Shell irregular, inequivalve and attached to substratum with one valve ETHERIIDAE
- Shell regular, equivalve and valve not attached to substratum UNIONIDAE

Class BIVALVIA

Subclass PALEOHETERODONTA

Order TRIGOINOIDA

Superfamily UNIONOIDEA

Family UNIONIDAE

Subfamily UNIONINAE

Genus *Arcidopsis* Simpson, 190053. *Arcidopsis footei* (Theobald)

1876. *Unio footei* Theobald, *J. Asiat. Soc. Beng.*, 45 : 187, pl. 14, figs. 9, 9a.

1915. *Arcidopsis footei* : Preston, *Fauna Brit. India Mollusca*, (Freshwater Gastropoda And Pelecypoda). P. 196.

2007. *Arcidopsis footei* : Ramakrishna and Dey, *Handbook on Indian Freshwater molluscs*, : 275. Publ., : Director, Zool. Surv. India, Kolkata.

Material examined/Source : Subra Rao (1989); Ramakrishna and Dey (2007).

Distribution : India : River system of Western Ghats. Maharashtra : Satara Dist. : Taloshi in the Koyna valley.

Subfamily AMBLEMINEAE

Tribe Amblemini

Genus *Lamellidens* Simpson, 1900

54. *Lamellidens consobrinus* (Lea)

1859. *Unio consobrinus* Lea, *Proc. Acad. Nat. Sci. Philad.*, 3 : 331.

1921. *Lamellidens consobrinus* : Prashad, *Rec. Indian Mus.*, 22 : 608.

1989. *Lamellidens consobrinus*: Subba Rao, *Handbook : Freshwater mollusks of India*, : 164.

2007. *Lamellidens consobrinus*: Ramakrishna and Dey, *Handbook on Indian Freshwater molluscs*, : 281. Publ., : Director, Zool. Surv. India, Kolkata.

Diagnostic characters : Shell rhomboidal, thick, umbones more inflated than in *L. marginalis*, dorsal margin curved and obliquely truncate, posterior side obtusely angled, anterior side rounded, left valves with two ragged cardinals.

Material examined / Source : Subba Rao and Mitra (1979); Patil and Ramakrishna (2004, 2005); Patil (2005); Patil and Talmale (2005b).

Distribution : India : Maharashtra : Amaravati Dist. : Melghat Tiger Reserve; Aurangabad Dist. : Nathsagar Wetland; Nagpur Dist. : Pench National Park; Pune Dist. : Pune.

Elsewhere : Bangladesh, China, Sri Lanka.

55. *Lamellidens corrianus* (Lea)

1834. *Unio corrianus* Lea, *Trans. Amer. Philos. Soc.*, 6(2) : 65. pl. 9, fig. 25.

1900. *Lamellidens corrianus* : Simpson, *Proc. U.S. Nat. Mus.*, 22 : 857.

1989. *Lamellidens corrianus* : Subba Rao, *Handbook : Freshwater mollusks of India*, : 165.

2007. *Lamellidens corrianus* : Ramakrishna and Dey, *Handbook on Indian Freshwater molluscs*, : 283. Publ., : Director, Zool. Surv. India, Kolkata.

Diagnostic characters : Shell elongate, elliptical; umbone slightly inflated; periostracum smooth and dark brown; dorsal margin almost straight and long; cardinals two in each valve.

Material examined/Source : Patil and Ramakrishna (2004); Patil and Talmale (2005b); Patil *et al.* (2006).

Distribution : Common throughout India : Maharashtra : Chandrapur Dist. : Tadoba Andhari Tiger Reserve; Nagpur Dist. : Pench National Park.

Elsewhere : Bangladesh, Myanmar.

56. *Lamellidens lamellatus* (Lea)

1838. *Unio lamellatus* Lea, *Trans. Amer. Phil. Soc.*, 6 : 19, pl. vi, fig. 16.

1922. *Lamellidens lamellatus* : Prashad, *Rec. Indian Mus.*, 24 : 108.

1989. *Lamellidens lamellatus*: Subba Rao, *Handbook : Freshwater mollusks of India*, : 167.

Material examined / Source : Subba Rao and Mitra (1979); Patil and Talmale (2005b).

Distribution : India : Maharashtra : Pune Dist. : Pune; West Bengal.

Elsewhere : Myanmar.

57. *Lamellidens marginalis* (Lamarck)

1819. *Unio marginalis* Lamarck, *Hist. Nat. Anim. Sans. Vert.*, 4 : 79.

1900. *Lamellidens marginalis* : Simpson, *Proc. U.S. Nat. Mus.*, 22 : 854.

1989. *Lamellidens marginalis* : Subba Rao, *Handbook : Freshwater mollusks of India*, : 168.

2007. *Lamellidens marginalis* : Ramakrishna and Dey, *Handbook on Indian Freshwater molluscs*, : 288-289. Publ., : Director, Zool. Surv. India, Kolkata.

Diagnostic characters : Shell oblong ovate, valves covered by blackish brown periostracum with light brown border along ventral margin, Umbo not elevated, posterior side broad, roundedly

angular, margin produced, narrow wing, dorsal margin slightly curved, central margin slightly contracted in middle, hinge with two cardinals in right valve, interior nacreous.

Material examined / Source : Subba Rao and Mitra (1979); Surya Rao *et al.* (2002); Patil and Ramakrishna (2004, 2005); Patil (2005); Patil and Talmale (2005b); Patil *et al.* (2006).

Distribution : Widely distributed in India : Maharashtra : Amaravati Dist. : Melghat Tiger Reserve; Aurangabad Dist. : Nathsagar Wetland; Chandrapur Dist. : Tadoba Andhari Tiger Reserve; Nagpur Dist. : Pench National Park; Pune Dist. : Pune, Ujani Wetland.

Elsewhere : Bangladesh, Myanmar, Sri Lanka.

58. *Lamellidens marginalis* var. *cylindrica* (Hanley & Theobald)

1876. *Unio marginalis* var. *cylindrica*, H. & T. C. I., p. 20, pl. 44, fig. 1.

1915. *Lamellidens marginalis* var. *cylindrica*: Preston, *Fauna of British India. Mollusca, (Freshwater Gastropoda : Pelecypoda)* : 179.

Material examined/Source : Patil and Talmale (2005b).

Distribution : India : Maharashtra.

Genus *Parreysia* Conrad, 1853

Subgenus *Parreysia* s. st.

59. *Parreysia (Parreysia) annandalei* Preston

1912. *Parreysia annandalei* Preston, *Rec. Indian Mus.*, 7 : 302.

1989. *Parreysia (Parreysia) annandalei*: Subba Rao, *Handbook : Freshwater mollusks of India*, :176-177.

2007. *Parreysia (Parreysia) annandalei* : Ramakrishna and Dey, *Handbook on Indian Freshwater molluscs*, : 292-293. Publ., : Director, Zool. Surv. India, Kolkata.

Diagnostic characters : Shell oval convex, coarsely and concentrically ribbed. Anterior side sharply rounded and posterior side bluntely subrostrate.

Material examined/Source : Patil (2005); Patil and Ramakrishna (2005); Patil and Talmale (2005b).

Distribution : India : Maharashtra : Amaravati Dist. : Melghat Tiger Reserve; Aurangabad Dist. : Nathsagar Wetland,. Assam.

60. *Parreysia (Parreysia) corrugata* Mueller

1774. *Mya corrugata* Muller, *Verm. Terr. Et. Fluv.*, pt. 2, p. 214, no. 398.

1900. *Parreysia corrugata* : Simpson, *Proc. U.S. natn. Mus.*, 22 : 841.

1989. *Parreysia (Parreysia) corrugata*: Subba Rao, *Handbook : Freshwater mollusks of India*, : 179.

2007. *Parreysia (Parreysia) corrugata* : Ramakrishna and Dey, *Handbook on Indian Freshwater molluscs*, : 296. Publ., : Director, Zool. Surv. India, Kolkata.

Diagnostic characters : Shell elliptic to oval, smooth, scarcely inequilateral; umbones prominent; lunule well marked; sculptured with somewhat radiating, oblique, linear ridges, ventral margin convex, cardinal teeth strong, not lamellar; green in colour.

Material examined / Source : Subba Rao and Mitra (1979); Subba Rao (1989); Patil (2005); Patil and Ramakrishna (2004, 2005); Patil and Talmale (2005b); Patil *et al.* (2006).

Distribution : Widely distributed throughout India : Maharashtra : Amaravati Dist. : Melghat Tiger Reserve; Aurangabad Dist. : Nathsagar Wetland; Chandrapur Dist. Chandrapur, Tadoba Andhari Tiger Reserve; Nagpur Dist. : Pench National Park; Pune Dist. : Pune.

Elsewhere : Bangladesh, Myanmar, Sri Lanka.

61. *Parreysia (Parreysia) corrugata* (Mueller) sub sp. *laevirostris* (Benson)

1862. *Unio laevirostris* Benson, *Ann. Mag. Nat. Hist.*, (3) 10 : 191.

1900. *Parreysia corrugata* (Mueller) var. *laevirostris* : Simpson, *Proc. U.S. natn. Mus.*, 22 : 842.

1989. *Parreysia (Parreysia) corrugata* (Mueller) subsp. *laevirostris*: Subba Rao, *Handbook : Freshwater mollusks of India*, : 179.

Diagnostic characters : Shell elliptical, thick, nearly smooth, dorsal margin almost straight, posterior end broadly angulate, anterior end well rounded, cardinal teeth strong.

Material examined/Source : Patil and Talmale (2005b); Patil *et al.* (2006).

Distribution : India : Maharashtra : Chandrapur Dist. : Tadoba Andhari Tiger Reserve, Assam, Andhra Pradesh, Bihar.

Elsewhere : Bangladesh.

62. *Parreysia (Parreysia) corrugata* (Mueller) subsp. *nagpoorensis* (Lea)

1859. *Unio nagpoorensis* Lea, *Proc. Acad. Nat. Sci., Philad.*, 3 : 331.

1900. *Parreysia corrugata* (Mueller) sub var. *nagpoorensis* : Simpson, *Proc. U. S. natn. Mus.*, 22 : 842.

1989. *Parreysia (Parreysia) corrugata* (Mueller) subsp. *nagpoorensis*: Subba Rao, *Handbook : Freshwater mollusks of India*, : 180.

2007. *Parreysia (Parreysia) corrugata* (Mueller) subsp. *nagpoorensis* : Ramakrishna and Dey, *Handbook on Indian Freshwater molluscs*, : 298. Publ., : Director, Zool. Surv. India, Kolkata.

Diagnostic characters : Shell oval, thick, greenish, sculptured with zigzag markings arranged in rows, concentrated at umbonal region; dorsal margin evenly sloping, anteriorly rounded, posterior end obtusely pointed.

Material examined / Source : Subba Rao and Mitra (1979); Subba Rao (1989); Patil (2005); Patil and Talmale (2005b); Ramakrishna and Dey (2007).

Distribution : India : Maharashtra : Amaravati Dist. : Melghat Tiger Reserve; Nagpur Dist. : Nagpur; Pune Dist. : Pune; Andhra Pradesh, Assam, Gujarat, Orissa, Tamil Nadu, West Bengal.

Elsewhere : Bangladesh.

63. *Parreysia (Parreysia) favidens* (Benson)

1862. *Unio favidens* Benson, *Ann. Mag. Nat. Hist.*, (3)10 : 188.

1900. *Parreysia favidens* : Simpson, *Proc. U. S. natn. Mus.*, 22 : 842.

1989. *Parreysia favidens* : Subba Rao, *Handbook : Freshwater mollusks of India*, : 180.

2007. *Parreysia (Parreysia) favidens*: Ramakrishna and Dey, *Handbook on Indian Freshwater molluscs*, : 299. Publ., : Director, Zool. Surv. India, Kolkata.

Diagnostic characters : Shell thicker, larger and more inequilateral, both anterior and posterior margins angulate, cardinal teeth strong and broad.

Material examined/Source : Subba Rao and Mitra (1979); Subba Rao (1989); Surya Rao *et al.* (2002); Patil and Ramakrishna (2004); Patil and Talmale (2005b); Patil *et al.* (2006).

Distribution : India : Maharashtra : Chandrapur Dist. : Tadoba Andhari Tiger Reserve; Nagpur Dist. : Pench National Park; Pune Dist. : Pune, Ujani Wetland, Andhra Pradesh, Assam, Bihar, Jharkhand, Meghalay, Orissa, Rajasthan, Tamil Nadu, Uttar Pradesh, West Bengal.

Elsewhere : Bangladesh, Pakistan.

64. *Parreysia (Parreysia) favidens* var. *marcens* (Benson)

1862. *Unio favidens* var. *marcens* Benson, *Ann. Mag. Nat. Hist.*, (3)10 : 188.

1992. *Parreysia favidens* var. *marcens* : Mitra and Dey, *Land and Freshwater Mollusca*, (Part-I), *Fauna of West Bengal, State Fauna Series 3* : 31.

2007. *Parreysia (Parreysia) favidens* var. *marcens* : Ramakrishna and Dey, *Handbook on Indian Freshwater molluscs*, : 304-305. Publ., : Director, Zool. Surv. India, Kolkata.

Material examined/Source : Subba Rao and Mitra (1979); Mitra and Dey (1992); Patil and Talmale (2005b); Ramakrishna and Dey (2007).

Distribution : India : Maharashtra : Pune Dist. : Pune, Andhra Pradesh, Assam, West Bengal.

65. *Parreysia (Parreysia) rajahensis* (Lea)

1841. *Unio rajahensis* Lea, *Proc. Am. Phil. Soc.*, 2 : 30.

1900. *Parreysia rajahensis* : Simpson, *Proc. U.S. natn. Mus.*, 22 : 844.

1989. *Parreysia (Parreysia) rajahensis*: Subba Rao, *Handbook : Freshwater mollusks of India*, : 185.

2007. *Parreysia (Parreysia) rajahensis*: Ramakrishna and Dey, *Handbook on Indian Freshwater molluscs*, : 308-309. Publ., : Director, Zool. Surv. India, Kolkata.

Material examined / Source : Subba Rao and Mitra (1979); Patil and Talmale (2005b).

Distribution : India : Maharashtra : Pune Dist. : Pune, Bihar, Madhya Pradesh, West Bengal.

Subgenus *Radiatula* Simpson, 190066. *Parreysia (Radiatula) caerulea* (Lea)

1831. *Unio caeruleus* Lea, *Trans. Amer. Phil. Soc.*, 4 : 95.
1989. *Parreysia (Radiatula) caerulea* : Subba Rao, *Handbook : Freshwater mollusks of India*, : 188.
2007. *Parreysia (Radiatula) caerulea* : Ramakrishna and Dey, *Handbook on Indian Freshwater molluscs*, : 316. Publ., : Director, Zool. Surv. India, Kolkata.

Diagnostic characters : Shell elongate, variable in shape, sculpture restricted to the upper half of the valves in the adult whereas in the young one the whole shell surface sculptured, posterior umbonal carina very distinct.

Material examined/Source : Tonapi (1971); Patil (2005); Patil and Ramakrishna (2004, 2005); Patil and Talmale (2005b); Patil *et al.* (2006).

Distribution : India : Maharashtra : Amaravati Dist. : Melghat Tiger Reserve; Aurangabad Dist. : Nathasagar Wetland; Chandrapur Dist. : Tadoba Andhari Tiger Reserve; Nagpur Dist. : Pench National Park; Pune Dist. : Pune. Assam, Bihar, Orissa, Punjab, Uttar Pradesh, West Bengal.

Elsewhere : Bangladesh, Myanmar, Nepal, Pakistan.

67. *Parreysia (Radiatula) cylindrica* Annandale and Prasad

1919. *Parreysia cylindrica* Annandale and Prasad, *Rec. Indian Mus.*, 16 : 150. pl. iv. Figs. 6,7.
1989. *Parreysia (Parreysia) cylindrica* : Subba Rao, *Handbook : Freshwater mollusks of India*, : 180.
2007. *Parreysia (Radiatula) cylindrica* : Ramakrishna and Dey, *Handbook on Indian Freshwater molluscs*, : 318. Publ., : Director, Zool. Surv. India, Kolkata.

Material examined / Source : Subba Rao (1989); Patil and Talmale (2005b); Ramakrishna and Dey (2007).

Distribution : India : Maharashtra : Satara Dist. : Yenna River, Upper Krishna Watershed, Medha.

68. *Parreysia (Radiatula) khadakvaslaensis* (Ray)

1966. *Indonaia khadakvaslaensis* Ray, *J. Conch. Paris*, 105(4) : 226.

1989. *Parreysia (Radiatula) khadakvaslaensis* : Subba Rao, *Handbook : Freshwater mollusks of India*, : 190.

2007. *Parreysia (Radiatula) khadakvaslaensis* : Ramakrishna and Dey, *Handbook on Indian Freshwater molluscs*, : 318. Publ., : Director, Zool. Surv. India, Kolkata.

Material examined / Source : Subba Rao (1989); Patil and Talmale (2005b); Ramakrishna and Dey (2007).

Distribution : India : Maharashtra : Pune Dist. : Khadakwasla Dam, Pune.

69. *Parreysia (Radiatula) shurtleffiana* (Lea)

1856. *Unio shurtleffiana* Lea, *Proc. Acad. Acad. Nat. Sci. Philad.*, 8 : 94.
1989. *Parreysia (Radiatula) shurtleffiana* : Subba Rao, *Handbook : Freshwater mollusks of India*, : 192.
2007. *Parreysia (Radiatula) shurtleffiana* : Ramakrishna and Dey, *Handbook on Indian Freshwater molluscs*, : 327. Publ., : Director, Zool. Surv. India, Kolkata.

Material examined / Source : Subba Rao (1989); Patil and Talmale (2005b); Ramakrishna and Dey (2007).

Distribution : India : Maharashtra : Ahmednagar Dist. : Ahmednagar. Bihar, Madhya Pradesh, Orissa, Uttar Pradesh.

Superfamily MUTELOIDEA

Family ETHERIIDAE

Genus *Pseudomulleria* Anthony, 190770. *Pseudomulleria dalyi* E.A. Smith

1898. *Mulleria dalyi* Smith, *Proc. Malac. Soc. Lond.*, 3 : 14.
1989. *Acostaea (Pseudomulleria) dalyi* : Subba Rao, *Handbook : Freshwater mollusks of India*, : 198.
2007. *Pseudomulleria dalyi* : Ramakrishna and Dey, *Handbook on Indian Freshwater molluscs*, : 330. Publ., : Director, Zool. Surv. India, Kolkata.

Material examined / Source : Subba Rao (1989); Patil and Talmale (2005b); Ramakrishna and Dey (2007).

Distribution : Western Ghats : Maharashtra : Satara Dist. : Taloshi, Koyana valley and Karnataka.

Subclass HETERODONTA

Order VENEROIDA

Superfamily CORBICULOIDEA

Family CORBICULIDAE

Genus *Corbicula* Mergerle von Muhlfeld71. *Corbicula krishnaea* Ray

1967. *Corbicula krishnaea* Ray, Arch. Moll., 96 : 191, figs. 1,2.
1989. *Corbicula krishnaea*: Subba Rao, Handbook : Freshwater mollusks of India, : 203.
2007. *Corbicula krishnaea* : Ramakrishna and Dey, Handbook on Indian Freshwater molluscs, : 341. Publ., : Director, Zool. Surv. India, Kolkata.

Material examined/Source : Subba Rao and Mitra (1979); Patil and Talmale (2005b); Ramakrishna and Dey (2007).

Distribution : India : Maharashtra : Pune Dist. : Pune; Sangli Dist. : Krishna river, near Sangli.

72. *Corbicula peninsularis* Prashad

1928. *Corbicula peninsularis* Prashad, Mem. Indian Mus., 9 : 21.
1989. *Corbicula peninsularis*: Subba Rao, Handbook : Freshwater mollusks of India, : 204.
2007. *Corbicula peninsularis*: Ramakrishna and Dey, Handbook on Indian Freshwater molluscs, : 342. Publ., : Director, Zool. Surv. India, Kolkata.

Material examined/Source : Tonapi (1971); Subba Rao and Mitra (1979); Patil and Talmale (2005b); Ramakrishna and Dey (2007).

Distribution : India : Maharashtra : Mumbai Dist. : Mumbai; Pune Dist. : Pune.

73. *Corbicula regularis* Prime

1860. *Corbicula regularis* Prime, P. Z. S., xxviii, pp. 321-322.
1915. *Corbicula regularis*: Preston, Fauna of British India, Mollusca (Freshwater Gastropoda : Pelecypoda), : 217.

Material examined/Source : Tonapi and Mulherkar (1963); Patil and Talmale (2005b).

Distribution : India : Maharashtra : Pune Dist. : Pune.

74. *Corbicula striatella* Deshayes

1854. *Corbicula striatella* Deshayes, Proc. Zool. Soc. Lond., 22 : 344.
1989. *Corbicula striatella*: Subba Rao, Handbook : Freshwater mollusks of India, : 204.
2007. *Corbicula striatella* : Ramakrishna and Dey, Handbook on Indian Freshwater molluscs, : 343. Publ., : Director, Zool. Surv. India, Kolkata.

Material examined/Source : Tonapi (1971); Subba Rao and Mitra (1979); Surya Rao *et al.* (2002); Patil (2005); Patil and Ramakrishna (2004, 2005); Patil and Talmale (2005b); Patil *et al.* (2006).

Distribution : Common throughout India : Maharashtra : Amaravati Dist. : Melghat Tiger Reserve; Chandrapur Dist. : Tadoba Andhari Tiger Reserve; Nagpur Dist. : Pench National Park; Pune Dist. : Pune, Ujani Wetland.

Elsewhere : Afghanistan, Bangladesh, Myanmar, Pakistan, Sri Lanka.

Genus *Polymesoda* Rafinesque, 1820Subgenus *Geloina* Fray, 184275. *Polymesoda (Geloina) erosa* (Solander)

1786. *Venus erosa* Solander, Portland Catalogue, p. 71, 186.
1989. *Geloina erosa* : Subba Rao, Handbook : Freshwater mollusks of India, : 210.
2007. *Polymesoda (Geloina) erosa* : Ramakrishna and Dey, Handbook on Indian Freshwater molluscs, : 348. Publ., : Director, Zool. Surv. India, Kolkata.

Material examined/Source : Ramakrishna and Dey (2007).

Distribution : India : Maharashtra, Andhra Pradesh, Andaman and Nikobar Island, Goa.

Elsewhere : Indo-Pacific. Backwaters and estuaries.

Family PISIDIIDAE

Genus *Pisidium* PfeifferSubgenus *Afropisidium* Kuiper, 196276. *Pisidium (Afropisidium) clarkeanum* G. & H. Nevill

1871. *Pisidium clarkeanum* G. & H. Nevill, J. Asiat. Soc. Beng., 40 : 9, pl. 1, figs. 4, 4a-d.

1989. *Pisidium (Afropisidium) clarkeanum* : Subba Rao, *Handbook : Freshwater molluscs of India*, : 218.

2007. *Pisidium (Afropisidium) clarkeanum* : Ramakrishna and Dey, *Handbook on Indian Freshwater molluscs*, : 352. Publ., : Director, Zool. Surv. India, Kolkata.

Material examined/Source : Ramakrishna and Dey (2007).

Distribution : India : Maharashtra : Mumbai, Andhra Pradesh, Bihar, Jharkhand, Manipur, Tamil Nadu, Uttar Pradesh, West Bengal.

Elsewhere : Myanmar, Bangladesh, Thailand, Laos.

Genus *Sphaerium* Scopoli, 1777

77 *Sphaerium indicum* Deshayes

1854. *Sphaerium indicum* Deshayes, *Proc. Zool. Soc. Lond.*, **22** : 342.

1989. *Sphaerium (Sphaerium) indicum*: Subba Rao, *Handbook : Freshwater molluscs of India*, : 213.

2007. *Sphaerium indicum*: Ramakrishna and Dey, *Handbook on Indian Freshwater molluscs*, : 360. Publ., : Director, Zool. Surv. India, Kolkata.

Material examined/Source : Ramakrishna and Dey (2007).

Distribution : Throughout Indian Plains (including Maharashtra), Himalayas.

Order SYSTELLOMMATOPHORA

Family VERONICELLIDAE

Genus *Laevicaulis* Simroth, 1913

78. *Laevicaulis alte* (Ferussac)

1821. *Vaginulus alte* Ferussac, *Tabl. Syst. Linaces*, p. 14.

1961. *Laevicaulis alte* : Ray, *Treubia*, **25** () : 275.

1979. *Laevicaulis alte* : Subba Rao and Mitra, *Rec. zool. Surv. India*, **75** : 10.

Material examined/Source : Subba Rao and Mitra (1979); Patil and Talmale (2005b).

Distribution : India : Maharashtra : Pune Dist. : Pune.

Elsewhere : East Africa, Mauritius, Reunion, Madagascar, Sri Lanka, Hong Kong, China, Formosa, Indonesia, New Caledonia and Loyalty Islands.

Remarks : It is widely distributed tropical species (Subba Rao and Mitra, 1979)

Genus *Semperula* Grimpe & Hoffman, 1924

79. *Semperula birmanica* (Theobald)

1864. *Vaginulus birmanicus* Theobald, *J. Asiat. Soc. Beng.*, **33** : 243.

1925. *Semperula birmanica* : Hoffmann, *Jenais Zeitschr. Naturw.*, **61** : 182, 254, Tab. 6 fig. 45, KI (Penis)

1979. *Semperula birmanica*: Subba Rao and Mitra, *Rec. zool. Surv. India*, **75** : 11.

Material examined/Source : Subba Rao and Mitra (1979); Patil and Talmale (2005b).

Distribution : India : Maharashtra : Pune Dist. : Pune; West Bengal.

Elsewhere : Myanmar, Thailand, Indonesia.

Genus *Sarasinula* Grimpe & Hoffman, 1924

80. *Sarasinula plebeja* (Fischer)

1868. *Vaginula plebeja* Fischer, *J. Conch. Paris*, **6** : 145.

1961. *Vaginulus (Sarasinula) plebeja* : Ray, *Treubia*, **25** : 275.

1979. *Sarasinula plebeja* : Subba Rao and Mitra, *Rec. zool. Surv. India*, **75** : 11.

Material examined / Source : Subba Rao and Mitra (1979); Patil and Talmale (2005b).

Distribution : India : Maharashtra : Maharashtra : Pune Dist. : Pune., Tamil Nadu.

Elsewhere : East Africa to Pasific Islands.

B) LAND MOLLUSCA

Phylum MOLLUSCA

Class GASTROPODA

Subclass PROSOBRANCHIA

Order MESOGASTROPODA

Key to the families of order Mesogastropoda

1. Shell with an operculum closing the aperture 2
- Shell without an operculum 4
2. Shell depressed or conoidly depressed, broader than high 3

- Shell ovate, elongately ovate, higher than broad DIPLOMMATINIDAE
- 3. Peristome double, usually expanded and reflected, foot without any groove CYCLOPHORIDAE
- Peristome simple, thin, foot with a median groove POMATIASIDAE
- 4. Shell elongate-ovate or conoid, longer than broad 7
- Shell depressed, broader than long 5
- 5. Shell with thickened and reflected peristome 6
- Shell with simple peristome ARIOPHANTIDAE/HELICARIONIDAE
- 6. Columella reflected over umbilicus, umbilical opening rather narrow CAMAENIDAE
- Columella not reflected over umbilicus, umbilical opening wide BRADYBAENIDAE
- 7. Shell small, upto 5mm in length 8
- Shell larger, above 5mm in length 9
- 8. Last whorl scarcely broader than the penultimate whorl, not ascending in front PUPILLIDAE
- Last whorl broader than the penultimate whorl, ascending in front VERTIGINIDAE
- 9. Shell with denticulate aperture STREPTAXIDAE
- Shell with simple aperture 10
- 10. Shell very large and swollen, seldom below 50 mm in length ACHATINIDAE
- Shell small, and narrow, seldom exceeding 30 mm in length 11
- 11. Spire equal or shorter than the last whorl in length 12
- Spire larger than the last whorl in length SUBULINIDAE
- 12. Shell thin, imperforate, last whorl constituting 75% to 90% of the total length, columella not reflected SUCCINEIDAE

- Shell fairly thick, perforate, last whorl equal or slightly larger than spire, columella reflected CERASTUIDAE

Family CYCLOPHORIDAE

Subfamily CYCLOPHORINAE

Genus *Cyclophorus* Montfort, 1810

81. *Cyclophorus (Annularia) aurantiacus* (Schumacher)

Material examined/Source : Patil and Talmale (2005b).

Distribution : India : Maharashtra.

Subgenus *Glossostylus* Kobelt & Moellendorff, 1899

82. *Cyclophorus (Glossostylus) indicus* (Deshayes)

1832. *Cyclostoma indicus* Deshayes. In Balanger, Voy. Ind. Orient. Zool., 415, pl. 1, figs. 4,5.

1921. *Cyclophorus indicus* Gude, Fauna of British India, Mollusca, III : 63.

1979. *Cyclophorus indicus*, Subba Rao and Mitra, Rec. zool. Surv. India, 75 :

Material examined/Source : Tonapi (1971); Subba Rao and Mitra (1979); Patil and Talmale (2005b); Patil (2006).

Distribution : India : Maharashtra : Mumbai Suburban Dist. : Sanjay Gandhi National Park, Borivali; Pune Dist. : Pune; Raigad Dist. : Elephanta Island.

Remarks : It is restricted to Western India.

83. *Cyclophorus (Glossostylus) stenomphalus* Pfeiffer

1846. *Cyclostoma stenomphalus* Pfeiffer, Zeits. Malak. iii, p.44.

1921. *Cyclophorus (Glossostylus) stenomphalus* Gude, Fauna of British India, Mollusca, III : 67.

Material examined/Source : Patil and Talmale (2005b).

Distribution : India : Maharashtra (Elephant Island, near Mumbai).

Elsewhere : Bhutan.

Subgenus *Litostylus* Kobelt & Moellendorff, 1899

84. *Cyclophorus (Litostylus) involvus* (Mueller)

1825. *Helix involvus* Mueller, *Hist. Verm.* Part 2 P. 84. Wood index Text Pl. 25, fig. 8.

1899. *Cyclophorus (Litostylus) involvus* : Kobelt, *Mollendorff Nachr. Deuts. Malali. Ges.*, 29 : 105.

2006. *Cyclophorus (Litostylus) involvus* : Patil, *Molluscs*, In : Fauna of Sanjay Gandhi National Park, Conservation Area Series, 26 : 16 (Publ., Director, Zool. Surv. India, Kolkata).

Material examined/Source : Patil and Talmale (2005b); Patil (2006).

Distribution : India : Maharashtra : Mumbai Suburban Dist. : Sanjay Gandhi National Park, Borivali.

Genus *Cyathopoma* Blanford, 1861

Subgenus *Cyathopoma* s. st.

85. *Cyathopoma (Cyathopoma) deccanense* Blanford

1868. *Cyathopoma deccanense* Blanford, *J. Conchyl.*, 16 :

1921. *Cyathopoma (Cyathopoma) deccanense* : Gude, *Fauna British India, Mollusca*, 3 : 134.

2004. *Cyathopoma (Cyathopoma) deccanense* : Mitra, Dey and Ramakrishna, *Pictorial Handbook – Indian Land Snails* (Selected Species), : 59-60 (Publ.,- Director, Zool. Surv. India, Kolkata).

Diagnostic characters : Shell small, turbate, narrowly umbilicate, pale whitish with a deciduous epidermis, close radial striae and distinct raised spiral ribs present throughout continuing within the umbilicus, whorls 4½, convex, last whorl swollen and cylindrical with 5-6 raised spiral ribs; aperture suboblique, circular, peristome not much expanded, crenulated at the terminations of the raised spiral ribs, operculum with raised edges to the whorls, incurved towards centre.

Material examined/Source : Mitra *et al.*, 2004.

Distribution : India : Western Ghat : Maharashtra : Pune Dist. : Khandalla, Bhore Ghat (upto 4000 ft.).

Remarks : Not common (Mitra *et al.*, 2004). Endemic to Western Ghats and Peninsular India (Ramakrishna and Mitra, 2002).

Family DIPLOMMATINIDAE

Subfamily DIPLOMMATININAE

Genus *Nicida* Blanford, 1868

86. *Nicida loricincta* Blanford

1868. *Diplommata (Nicida) loricincta*, Blanford, *J. Conchyl.*, 16 : 336, pl. 14, fig. 5.

1921. *Nicida loricincta* : Gude, *Fauna British India, Mollusca*, 3 : 293.

Material examined/Source : Gude (1921); Patil and Talmale (2005b).

Distribution : India : Maharashtra (Khandala, Pune Dist.).

Genus *Opisthostoma* Blanford, 1861

87. *Opisthostoma fairbanki* Blanford

1866. *Opisthostoma fairbanki*, Blanford, *Proc. Zool. Soc.*, P. 448, pl. 38, fig. 14.

1921. *Opisthostoma fairbanki* : Gude, *Fauna British India, Mollusca*, 3 : 298.

Material examined/Source : Gude (1921), Patil and Talmale (2005b).

Distribution : India : Maharashtra (Khandala, Pune Dist.).

Family POMATIASIDAE

Subfamily CYCLOTOPSINAE

Genus *Cyclotopsis* Blanford, 1864

88. *Cyclotopsis semistriata* (Sowerby)

1843. *Cyclostoma semistriatum* Sowerby, *Thes. Conch.*, 1 : 91, pl. 23, fig. 6.

1921. *Cyclotopsis semistriata* : Gude, *Fauna of British India, Mollusca*, 3 : 353.

2004. *Cyclotopsis semistriata* : Mitra, Dey and Ramakrishna, *Pictorial Handbook – Indian Land Snails* : 110-111.

Diagnostic characters : Shell depressedly orbiculate, rather narrowly umbilicate, thin, whitish with spirally arranged brown spots, finely, spirally striate above; smooth below, spiral striae also present inside the umbilicus; whorls 4, rounded; last whorl large, slightly descending; suture deep; aperture rather oblique, peristome thin, scarcely reflected continuous, acuminate above.

Material examined/Source : Tonapi (1971); Subba Rao and Mitra (1979); Mitra *et al.* (2004); Patil and Talmale (2005b).

Distribution : Maharashtra : Pune Dist. : Pune.

Remarks : It is restricted to hills near Pune city (Subba Rao and Mitra, 1979).

Subclass PULMONATA
Order STYLOMMATOPHORA
Family PUPILLIDAE
Subfamily PUPILLINAE

Genus *Pupoides* Pfeiffer, 1854

89. *Pupoides tutulus* (Reeve)

1849. *Bulimus tutulus* (Benson) Reeve, *Conch. Icon.*, 5 *Bulimus*, pl. 84, fig. 625.
1914. *Pupoides tutulus* : Gude, *Fauna of British India, Mollusca*, 2 : 261.
2004. *Pupoides tutulus*: Mitra, Dey and Ramakrishana, *Pictorial Handbook—Indian Land Snails*, : 119-120.

Material examined/Source : Mitra *et al.* (2004).

Distribution : India : Maharashtra, Bihar, Delhi, Gujrat, Madhya Pradesh, Rajasthan, Uttar Pradesh.

Family VERTIGINIDAE
Subfamily GASTROCOPTINAE
Genus *Gastrocopta* Wollaston, 1878
90. *Gastrocopta bathyodon* (Benson)

1863. *Pupa bathyodon* Benson, *Ann. Mag. Nat. Hist.*, (3)12 : 426.
1914. *Bifidaria bathyodon* : Gude, *Fauna Brit. India, Mollusca*, 2 : 290.
2004. *Gastrocopta bathyodon* : Mitra, Dey and Ramakrishana, *Pictorial Handbook—Indian Land Snails* : 124-125.

Material examined/Source : Mitra *et al.* (2004).

Distribution : India : Maharashtra.

Subfamily NESOPUPINAE
Genus *Pupisoma* Stoliczka, 1873
91. *Pupisoma evezardi* (Blanford)

1875. *Pupa evezardi* Blanford Mss., Hanley and Theobald, *Conch. Indica*, P. 41, pl. 101, figs. 5,6.

1880. *Pupa (Pupisoma) evezardi* Blanford, *J. Asiat. Soc. Bengal.*, 49 : 199.

Material examined/Source : Subba Rao and Mitra (1979); Patil and Talmale (2005b)

Distribution : India : Maharashtra : Pune Dist. : Lonavala, Khandala.

Family CERASTUIDAE

Genus *Cerastua* Strand, 1928

92. *Cerastua abyssinicus* (Pfeiffer)

1845. *Bulimus abyssinicus* (Ruppell) Pfeiffer, *Zeit. Malak.* ii, p. 157.
1914. *Cerastus abyssinicus* : Gude, *Fauna Brit. India, Mollusca*, 2 : 263.

Material examined/Source : Gude (1914); Patil and Talmale (2005b).

Distribution : India : Maharashtra : Pune; Bombay Island; Madhya Pradesh.

93. *Cerastua densus* (Pfeiffer)

1856. *Bulimus (Petraeus) densus* Pfeiffer, *Malack. Blatt.*, 2 : 154.
1914. *Cerastus densum* : Gude, *Fauna Brit. India, Mollusca*, 2 : 269.
1979. *Cerastus densum* : Subba Rao and Mitra, *Rec. zool. Surv. India*, 75 : 12.

Material examined/Source : Subba Rao and Mitra (1979); Patil and Talmale (2005).

Distribution : India : Maharashtra : Ahmadnagar Dist. : Ahmadnagar; Pune Dist. : Pune, Kerala.

94. *Cerastua distans* (Pfeiffer)

1856. *Bulimus distances* Pfeiffer, *P.Z.S.* 1856, p. 331.
1914. *Cerastus distances*: Gude, *Fauna Brit. India, Mollusca*, 2 : 270.

Material examined/Source : Gude (1914); Patil and Talmale (2005b).

Distribution : India : Maharashtra : Pune.

Elsewhere : Karak I., Persian Gulf.

95. *Cerastua jerdoni* (Reeve)

1848. *Bulimus jerdoni* (Benson) Reeve, *Conch. Icon.* v, *Bullimus*, pl. 46, fig. 297.
1914. *Cerastus jerdoni* : Gude, *Fauna Brit. India, Mollusca*, 2 : 265.

Material examined/Source : Gude (1914); Patil and Talmale (2005b).

Distribution : India : Maharashtra : Pune.

96. *Cerastua jerdoni* var. *redfieldi* (Pfeiffer)

1854. *Bulimus redfieldi* Pfeiffer, *Malak. Blatt.* I, p. 66.
1914. *Cerastus jerdoni* var. *redfieldi* : Gude, *Fauna of British India, Mollusca*, 2 : 266.

Material examined/Source : Gude (1914); Patil and Talmale (2005b).

Distribution : India : Maharashtra : Ahmednagar, Pune.

97. *Cerastua fairbanki* (Pfeiffer)

1857. *Bulimus fairbanki* Pfeiffer, *Proc. Zool. Soc. Lond.*, p. 109.
1914. *Cerastus fairbanki* : Gude, *Fauna of British India, Mollusca*, 2 : 264.
2004. *Cerastua fairbanki*: Mitra, Dey and Ramakrishana, *Pictorial Handbook—Indian Land Snails* : 136-137.

Material examined / Source : Gude (1914); Mitra *et al.*, 2004.

Distribution : India : Maharashtra : Ahmednagar.

98. *Cerastua moussonianus* (Petit)

1851. *Bulimus moussonianus* Petit, *J. Conchyl.*, 2 : 266, pl. 7, fig. 4.
1914. *Cerastus moussonianus* : Gude, *Fauna of British India, Mollusca*, 2 : 267.
2004. *Cerastua moussonianus* : Mitra, Dey and Ramakrishana, *Pictorial Handbook—Indian Land Snails* : 137.

Material examined/Source : Mitra *et al.*, 2004.

Distribution : India : Maharashtra, Gujarat.

Genus *Edouardia* Gude, 1914

99. *Edouardia orbus* (Blanford)

1861. *Bulimus orbus* Blanford, *J. Asiat. Soc. Beng.*, 30 : 361, pl. 1, fig. 14.

1914. *Endouardia orbus* : Gude, *Fauna Brit. India, Mollusca*, 2 : 280.

2004. *Endouardia orbus*: Mitra, Dey and Ramakrishana, *Pictorial Handbook—Indian Land Snails*, : 138.

Material examined/Source : Mitra *et al.*, 2004.

Distribution : India : Maharashtra, Andhra Pradesh, Tamil Nadu.

Genus *Rachis* Albers, 1850

100. *Rachis punctatus* (Anton)

1839. *Butinus punctatus* Anton, *Verzeich. conch.*, : 42.
1914. *Rachis punctatus* : Gude, *Fauna Brit. India, Mollusca*, 2 : 277.
2004. *Rachis punctatus* : Mitra, Dey and Ramakrishana, *Pictorial Handbook—Indian Land Snails* : 140.

Diagnostic characters : Shell ovately conical, distinctly perforate, marked with transverse streaks throughout and a single narrow chocolate band below the periphery, pale white; whorls 7-8, fairly rounded, last whorl with a single band, rarely an indistinct second band exists, apex acute; aperture ovate, peristome slightly thickened; columella dilated and reflected.

Material examined/Source : Tonapi (1971), Subba Rao and Mitra (1979), Patil and Ramakrishna (2004); Patil and Talmale (2005a,b); Patil *et al.* (2006).

Distribution : India : Maharashtra : Chandrapur Dist. : Tadoba Andhari Tiger Reserve; Nagpur Dist. : Pench National Park; Pune Dist. : Pune, Goa, Jharkhand, Madhya Pradesh, Tamil Nadu, Uttar Pradesh, Orissa and West Bengal.

Elsewhere : Africa, Sri Lanka.

Remarks : Common throughout Maharashtra.

101. *Rachis bengalensis* Lamarck

1822. *Bulimus bengalensis* Lamarck, *Hist. Nat. Anim. Sans. Vert.*, 6(2) : 124.
1914. *Rachisellus bengalensis* : Gude, *Fauna of British India, Mollusca*, 2 : 273.
2004. *Rachis bengalensis* : Mitra, Dey and Ramakrishna, *Pictorial Handbook—Indian Land Snails*, : 139 (Publ., : Director, Zool. Surv. India, Kolkata).

Diagnostic characters : Shell ovate, narrowly perforate, thin, nearly transparent, smooth, faintly spiral;ly striate,. Pale white or yellowish white, with 3-4 chocolate bands, the lower ones of which are more prominent; whorls 6, not much rounded, last whorl swollen; aperture oval, wide, peristome thin a little reflected; columellar margin dilated.

Material examined/Source : Patil and Talmale (2005b).

Distribution : India : Maharashtra, Orissa, Tripura, West Bengal.

Elsewhere : Bangladesh, Myanmar.

Remarks : Commonly found attached to stems, branches or leaves of trees.

102. *Rachis praetermissus* Blanford

1861. *Bulimus praetermissus* Blanford, *J.A.S.B.* xxx, p. 360.

1914. *Rachisellus praetermissus*: Gude, *Fauna of British India, Mollusca*, 2 : 275.

Material examined/Source : Patil and Talmale (2005b).

Distribution : India : Maharashtra : Bombay; Orissa, Tamil Nadu, Bengal.

Family SUBULINIDAE

Subfamily SUBULININAE

Genus *Subulina* Beck, 1837

103. *Subulina octona* (Bruguiere)

1789. *Bulimus octona* Bruguiere, *Encycl. Meth. Vers.*, 1 : 325.

1914. *Subulina octona* : Gude, *Fauna of British India, Mollusca*, 2 : 341.

2004. *Subulina octona* : Mitra, Dey and Ramakrishna, *Pictorial Handbook-Indian Land Snails*, : 152 (Publ., : Director, Zool. Surv. India, Kolkata).

Material examined/Source : Mitra et al. 2004.

Distribution : India : Maharashtra, Kerala, Andaman and Nicobar Islands, Tamil Nadu.

Elsewhere : Widely distributed through out America (North and South), Europe; Mauritius, Scyelles, Sri Lanka, West Africa etc.

Genus *Glessula* Von Martens, 1850

104. *Glessula arthuri* (Benson)

1864. *Achatina arthuri* Benson, *A.M.N.H.* ser. 3, xiii, p. 209.

1914. *Glessula arthuri*, Gude, *Fauna of British India, Mollusca*, 2 : 353.

Material examined/Source : Gude (1914); Patil and Talmale (2005b).

Distribution : India : Maharashtra : Satara Dist. : Mahabaleshwar.

105. *Glessula brevis* (Pfeiffer)

1861. *Achatina brevis*, Pfeiffer, *P.Z.S.*, : 387.

1914. *Glessula brevis*, Gude, *Fauna of British India, Mollusca*, 2 : 359.

Material examined/Source : Gude (1914); Patil and Talmale (2005b).

Distribution : India : Maharashtra : Ahmednagar Dist. : Ahmednagar, Pune Dist. : Pune; Rajasthan.

106. *Glessula chessoni* (Benson)

1860. *Achatina chessoni* Benson, *A.M.N.H.* ser. 3, v, p. 462.

1914. *Glessula chessoni*, Gude, *Fauna of British India, Mollusca*, 2 : 359.

Material examined/Source : Gude (1914); Patil and Talmale (2005b).

Distribution : India : Maharashtra : Satara Dist. : Mahabaleshwar, Nashik Dist. : Igatpuri; Pune Dist. : Torana and Purandar; Karnataka.

107. *Glessula ceylanica* (Pfeiffer)

1849. *Achatina ceylanica* Pfeiffer, *Zeits. Malak.* li, p. 157.

1914. *Glessula ceylanica* : Gude, *Fauna of British India, Mollusca*, 2 : 359.

1979. *Glessula ceylanica*: Subba Rao and Mitra, *Rec. zool. Surv. India*, 75 : 13

Material examined/Source : Tonapi (1971); Subba Rao and Mitra (1979); Patil and Talmale (2005b).

Distribution : India : Maharashtra : Pune Dist. : Pune.

Elsewhere : Sri Lanka.

108. *Glessula gemma* (Reeve)

1850. *Achatina gemma* Benson MS Reeve, *Conch. Icon.* 5, *Achatina*, pl. 22, fig. 123.
1914. *Glessula gemma* : Gude, *Fauna of British India, Mollusca*, 2 : 428.
2004. *Glessula gemma*: Mitra, Dey and Ramakrishna, *Pictorial Handbook—Indian Land Snails*, : 158-159 (Publ., : Director, Zool. Surv. India, Kolkata).

Material examined/Source : Subba Rao and Mitra (1979).

Distribution : India : Maharashtra : Pune Dist. : Pune; Bihar, Kerala, Meghalaya.

Elsewhere : Bangladesh, Myanmar.

109. *Glessula lyrata* Blanford

1870. *Glessula lyrata* Blanford, *J. A. S. B.*, 39 : 20.
1914. *Glessula lyrata* : Gude, *Fauna of British India, Mollusca*, 2 : 441-442.

Material examined/Source : Gude (1914); Patil and Talmale (2005b).

Distribution : India : Maharashtra : Pune Dist. : Khandala, Raigad Dist. : Matheran; Satara Dist. : Mahabaleshwar.

110. *Glessula illustris* var. *tumida* Godwin-Austen

1920. *Glessula illustris* var. *tumida* Godwin-Austen, *Land & Freshwater Moll. India*, 3(1) : 39.
1979. *Glessula illustris* var. *tumida* : Subba Rao and Mitra, *Rec. zool. Surv. India*, 75 : 13.

Material examined/Source : Subba Rao and Mitra (1979); Patil and Talmale (2005b).

Distribution : India : Maharashtra : Pune Dist. : Pune; Lukah valley, Jaintia.

111. *Glessula notigena* (Benson)

1860. *Achatina notigena* Benson, *Ann. & Mag. nat. Hist.*, (3) 5 : 462.
1914. *Glessula notigena*: Gude, *Fauna of British India, Mollusca*, 2 : 412.

Material examined/Source : Gude (1914); Tonapi (1971); Subba Rao and Mitra (1979); Patil and Talmale (2005b); Patil and Ramakrishna (2004); Patil *et al.* (2006).

Distribution : India : Maharashtra : Chandrapur Dist. : Tadoba Andhari Tiger Reserve; Nagpur Dist. : Pench National Park; Pune Dist. : Pune; Khandala; Satara Dist. : Mahabaleshwar; Assam, West Bengal, Sikkim.

Elsewhere : Bangladesh.

112. *Glessula pulla* Blanford

1870. *Glessula pulla* Blanford, *J.A.S.B.*, 39 : 21.
1914. *Glessula pulla* : Gude, *Fauna of British India, Mollusca*, 2 : 430.

Material examined/Source : Gude (1914); Patil and Talmale (2005b).

Distribution : India : Maharashtra : Pune Dist. : Torna.

113. *Glessula rugata* Blanford

1870. *Glessula rugata* Blanford, *J. A.S. B.*, 39 : 21.
1914. *Glessula rugata* : Gude, *Fauna of British India, Mollusca*, 2 : 442-443.

Material examined/Source : Gude (1914); Patil and Talmale (2005b).

Distribution : India : Maharashtra : Pune Dist. : Pune, Purandar.

114. *Glessula dikarngense* Godwin-Austen

1971. *Glessula (Rishetia) dikarngense* : Tonapi, *J. Bombay nat. Hist. Soc.*, 68(1) : 120.

Material examined/Source : Tonapi (1971); Patil and Talmale (2005b).

Distribution : India : Maharashtra : Pune Dist. : Pune.

115. *Glessula singhurensis* Blanford

1870. *Glessula singhurensis* Blanford, *J. A. S. B.*, 39 : 19.
1914. *Glessula singhurensis*: Gude, *Fauna of British India, Mollusca*, 2 : 418-419.

Material examined/Source : Gude (1914); Patil and Talmale (2005b).

Distribution : India : Maharashtra : Pune Dist. : Pune.

116. *Glessula tornensis* Blanford1870. *Glessula tornensis* Blanford, J.A.S.B., 39 : 19.1914. *Glessula tornensis* : Gude, *Fauna of British India, Mollusca*, 2 : 389.*Material examined/Source* : Gude (1914); Patil and Talmale (2005b).*Distribution* : India : Maharashtra : Pune Dist. : Torna, Pune; Kerala.117. *Glessula hebes* Pfeiffer1868. *Achatina hebes* (Blanford), Pfeiffer, *Mon. Helic. Viv.* vi, p. 230.1914. *Glessula hebes*: Gude, *Fauna of British India, Mollusca*, 2 : 382.*Material examined/Source* : Gude (1914); Patil and Talmale (2005b).*Distribution* : India : Maharashtra : Pune Dist. : Deo Ghat, Pune; Tamil Nadu.118. *Glessula textilis* (Blanford)1866. *Achatina textilis* Blanford, *J. Asiat. Soc. Beng.*, 35 : 41.1914. *Glessula textilis*: Gude, *Fauna of British India, Mollusca*, 2 : 390.*Material examined/Source* : Gude (1914); Mitra *et al.* (2004); Patil and Talmale (2005b).*Distribution* : India (Western Ghats) : Maharashtra : Satara Dist. : Mahabaleshwar; Karnataka; Kerala; Tamil Nadu.Genus *Lamellaxis* Strebel and Pfeiffer, 1882Subgenus *Allopeas* H.B. Baker, 1935119. *Lamellaxis (Allopeas) gracile* (Hutton)1834. No. 5, *Bulimus* ? Hutton, *J. Asiat. Soc. Beng.*, 3 : 84.1914. *Opeas gracile* : Gude, *Fauna of British India, Mollusca*, 2 : 355.2004. *Lamellaxis (Allopeas) gracile* : Mitra, Dey and Ramakrishna, *Pictorial Handbook—Indian Land Snails*, : 152 (Publ., : Director, Zool. Surv. India, Kolkata).*Material examined/Source* : Gude (1914); Tonapi and Mulherkar (1963); Subba Rao and Mitra (1979); Mitra *et al.* (2004); Patil and Ramakrishna (2004); Patil and Talmale (2005b).*Distribution* : Throughout India : Maharashtra : Pune Dist. : Pune; Mumbai Dist. : Bombay Island; Nagpur Dist. : Pench National Park.*Elsewhere* : Most common in south east Asia.

Subfamily RUMININAE

Genus *Zootecus* Westerlund, 1887120. *Zootecus chion* (Pfeiffer)1856. *Bulimus chion* Pfeiffer, *P.Z.S.*, p. 332.1914. *Zootecus chion* : Gude, *Fauna of British India, Mollusca*, 2 : 355.*Material examined/Source* : Tonapi and Mulherkar (1963); Patil and Talmale (2005b).*Distribution* : India : Maharashtra : Pune Dist. : Pune; Andhra Pradesh; Punjab.*Elsewhere* : Afghanistan.121. *Zootecus insularis* (Ehrenberg)1831. *Pupa insularis* Ehrenberg, *Symb. Phys. Anim. Evert.*, Series 1, p.3.1914. *Zootecus insularis* : Gude, *Fauna of British India, Mollusca*, 2 : 367.2004. *Zootecus insularis* : Mitra, Dey and Ramakrishna, *Pictorial Handbook—Indian Land Snails*, : 165 (Publ., : Director, Zool. Surv. India, Kolkata).*Material examined/Source* : Gude (1914); Tonapi and Mulherkar (1963); Subba Rao and Mitra (1979); Patil and Talmale (2005b).*Distribution* : India : Drier regions of the country. Maharashtra : Pune Dist. : Pune ; Mumbai Dist. : Bombay Island; Andhra Pradesh, Bihar, Delhi, Gujrat, Kashmir, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh.*Elsewhere* : Africa, Arab countries, Myanmar, Sri Lanka.

Family ACHATINIDAE

Genus *Achatina* Lamarck, 1799Subgenus *Lissachatina* Bequaert, 1951122. *Achatina (Lissachatina) fulica fulica* (Bowdich)1822. *Achatina fulica* 'Lamarck' Bowdich, *Elements of Conchology*, 1, pl. 13, fig. 8.

2004. *Achatina fulica fulica* : Mitra, Dey and Ramakrishna, *Pictorial Handbook—Indian Land Snails*, : 166 (Publ., : Director, Zool. Surv. India, Kolkata).

Material examined/Source : Mitra *et al.* (2005); Patil and Talmale (2005b).

Distribution : India : Throughout the country except north-west region.

Elsewhere : Malagasy, Mauritius, Scydhelles, Singapore, Zanzibar.

Family STREPTAXIDAE

Subfamily STREPTAXINAE

Genus *Streptaxis* Gray, 1837

123. *Streptaxis scalptus* Blanford

1899. *Streptaxis scalptus* Blanford, *P. Z. S.*, p. 766, pl. 50, figs. 8,9,10.
1908. *Streptaxis scalptus* : Blanford & Godwin-Austen, *The Fauna of British India, Including Ceylon and Burma, Mollusca*, (Testacellidae and Zonitidae) : 12.

Material examined/Source : Subba Rao and Mitra (1979); Patil and Talmale (2005b).

Distribution : India : Maharashtra (Torna Hills, Pune); Tamil Nadu, Karnataka.

Family SUCCINEIDAE

Subfamily SUCCINEINAE

Genus *Succinea* Draparnaud, 1810

124. *Succinea raoi* Subba Rao and Mitra

1925. *Succinea arboricola* Rao, *Rec. Indian Mus.*, **27** : 394, figs.7-10 (Preoccupied).
1976. *Succinea raoi* Subba Rao and Mitra, *Nautilus*, **90**(3) : 125.
2004. *Succinea raoi* : Mitra, Dey and Ramakrishna, *Pictorial Handbook—Indian Land Snails*, : 198 (Publ., : Director, Zool. Surv. India, Kolkata).

Material examined/Source : Mitra *et al.*, 2004.

Distribution : India : Maharashtra : Lonavala (Under bark of mango trees (Mitra *et al.*, 2004); Karnataka (Mavinkurve *et al.*, 2004).

Remarks : Endemic to the Western Ghat (Mitra *et al.*, 2004).

125. *Succinea collina* Hanley & Theobald

1876. *Succinea collina* Hanley & Theobald, *Conch. Indea*. p. 30. pl. 68, figs. 8, 9.
1924. *Succinea collina* : Rao, *Rec. Indian Mus.*, **26** : 384.
1979. *Succinea collina* : Subba Rao and Mitra, *Rec. zool. Surv. India*, **75** : 29.

Material examined/Source : Subba Rao and Mitra (1979); Patil and Talmale (2005b).

Distribution : India : Maharashtra : Pune Dist. : Torana; Satara Dist. : Mahabaleshwar.

Remarks : Restricted to Western Ghats (Subba Rao and Mitra, 1979).

126. *Succinea tornadri* Rao

1924. *Succinea tornadri* Rao, *Rec. Indian Mus.*, **26** : 384.
1979. *Succinea tornadri* : Subba Rao and Mitra, *Rec. zool. Surv. India*, **75** : 29-30.

Material examined/Source : Subba Rao and Mitra (1979); Patil and Talmale (2005b).

Distribution : India : Maharashtra : Pune Dist. : Torana, Pune.

Genus *Camptonyx* Benson, 1858

Subgenus *Lithotis* Blanford, 1861

127. *Camptonyx (Lithotis) rupicola* Blanford

1863. *Succinea (Lithotis) rupicola* Blanford, *Ann. Mag. Nat. Hist.*, (3)**12** : 186.
1914. *Lithotis rupicola* : Gude, *Fauna of British India, Mollusca*, **2** : 458.
2004. *Camptonyx (Lithotis) rupicola* : Mitra, Dey and Ramakrishna, *Pictorial Handbook—Indian Land Snails*, : 200-201 (Publ., : Director, Zool. Surv. India, Kolkata).

Material examined/Source : Subba Rao and Mitra, 1979; Mitra *et al.*, 2004.

Distribution : India : Maharashtra : Pune Dist. : Khandala.

Remarks : Endemic to the Western Ghats (Mitra *et al.*, 2004).

128. *Camptonyx (Lithotis) tumida* Blanford

1870. *Succinea (Lithotis) tumida* Blanford, *J. Asiat. Soc. Beng.*, **39** : 23, pl. 3, fig. 24.

1914. *Lithotis tumida* : Gude, *Fauna of British India, Mollusca*, 2 : 459.
2004. *Camptonyx (Lithotis) tumida* : Mitra, Dey and Ramakrishna, *Pictorial Handbook-Indian Land Snails*, : 201-202 (Publ., : Director, Zool. Surv. India, Kolkata).

Material examined/Source : Subba Rao and Mitra, 1979; Mitra *et al.*, 2004

Distribution : India : Maharashtra : Pune.

Remarks : Endemic to the Western Ghats (Mitra *et al.*, 2004).

Subfamily CATINELLINAE

Genus *Indosuccinea* Rao, 1924

129. *Indosuccinea khandalla* Rao

1924. *Indosuccinea semiserica* f. *khandakka* Rao, *Rec. Indian Mus.*, 26 : 407.
2004. *Indosuccinea khandalla*: Mitra, Dey and Ramakrishna, *Pictorial Handbook-Indian Land Snails*, : 203-204 (Publ., : Director, Zool. Surv. India, Kolkata).

Material examined/Source : Subba Rao and Mitra, 1979; Mitra *et al.*, 2004.

Distribution : India : Maharashtra : Pune Dist. : Khandalla.

Remarks : Known from type locality only (Mitra *et al.*, 2004).

130. *Indosuccinea semiserica* (Gould)

1846. *Succinea semiserica* Gould, *Proc. Boston Soc. Nat. Hist.*, 2 : 100.
1914. *Succinea semiserica* : Gude, *Fauna of British India, Mollusca*, 2 : 452.
1924. *Indosuccinea semiserica* : Rao, *Rec. Indian Mus.*, 26 : 374.
2004. *Indosuccinea semiserica* : Mitra, Dey and Ramakrishna, *Pictorial Handbook- Indian Land Snails*, : 202-203 (Publ., : Director, Zool. Surv. India, Kolkata).

Material examined/Source : Mitra *et al.*, 2004.

Distribution : India : Maharashtra, Manipur, West Bengal.

Elsewhere : Bangladesh, Myanmar.

Genus *Quickia* Odhner, 1950

131. *Quickia bensoni* (Pfeiffer)

1849. *Succinea bensoni* Pfeiffer, *Proc. Zool. Soc. Lond.*, 1849 : 133.
1992. *Quickia bensoni* : Mitra and Dey, *Fauna of West Bengal, State Fauna Series*, 3 : 41.
2004. *Quickia bensoni* : Mitra, Dey and Ramakrishna, *Pictorial Handbook-Indian Land Snails*, : 202-203 (Publ., : Director, Zool. Surv. India, Kolkata).

Material examined/Source : Subba Rao and Mitra (1979); Mitra *et al.*, 2004.

Distribution : India : Maharashtra : Mumbai Dist. : Mumbai; Pune Dist. : Pune, Gujarat; Uttar Pradesh, West Bengal.

132. *Quickia gravelyi* (Rao)

1924. *Succinea gravelyi* Rao, *Rec. Indian Mus.*, 26 : 401.
1971. *Quickia gravelyi* : Patterson, *Mal. Rev.*, 4 : 171.
2004. *Quickia gravelyi* : Mitra, Dey and Ramakrishna, *Pictorial Handbook- Indian Land Snails*, : 205 (Publ., : Director, Zool. Surv. India, Kolkata).

Material examined/Source : Mitra *et al.*, 2004.

Distribution : India : Maharashtra, Andhra Pradesh, Tamil Nadu.

Family HELICARIONIDAE

Subfamily HELICARIONINAE

Genus *Eurychlamys* Godwin-Austen, 1899

133. *Eurychlamys platychlamys* Blanford

1880. *Macrochlamys platychlamys* Blanford, *J. Asiat. Soc. Beng.*, 2 : 195, pl. 2, fig. 9.
1903. *Eurychlamys platychlamys* : Blanford and Godwin-Austen, *Fauna Brit. India, Mollusca*, p. 188, fig. 65 A-D.
1979. *Eurychlamys platychlamys* : Subba Rao and Mitra, *Rec. zool. Surv. India*, 75 : 16-17.

Material examined/Source : Subba Rao and Mitra (1979); Patil and Talmale (2005b).

Distribution : India : Maharashtra : Pune and Mumbai.

Genus *Pseudaustenia* Cockerell, 1891134. *Pseudaustenia atra* Godwin-Austen

1888. *Africarion atra* Godwin-Austen, *Moll. Ind.*, 1 : 244, pl. 57, figs. 1-6.
1908. *Pseudaustenia atra* : Blanford & Godwin-Austen, *Fauna of British India, Mollusca*, (Testacellidae & Zonitidae), p. 207.
2004. *Pseudaustenia atra* : Mitra, Dey and Ramakrishna, *Pictorial Handbook-Indian Land Snails*, : 207 (Publ., : Director, Zool. Surv. India, Kolkata).

Material examined/Source : Subba Rao and Mitra (1979); Mitra *et al.* (2004); Patil and Talmale (2005b)

Distribution : India : Maharashtra, South Indian Hill (Kerala, Tamil Nadu).

Remarks : Endemic to Western Ghats and Peninsular India (Ramakrishna and Mitra, 2002).

Subfamily SESARINAE

Genus *Kaliella* Blanford 1863135. *Kaliella barrackporensis* Pfeiffer

1952. *Helix barrackporensis* Pfeiffer, *Proc. Zool. Soc. Lond.*, 1852 : 156.
1908. *Kaliella barrackporensis* : Blanford & Godwin-Austen, *Fauna of British India, Mollusca*, (Testacellidae & Zonitidae), p. 258.
2004. *Kaliella barrackporensis* : Mitra, Dey and Ramakrishna, *Pictorial Handbook-Indian Land Snails*, : 211 (Publ., : Director, Zool. Surv. India, Kolkata).

Material examined/Source : Subba Rao and Mitra (1979); Mitra *et al.* (2004); Patil and Talmale (2005b).

Distribution : India : Widely distributed from Kashmir to Kanya Kumari.

Elsewhere : Bangladesh, Myanmar, Pakistan, Sri Lanka.

136. *Kaliella bullula* (Hutton)

1837. *Helix bullula* Hutton, *J. Asiat. Soc. Beng.*, 7 : 218.
1908. *Kaliella bullula* : Blanford & Godwin-Austen, *Fauna of British India, Mollusca*, (Testacellidae & Zonitidae), p. 267.
2004. *Kaliella bullula* : Mitra, Dey and Ramakrishna, *Pictorial Handbook-Indian Land Snails*, : 211 (Publ., : Director, Zool. Surv. India, Kolkata).

Material examined/Source : Tonapi (1971); Patil and Talmale (2005b).

Distribution : India : Maharashtra : Pune Dist. Pune, Western Himalaya (Himachal Pradesh, Uttaranchal).

Genus *Sivella* Blanford, 1883137. *Sivella billeana* (Moerch)

1872. *Nanina (Videna) billeana* Moerch, *J. Conchyl.*, 1872 : 310.
1914. *Trochomorpha (Sivella) billeana* : Gude : *Fauna of British India, Mollusca*, 2 : 4.
2004. *Sivella billeana* : Mitra, Dey and Ramakrishna, *Pictorial Handbook-Indian Land Snails*, : 221 (Publ., : Director, Zool. Surv. India, Kolkata).

Material examined/Source : Subba Rao and Mitra (1979); Mitra *et al.* (2004).

Distribution : India : Maharashtra : Pune Dist. : Pune, Nicobar Islands.

Family ARIOPHANTIDAE

Subfamily ARIOPHANTINAE

Genus *Ariophanta* Desmoulins, 1829138. *Ariophanta bajadera* (Pfeiffer)

1850. *Helix bajadera* Pfeiffer, *Zeitschr. Mal.*, 1850 : 69.
1908. *Ariophanta bajadera* : Blanford and Godwin-Austen, *Fauna of British India, Mollusca*, Testacellidae & Zonitidae, : 31.
2004. *Ariophanta bajadera* : Mitra, Dey and Ramakrishna, *Pictorial Handbook-Indian Land Snails*, : 226-227 (Publ., : Director, Zool. Surv. India, Kolkata).

Diagnostic characters : Shell moderately arge, globosely turbinata, sinistral, greenish brown, thin, very narrowly perforate, coarsely, obliquely ribbed above, smoother below, apex obtuse; Suture deep; whorls 4-5, rounded, the last swollen and well rounded.

Material examined/Source : Subba Rao and Mitra (1979); Mitra *et al.* (2004); Patil *et al.* (2006);

Distribution : Maharashtra : Chandrapur Dist. : Tadoba Andhari Tiger Reserve; Mumbai Dist. : Mumbai; Goa.

Remarks : Endemic to Western Ghats and Peninsular India (Ramakrishna and Mitra, 2002).

139. *Ariophanta laevipes* (Muller)

1856. *Helix laevipes* Muller, *Hist. Ver.*, 2 : 22.

1908. *Ariophanta laevipes* : Blanford and Godwin-Austen, *Fauna of British India, Mollusca, Testacellidae & Zonitidae*, : 29.

2004. *Ariophanta laevipes* : Mitra, Dey and Ramakrishna, *Pictorial Handbook-Indian Land Snails*, : 226-227 (Publ., : Director, Zool. Surv. India, Kolkata).

Material examined/Source : Mitra *et al.* (2004).

Distribution : Maharashtra, Andhra Pradesh, Gujrat.

Remarks : Common in gardens.

Genus *Cryptozona* Morch, 1872

140. *Cryptozona semirugata* (Beck)

1837. *Galaxis semirugata* Beck, *Ind.*, 1837. : 42.

1908. *Ariophanta semirugata* : Blanford and Godwin-Austen, *Fauna of British India, Mollusca, Testacellidae & Zonitidae*, : 35.

2004. *Cryptozona semirugata* : Mitra, Dey and Ramakrishna, *Pictorial Handbook-Indian Land Snails*, : 236-237 (Publ., : Director, Zool. Surv. India, Kolkata).

Material examined/Source : Tonapi (1971); Subba Rao and Mitra (1979); Patil and Talmale (2005b).

Distribution : India : Maharashtra : Pune; Peninsular part of the country (including Maharashtra), from Gujarat southwards.

Elsewhere : Sri Lanka.

141. *Cryptozona (Xestina) belangeri* var. *bombayana* (Pfeiffer)

1841. *Helix bombayana* Pfeiffer, *Grat., Act. Soc. Lin. Bord.* xi, p. 406, pl. 1, fig. 1.

1963. *Cryptozona (Xestina) belangeri* var. *bombayana* : Tonapi and Mulherkar, *J. Bombay nat. Hist. Soc.*, 60 (1) : 115.

Material examined/Source : Tonapi and Mulherkar (1963); Patil and Talmale (2005).

Distribution : India : Maharashtra : Pune.

142. *Cryptozona bistrialis* (Beck)

1838. *Nanina bistrialis* Beck, *Ind. Moll.*, 1 : 2.

1908. *Cryptozona bistrialis* : Blanford and Godwin-Austen, *Fauna of British India, Mollusca, Testacellidae & Zonitidae*, : 39.

2004. *Cryptozona bistrialis* : Mitra, Dey and Ramakrishna, *Pictorial Handbook-Indian Land Snails*, : 233-234 (Publ., : Director, Zool. Surv. India, Kolkata).

Diagnostic characters : Shell subglobose depressed, perforate, thin, pale whitish to brownish with two narrow chocolate bands around, area between the two bands white, sometimes with a single band, rarely without; decussately sculptured both above and below; spire low; whorls 4½, very little convex, the last large, rounded above and below; aperture oblique, widely lunate, peristome thin, columellar margin slightly reflected.

Material examined/Source : Subba Rao and Mitra (1979); Patil and Talmale (2005b); Patil (2006).

Distribution : Maharashtra : Mumbai Suburban Dist. : Sanjay Gandhi National Park; Pune Dist. : Pune; Satara Dist. : Panchgani; Andhra Pradesh, Orissa, Tamil Nadu.

Elsewhere : Sri Lanka.

Genus *Euplecta* Semper, 1870

143. *Euplecta subdecussata* Pfeiffer

1859. *Nanina subdecussata* Pfeiffer, *Proc. Zool. Soc. Lond.*, 1857 : 107.

1908. *Euplecta subdecussata* : Blanford and Godwin-Austen, *Fauna of British India, Mollusca, Testacellidae & Zonitidae*, : 55.

2004. *Euplecta subdecussata* : Mitra, Dey and Ramakrishna, *Pictorial Handbook-Indian Land Snails*, : 239 (Publ., : Director, Zool. Surv. India, Kolkata).

Material examined/Source : Mitra *et al.* (2004) and Patil and Talmale (2005).

Distribution : India : Maharashtra, Orissa, Tamil Nadu.

Subfamily GIRASIINAE

Genus *Mariaella* Gray, 1855144. *Mariaella dussumieri* Gray1855. *Mariaella dussumieri* Gray, *Cat. Pulm. B.M.*, p. 63.1908. *Mariaella dussumieri* : Blanford and Godwin-Austen, *Fauna of British India, Mollusca, Testacellidae & Zonitidae*, : 205-206.*Material examined / Source* : Subba Rao and Mitra (1979).*Distribution* : India : Maharashtra (Mahabaleshwar), Karnataka in Western Ghats.*Elsewhere* : Sri Lanka.

Subfamily MACROCHLAMYDINAE

Genus *Macrochlamys* Benson, 1832145. *Macrochlamys pedina* (Benson)1865. *Helix pedina* Benson, *Ann. Mag. Nat. Hist.*, (3) 15 : 13.1908. *Macrochlamys pedina* : Blanford & Godwin-Austen, *Fauna of British India, Mollusca, Testacellidae & Zonitidae*, : 132.2004. *Kaliella bullula* : Mitra, Dey and Ramakrishna, *Pictorial Handbook-Indian Land Snails*, : 257-258 (Publ., : Director, Zool. Surv. India, Kolkata).*Material examined/Source* : Mitra et al. (2004); Patil and Talmale (2005b).*Distribution* : India : Western India, Maharashtra, Gujrat.146. *Macrochlamys indica* (Godwin & Austen)1908. *Macrochlamys indica* Blanford & Godwin-Austen, *Fauna of British India, Mollusca, Testacellidae & Zonitidae*, : 95.2004. *Macrochlamys indica* : Mitra, Dey and Ramakrishna, *Pictorial Handbook-Indian Land Snails*, : 255-256 (Publ., : Director, Zool. Surv. India, Kolkata).*Material examined/Source* : Subba Rao and Mitra (1979); Patil and Talmale (2005b).*Distribution* : India : Common throughout, except the drier parts of north-west region. Maharashtra : Pune Dist. : Pune.*Elsewhere* : Bangladesh, Sri Lanka.147. *Macrochlamys petrosa* (Hutton)1834. *Helix ? petrosa* Hutton, *J. Asiat. Soc. Beng.*, 3 : 96.1908. *Macrochlamys petrosa* : Blanford & Godwin-Austen, *Fauna of British India, Mollusca*, : 96.*Material examined/Source* : Subba Rao and Mitra (1979); Patil and Talmale (2005b).*Distribution* : Maharashtra, Assam, Bihar, Himachal Pradesh, Sikkim, Uttar Pradesh, West Bengal.148. *Macrochlamys petasus* (Benson)1859. *Helix petasus* Benson, *Ann. Mag. Nat. Hist.*, (3) 3 : 388.1908. *Macrochlamys ? petasus* : Blanford & Godwin-Austen, *Fauna British India, Mollusca*, : 115.1992. *Macrochlamys petasus* : Thakur, Mitra & Maitra, *Fauna of West Bengal, Land and Freshwater Molluscs, part II. State Fauna Series, 3*, : 103.*Material examined/Source* : Subba Rao and Mitra (1979).*Distribution* : India : Maharashtra. Arunachal Pradesh, Assam, West Bengal.*Elsewhere* : Myanmar.149. *Macrochlamys (Eurychlamys) platychlamys* Blanford1880. *Macrochlamys platychlamys* Blanford, *J. Asiat. Soc. Beng.*, 2 : 195, pl. 2, fig. 9.1908. *Eurychlamys platychlamys* : Blanford and Godwin-Austen, *Fauna Brit. India, Mollusca*, p. 188, fig. 65 A-D.*Material examined/Source* : Subba Rao and Mitra (1979).*Distribution* : India : Maharashtra : Mumbai and Pune Dists.150. *Macrochlamys infausta* Blanford1880. *Macrochlamys infausta* Blanford, Nania (Macrochlamys), *J. Asiat. Soc. Beng.*, 2 : 36.1908. *Macrochlamys infausta* : Blanford and Godwin-Austen, *Fauna Brit. India, Mollusca*, p. 133-134.1963. *Macrochlamys infausta* : Tonapi and Mulherkar, *J. Bombay nat. Hist. Soc.*, 60(1) : 115.*Material examined/Source* : Tonapi and Mulherkar (1963).

Distribution : India : Maharashtra (Pune); Andhra Pradesh, Rajasthan.

151. *Macrochlamys tenuicula* (H. Adams)

1868. *Macrochlamys tenicula* H. Adams, *Proc. Zool. Soc. Lond.*, : 14, Pl. 4 fig. 9.

1908. *Macrochlamys tenicula* Blanford & Godwin-Austen, *Fauna British India, Moll.*, : 130.

Material examined/Source : Subba Rao and Mitra (1979); Patil (2006).

Distribution : India : Maharashtra : Mumbai Suburban Dist. : Sanjay Gandhi National Park; Pune Dist. : Khandala; Satara Dist. : Satara (Type locality). Gujarat.

Subfamily DURGELLINAE

Genus *Sitala* H. Adams, 1856

152. *Sitala denselirata* Preston

1908. *Sitala denselirata* Preston, *Rec. Indian Mus.*, 2 : 187.

1979. *Sitala denselirata* : Subba Rao and Mitra, *Rec. zool. Surv. India*, 75 : 17.

2004. *Sitala denselirata* : Mitra, Dey and Ramakrishna, *Pictorial Handbook—Indian Land Snails*, : 291-292 (Publ., : Director, Zool. Surv. India, Kolkata).

Material examined/Source : Tonapi (1971); Subba Rao and Mitra (1979); Patil and Talmale (2005b).

Distribution : India : Maharashtra : Pune Dist. : Pune, Andaman Islands.

Family CAMAENIDAE

Subfamily CAMAENINAE

Genus *Chloritis* Beck, 1838

153. *Chloritis leithi* Gude

1914. *Chloritis leithi* Gude, *Proc. Malac. Soc. London*, xi, p. 53.

1914. *Chloritis leithi* Gude, *Fauna British India including Ceylon and Burma, Mollusca II (Trochomorphidae-Janellidae)*, :170

Material examined/Source : Subba Rao and Mitra (1979).

Distribution : India : Maharashtra (Bombay).

154. *Chloritis propinqua* (Pfeiffer)

1857. *Helix propinqua*, Pfeiffer, *P.Z.S.*, p. 109.

1914. *Chloritis propinqua* : Gude, *Fauna British India including Ceylon and Burma, Mollusca II (Trochomorphidae-Janellidae)*, : 169

Material examined/Source : Gude (1914); Subba Rao and Mitra (1979).

Distribution : India : Maharashtra (Khandala, Pune Dist.; Mumbai; Mahabaleshwar, Satara Dist.); Karnataka.

Genus *Landouria* Godwin-Austen, 1918

155. *Landouria hengdanensis* Godwin-Austen

1918. *Landouria hengdanensis* Godwin-Austen, *Rec. Indian Mus.*, 8 : 608.

2004. *Landouria hengdanensis* : Mitra, Dey and Ramakrishna, *Pictorial Handbook—Indian Land Snails*, : 312 (Publ., : Director, Zool. Surv. India, Kolkata).

Material examined/Source : Mitra et al. (2004).

Distribution : India : Maharashtra, Arunachal Pradesh, Madhya Pradesh.

Genus *Trachia* Albers, 1860

156. *Trachia asperella* (Pfeiffer)

1846. *Helix asperella* Pfeiffer, *Symb. Hist. Helic.*, 3 : 78.

1914. *Planispira (Trachia) asperella* : Gude, *Fauna of British India, Mollusca*, 2 : 155.

2004. *Trachia asperella*: Mitra, Dey and Ramakrishna, *Pictorial Handbook—Indian Land Snails*, : 314-315 (Publ., : Director, Zool. Surv. India, Kolkata).

Material examined/Source : Mitra et al. (2004).

Distribution : India : Maharashtra, Andhra Pradesh, Madhya Pradesh.

157. *Trachia crassicosata* (Benson)

1848. *Helix crassicosata* Benson, *Ann. Mag. Nat. Hist.*, (2)2 : 159.

1914. *Planispira (Trachia) crassicosata* : Gude, *Fauna of British India, Mollusca*, 2 : 158.

2004. *Trachia crassicosata* : Mitra, Dey and Ramakrishna, *Pictorial Handbook—Indian Land Snails*, : 315-316 (Publ., : Director, Zool. Surv. India, Kolkata).

Diagnostic characters : Shell small, depressed, openly perforate, fairly thick, white, very coarsely

sculptured with rather distant, oblique raised ribs above, sculpture is closer below; spire very low, convex, suture deep; whorls 4, narrow, flattened above, the last keeled at the periphery with a groove like depression just below, fairly convex at base, angulate around perforation, descending in front; aperture oblique, subcircular, peristome continuous, margin slightly reflected.

Material examined/Source : Subba Rao and Mitra (1979); Patil and Talmale (2005b).

Distribution : Peninsular India : Maharashtra : Pune Dist. : Pune.

Genus *Planispira* Beck, 1837

158. *Planispira footei* Stoliczka

1873. *Tachia footei* Stoliczka, J. A. S. B. xlii, p. 170.

1914. *Planispira footei*: Gude, *Fauna of British India, Mollusca*, 2 : 159.

Material examined / Source : Gude (1914).

Distribution : India : Maharashtra.

159. *Planispira proxima* (Ferussac)

1821. *Helix (Helicella) proxima* Ferussac, *Tabl. Syst., Limacons*, p. 43 (nom. Nud.).

1915. *Planispira proxima*: Gude, *Fauna of British India, Mollusca*, 2 : 162.

Material examined/Source : Tonapi and Mulherkar (1963).

Distribution : India : Maharashtra (Pune); Tamil Nadu.

Family BRADYBAENIDAE

Genus *Bradybaena* Beck, 1837

160. *Bradybaena sculpturita* (Benson)

1857. *Helix sculpturita* (Benson), Theobald, J.A.S.B. xxvi, p. 248 (nom. Nud.).

1914. *Eulota sculpturita*: Gude, *Fauna of British India, Mollusca*, 2 : 203.

Material examined/Source : Subba Rao and Mitra (1979).

Distribution : India : Maharashtra : Pune Dist. : Pune.

Elsewhere : Myanmar

SUMMARY

An attempt has been made here to give a consolidated list of land and freshwater mollusc species reported from Maharashtra State. The present paper depicts altogether 160 freshwater and land mollusca species belonging to 65 genera, under 30 families. This list of land and freshwater Mollusca of Maharashtra State is given on the basis of past and present records and from the recent surveys made in this area.

ACKNOWLEDGEMENTS

The authors are thankful to Dr. Ramakrishna, Director, Zoological Survey of India, Kolkata and Dr. Anil Mahabal, Officer-in-Charge, Zoological Survey of India, Western Regional Station, Pune for facilities.

REFERENCES

- Annandale, N. 1919. The fauna of certain small streams in Bombay Presidency, *Rec. Indian Mus.*, 16 : 117-120.
- Annandale, N. and Prashad, B. 1919. Some freshwater Mollusca from the Bombay Presidency, *Rec. Indian Mus.*, 16 : 139-152, pls. 4,5.
- Annandale, N. and Rao, H.S. 1925. Materials for a revision of recent Indian Limnaeidae (Mollusca, Pulmonata). *Rec. Indian Mus.*, 27 : 137-189.
- Blanford, W.R. 1863. "Descriptions of *Cremnoconchus syhadrensis* and *Lithotis rupicola* two new generic forms of Mollusca inhabiting cliffs in the Western Ghats of India. *Ann. Mag. nat. Hist.*, (3)12 : 184-187. pl. 4.

- Blanford, W.T. 1870. Contributions to Indian Malacology, No.XI Descriptions of new species of *Paludomus*, *Cremnoconchus*, *Cyclostoma* and of Helicidae from various parts of India. *J. asiat. Soc. Beng.*, **39**(2) : 9-25, pl. 3.
- Blanford, W.T. 1880. Contributions to Indian Malacology No.XII, Descriptions of new land and freshwater shells from Southern and Western India, Burmah, the Andaman Islands. *J. asiat. Soc. Beng.*, **49**(2) : 181-222, pl. I, II.
- Blanford, W.T. & Godwin Austen H.H. 1908. The fauna of British India, including Ceylon and Burma : Mollusca testacellidae and Zonitidae. Taylor & Francis, London.
- Gude, G.K. 1914. The fauna of British India including Ceylon and Burma Mollusca II (Iroknomorphidae Tanellidae) Taylor and Francis, London.
- Gude, G.K. 1921. The fauna of British India including Ceylon and Burma Mollusca III Land operculate, Taylor & Francis, London.
- Hora, S.L. 1926. On some interesting features of the Western Ghats, *J. Bombay nat. Hist. Soc.*, **31** : 447-449.
- Mitra, S. C., Dey, A. and Ramakrishna. 2004. Pictoral Handbook-Indian Land Snails (Selected species) : 1-344 (Published- Director, *Zool. Surv. India*, Kolkata)
- Patil S.G. 2003. Occurrence of freshwater Bivalves (Bivalvia:Unionidae) in Pusad, Yavatmal district, Maharashtra, *Zoos Print Journal*, **18**(9) : 1195.
- Patil, S.G. & Ramakrishna (2004). Mollusca In : *Fauna of Pench National Park, Conservation Area Series*, **20** : 141-158 (Published by the Director, *Zool. Surv. India*, Kolkata).
- Patil, S.G. and Ramakrishna. 2005. Freshwater Mollusca, In : Fauna of Nathsagar Wetland and Jaikwadi Bird Sanctuary (Maharashtra), *Wetland Ecosystem Series*, **7** : 101-114 (Published by the Director, *Zool. Surv. India*, Kolkata).
- Patil, S.G. 2005. Freshwater Mollusca of Melghat Tiger Project Maharashtra State (Published by the Director, *Zool. Surv. India*, Kolkata).
- Patil, S.G. 2006. Molluscs In : *Fauna of Sanjoy Gandhi National Park*, Bosivili Mumbai, *Conservation Area Series*, **26** : 9-18 (Published by the Director 2001. *Zool. Surv. India*, Kolkata).
- Patil, S.G., Ramakrishna and S.C. Mitra. 2006. Mollusca In : Fauna of Tadoba–Andhari Tiger Reserve (Maharashtra), *Conservation Area Series*, **25** : 161-176. (Published by the Director, *Zool. Surv. India*, Kolkata).
- Patil, S.G. & Talmale, S.S. 2003. Occurrence of a pestiferous land Mollusca from Maharashtra. On new host plants *Bionotes*, **5**(3) : 71.
- Patil, S.G. and Talmale, S.S. 2004. Biodiversity of a few aquatic fauna in Melghat Tiger Reserve, District Amaravati, Maharashtra. In : Proceedings of Symposium on three decades of project Tiger in Melghats, 8-9 October, 2004. Melghat Tiger Reserve, *Technical Bulletin No.*, **25** : 42-48.
- Patil, S.G. & Talmale, S.S. 2005a. A new record of land planeria and mollusca predating on earthworms. *Bionotes*, **7**(4) : 121.
- Patil, S.G. & Talmale, S.S. 2005b. A checklist of land and freshwater mollusca of Maharashtra State. *Zoos' Print Journal*, **20**(6) : 1912-1913.

- Preston, H.B. 1915. Fauna of British India including Ceylon and Burma, Mollusca (Freshwater Gastropoda and Pelecypoda), London, xix + 244 pp.
- Ramakrishna and Dey, Anirudha. 2007. Handbook on Indian freshwater molluscs : 1-399. (Published-Director, *Zool. Surv. India*, Kolkata)
- Rao, H.S. 1925. On certain succineid Molluscs from the Western Ghats, Bombay Presidency. *Rec. Indian Mus.*, **27** : 385-400.
- Rao, V.T. and Ramadoss, F. 1953. Damage to vegetable crops by slugs observed in the Krishna District and the experiments on their control. *J. Zool. Soc. India*, **5** : 211-216.
- Subba Rao, N.V. 1989. Handbook freshwater Molluscs of India, Ed. Director, *Zoological Survey of India*, Calcutta 289 pp.
- Subba Rao, N.V. and Mitra, S.C. 1975. On collections of Mollusca from Poona and adjacent districts. *Newsl. Zool. Surv. India*. **1**(4) : 77-79.
- Subba Rao, N.V. and Mitra, S.C. 1979. On land and freshwater Molluscs of Pune district, Maharashtra. *Rec. zool. Surv. India*, **75** : 1-37.
- Surya Rao, K.V., S.C. Mitra and S. Maitra, 2002. Mollusca of Ujani Wetland. *Wetland ecosystem series*, **2** fauna of Ujani, 110-115.
- Tonapi, G.T. and Mulherkar, Leela 1963. On the freshwater molluscs of Poona, *J. Bombay nat. Hist. Soc.*, **60**(1) : 104-120. Map., pls. i-v.
- Tonapi, G.T. 1971. Studies on the freshwater and amphibious Mollusca of Poona with notes on their distribution-Part II. *J. Bombay nat. Hist. Soc.*, **68**(1) : 115-126.

MARINE GASTROPODS (MOLLUSCA : GASTROPODA)

S.K. PATI and R.M. SHARMA

Zoological Survey of India, Western Regional Centre, Vidya Nagar, Sector No. 29, P.C.N.T Post,
Rawet Road, Akurdi, Pune-411 044, India

INTRODUCTION

Gastropoda is a biggest class in the Phylum Mollusca having 409 extant families and over 80000 species in world (Bouchet and Rocroi, 2005). Gastropoda is the second largest class in the Animal Kingdom next to insecta. Two third of gastropod species are found in marine environment. They have great economical and ecological significance, thus, Indian marine gastropods have been well studied (Subba Rao, 2003). Many researchers have reported marine gastropods from Maharashtra state (Nevill, 1884; Melvill, 1893, 1894, 1896, 1928; Melvill and Abercrombie, 1893; Melvill and Standen, 1901; Winckworth, 1946; Hornell, 1851; Subrahmanyam *et al.*, 1951a,b; Tikader, 1964; Joshi, 1969; Ray, 1977; Rajagopal and Mookherjee, 1978 and 1982; Bertsch and D'Attilio, 1980; Subba Rao and Dey, 1984 and 2000; Mookherjee, 1985; Tikader *et al.*, 1986; Subba Rao *et al.*, 1991, 1992; Surya Rao and Subba Rao, 1991; Subba Rao and Surya Rao, 1993; Mathew and Govindan, 1995; Apte, 1998; Jaiswar and Kulkarni, 2001 and 2002; Mohapatra, 2001 and 2010; Subba Rao, 2003; Surya Rao *et al.*, 2004; Ganesh *et al.*, 2006; Benjamin Franklin *et al.*, 2007 and 2009; Ramakrishna *et al.*, 2007; Mahapatra, 2008; Dutta *et al.*, 2008 and 2010; Gaonkar *et al.*, 2010 and Kurve and Kurve, 2010). However, no single document giving complete list of marine gastropods is available for the state. Thus, we have prepared a systematic list of all the marine gastropods including brackish water

species so far recorded from Maharashtra following recent classification system of Bouchet and Rocroi (2005).

SYSTEMATIC LIST

- Phylum MOLLUSCA Linnaeus, 1758
- Class GASTROPODA Cuvier, 1819
- Subclass CAENOGASTROPODA Cox, 1960
- Order LITTORINIMORPHA Golikov & Starobogatov, 1975
- Superfamily CALYPTRAEOIDEA Lamarck, 1809
- Family CALYPTRAEIDAE Lamarck, 1809
- 1. *Calyptraea pellucida* Reeve, 1859
- 2. *Crepidula walshi* (H. Adams & A. Adams, 1858)
- 3. *Crucibulum scutellatum* (Wood, 1828)
- Superfamily CAPULOIDEA Fleming, 1822
- Family CAPULIDAE Fleming, 1822
- 4. *Capulus (Capulus) violacea* Angas, 1867
- Superfamily CYPRAEOIDEA Rafinesque, 1815
- Family CYPRAEIDAE Rafinesque, 1815
- 5. *Cypraea tigris* Linnaeus, 1758
- 6. *Erosaria lamarckii* (J.E. Gray, 1825)
- 7. *Erosaria marginalis marginalis* (Dillwyn, 1827)
- 8. *Erosaria miliaris* (Gmelin, 1791)
- 9. *Erosaria nebrates ceylonica* Schilder & Schilder, 1938

10. *Erosaria ocellata* (Linnaeus, 1758)
11. *Erosaria turdus winkworthi* Schilder and Schilder, 1938
12. *Erronea onyx* (Linnaeus, 1758)
13. *Erronea pallida* (J.E. Gray, 1824)
14. *Lyncina lynx* (Linnaeus, 1758)
15. *Lyncina vitellus* (Linnaeus, 1758)
16. *Mauritia arabica* (Linnaeus, 1758)
17. *Mauritia eglantina* (Duclos, 1833)
18. *Mauritia histrio* (Gmelin, 1791)
19. *Monetaria annulus* (Linnaeus, 1758)
20. *Monetaria moneta* (Linnaeus, 1758)
21. *Nucleolaria nucleus* (Linnaeus, 1758)
22. *Palmadusta lentiginosa* (J. E. Gray, 1825)
23. *Talostolida teres* (Gmelin, 1791)
24. *Talparia talpa* (Linnaeus, 1758)
Family OVULIDAE Fleming, 1822
Subfamily OVULINAE Fleming, 1828
25. *Phenacovolva brevirostris* (Schumacher, 1817)
Subfamily PRIONOVOLVINAE Fehse, 2007
26. *Crenavolva striatula* (G.B. Sowerby I, 1828)
27. *Crenavolva traillii* (A. Adams, 1855)
28. *Cuspivolva singularis* (Cate, 1973)
29. *Primovula indica* (Reeve, 1865)
30. *Prionovolva brevis* (G. B. Sowerby I, 1828)
Subfamily SIMNIINAE F.A. Schilder, 1925
31. *Simnia spelta* (Linnaeus, 1758)
Superfamily FICOIDEA Meek, 1864 (1840)
Family FICIDAE Meek, 1864 (1840)
32. *Ficus ficus* (Linnaeus, 1758)
33. *Ficus variegata* Röding, 1798
Superfamily LITTORINOIDEA Children, 1834
Family LITTORINIDAE Children, 1834
Subfamily LITTORININAE Children, 1834
34. *Cenchritis malaccanus* (Philippi, 1847)
35. *Echinolittorina leucosticta* (Philippi, 1847)
36. *Echinolittorina millegrana* (Philippi, 1848)
37. *Echinolittorina pascua* (Rosewater, 1970)
38. *Echinolittorina vidua* (Gould, 1859)
39. *Littoraria carinifera* (Menke, 1830)
40. *Littoraria intermedia* (Philippi, 1846)
41. *Littoraria scabra* (Linnaeus, 1758)
42. *Littoraria undulata* (Gray, 1839)
43. *Mainwaringia leithii* (E.A. Smith, 1876)
44. *Nodilittorina (Nodilittorina) quadricincta* (Mühlfeldt, 1824)
45. *Nodilittorina pyramidalis* (Quoy & Gaimard, 1833)
Superfamily NATICOIDEA Guilding, 1834
Family NATICIDAE Guilding, 1834
Subfamily NATICINAE Guilding, 1834
46. *Natica lineata* (Röding, 1798)
47. *Natica maculosa* Lamarck, 1822
48. *Natica picta* Récluz, 1844
49. *Natica rufa* Born, 1778
50. *Natica vitellus* (Linnaeus, 1758)
51. *Naticarius alapapilionis* (Röding, 1798)
52. *Naticarius pulicaria* (Philippi, 1852)
53. *Notocochlis gualteriana* (Récluz, 1844)
54. *Notocochlis tigrina* (Röding, 1798)
55. *Stigmaulax sulcatus* (Born, 1778)
Subfamily POLINICINAE Gray, 1847
56. *Mammilla melanostoma* (Gmelin, 1791)
57. *Neverita didyma* (Röding, 1798)
58. *Neverita incei* Philippi, 1853
59. *Polinices mammilla* (Linnaeus, 1758)
60. *Polinices zanzibarica* (Recluz, 1843)
Subfamily SININAE Woodring, 1928
61. *Eunaticina papilla* (Gmelin, 1791)
62. *Eunaticina pomatiella* (Melvill, 1892)
63. *Sinum haliotoideum* (Linnaeus, 1758)
64. *Sinum neritoideum* (Linnaeus, 1758)
65. *Sinum planulatum* (Récluz, 1843)
Superfamily RISSOOIDEA Gray, 1847
Family ASSIMINEIDAE H. Adams & A. Adams, 1856
66. *Assimineia bombayana* (Grateloup)

67. *Assiminea brevicula* (Pfeiffer, 1854)
68. *Assiminea cornea* (Pfeiffer, 1854)
69. *Assiminea rotunda* (Blanford, 1867)
70. *Assiminea subconica* (Leith, 1853)
Family HYDROBIIDAE Stimpson, 1865
71. *Stenothyra minima* (G.B. Sowerby, 1837)
72. *Stenothyra woodmasoniana* Nevill, 1880
Family IRAVADIIDAE Thiele, 1928
73. *Fairbankia bombayana* (Stoliczka, F., 1868)
74. *Iravadia (Pseudomerelina) mahimensis* (Melvill, 1893)
75. *Iravadia (Pseudonoba) atemeles* (Melvill, 1896)
76. *Iravadia (Pseudonoba) delicata* (Philippi, 1849)
77. *Iravadia trochlearis* (Gould, 1861)
Family RISSOIDAE Gray, 1847
Subfamily RISSOINAE Gray, 1847
78. *Alvania (Alvania) versoverana* (Melvill, 1893)
79. *Rissoina (Rissoina) canaliculata* Schwartz, G., 1860
80. *Rissoina (Rissoina) pachystoma* Melvill, J.C., 1896
81. *Rissoina (Rissoina) plicatula* Gould, 1861
82. *Rissoina ambigua* (Gould, 1849)
83. *Rissoina seguenziana* Issel, 1869
Subfamily RISSOININAE Stimpson, 1865
84. *Stosicia abnormalis* (Nevill, 1875)
85. *Zebina applanata* Melvill, J.C., 1893
Family TORNIDAE Sacco, 1896 (1884)
86. *Pseudoliotia pulchella* Dunker, 1860
87. *Tornus vanikoroides* (Melvill, 1896)
Superfamily STROMBOIDEA Rafinesque, 1815
Family ROSTELLARIIDAE Gabb, 1868
88. *Tibia curta* (G.B. Sowerby II, 1842)
89. *Tibia delicatula* Nevill, 1881
90. *Tibia fusus* (Linnaeus, 1758)
91. *Tibia insulaechorab* Röding, 1798
Family STROMBIDAE Rafinesque, 1815
92. *Gibberulus gibberulus* (Linnaeus, 1758)
93. *Lambis lambis* (Linnaeus, 1758)
94. *Tridentarius dentatus* (Linnaeus, 1758)
Superfamily TONNOIDEA Suter, 1913 (1825)
Family BURSIDAE Thiele, 1925
95. *Bufonaria echinata* (Link, 1807)
96. *Bursa granularis* (Röding, 1798)
97. *Marsupina bufo* (Bruguière, 1792)
Family RANELIDAE Gray, 1854
Subfamily CYMATIINAE Iredale, 1913 (1854)
98. *Linatella caudata* (Gmelin, 1791)
99. *Monoplex aquatilis* (Reeve, 1844)
100. *Monoplex pilearis* (Linnaeus, 1758)
Subfamily RANELLINAE Gray, 1854
101. *Gyrineum natator* (Röding, 1798)
Family TONNIDAE Suter, 1913 (1825)
102. *Tonna allium* (Dillwyn, 1817)
103. *Tonna canaliculata* (Linnaeus, 1758)
104. *Tonna tessellata* (Lamarck, 1816)
Superfamily VANIKOROIDEA Gray, 1840
Family VANIKORIDAE Gray, 1840
105. *Vanikoro cuvieriana* (Récluz, 1844)
Superfamily VERMETOIDEA Rafinesque, 1815
Family VERMETIDAE Rafinesque, 1815
106. *Serpulorbis inopertus* (Rüppell & Leuckart, 1828)
Superfamily XENOPHOROIDEA Troschel, 1852 (1840)
Family XENOPHORIDAE Troschel, 1852 (1840)
107. *Stellaria solaris* (Linnaeus, 1764)
108. *Xenophora (Xenophora) solarioides* (Reeve, 1845)
Order NEOGASTROPODA Wenz, 1938
Superfamily BUCCINOIDEA Rafinesque, 1815
Family BUCCINIDAE Rafinesque, 1815
109. *Cantharus spiralis* Gray, 1839
110. *Engina epidromidea* Melvill, 1894
111. *Engina mendicaria* (Linnaeus, 1758)
112. *Engina zea* Melvill, 1893
113. *Nassaria acuminata* (Reeve, 1844)
114. *Polia fumosa* (Dillwyn, 1817)

115. *Polia rubiginosa* (Reeve, 1846)

116. *Polia undosa* (Linnaeus, 1758)

Family COLUMBELLIDAE Swainson, 1840

117. *Anachis terpsichore* (G.B. Sowerby II, 1822)

118. *Metanachis marquesa* (Gaskoin, 1851)

119. *Mitrella euterpe* (Melvill, 1893)

120. *Mitrella flavilinea* (Melvill, 1893)

121. *Mitrella scripta* (Linnaeus, 1758)

122. *Zafra atrata* (Gould, 1860)

123. *Zafra pumila* (Dunker, 1858)

Family FASCIOLARIIDAE Gray, 1853

Subfamily FASCIOLARIINAE Gray, 1853

124. *Pleuroploca trapezium* (Linnaeus, 1758)

125. *Pleurotoma lemniscata* Neill and Nevill, 1869

Subfamily FUSININAE Wrigley, 1927

126. *Fusinus townsendi* (Melvill, 1899)

Subfamily PERISTERNIINAE Tryon, 1880

127. *Peristernia pulchella* (Reeve, 1847)

Family MELONGENIDAE Gill, 1871 (1854)

128. *Pugilina carnaria* (Röding, 1798)

129. *Pugilina cochlidium* (Linnaeus, 1758)

Family NASSARIIDAE Iredale, 1916 (1835)

130. *Bullia malabarica* Hanley

131. *Bullia mauritiana* Gray, 1839

132. *Bullia tranquebarica* (Röding, 1798)

133. *Bullia vittata* (Linnaeus, 1767)

134. *Bullina lineata* (Gray, 1825)

135. *Cyllene fuscata* Adams & Reeve, 1849

136. *Nassarius (Zeuxis) canaliculata* Schepman

137. *Nassarius arcularia arcularia* (Linnaeus, 1758)

138. *Nassarius dorsatus* (Röding, 1798)

139. *Nassarius foveolatus* (Dunker, 1847)

140. *Nassarius gaudiosus* (Hinds, 1844)

141. *Nassarius gayii* (Kiener, 1834)

142. *Nassarius glans particeps* (Hedley, 1915)

143. *Nassarius jacksonianus* (Quoy & Gaimard, 1833)

144. *Nassarius livescens* (Philippi, 1849)

145. *Nassarius mobilis* (Hedley & May, 1908)

146. *Nassarius nodifer* (Powys, 1835)

147. *Nassarius obesus* (G. Nevill & H. Nevill, 1875)

148. *Nassarius olivaceus* (Bruguière, 1789)

149. *Nassarius pictus* Dunker

150. *Nassarius pullus* (Linnaeus, 1758)

151. *Nassarius reeveanus* (Dunker, 1847)

152. *Nassarius stolatus* (Gmelin, 1791)

Superfamily CANCELLARIOIDEA Forbes & Hanley, 1851

Family CANCELLARIIDAE Forbes & Hanley, 1851

153. *Merica oblonga* (G.B. Sowerby I, 1825)

154. *Scalptia crenifera* (Sowerby, 1832)

155. *Scalptia scalarina* (Lamarck, 1822)

156. *Trigonostoma costiferum* (G.B. Sowerby I, 1832)

Superfamily CERITHIOIDEA Fleming, 1822

Family CERITHIIDAE Fleming, 1822

Subfamily BITTIINAE Cossmann, 1906

157. *Bittium latreillei* (Payraudeau, 1826)

158. *Bittium tenthrenois* Melvill, 1896

159. *Cerithidium cerithinum* (Philippi, 1849)

Subfamily CERITHIINAE Fleming, 1822

160. *Cerithium corallium* Kiener, 1841

161. *Cerithium echinatum* Lamarck, 1822

162. *Cerithium zonatum* (Wood, 1828)

163. *Clypeomorus batillariaeformis* Habe & Kosuge, 1966

164. *Clypeomorus bifasciatus* (G.B. Sowerby II, 1855)

Family DIALIDAE Kay, 1979

165. *Diala macula* Récluz (*Nomen nudum*)

166. *Diala sulcifera* (A. Adams, 1862)

Family LITIOPIDAE Gray, 1847

167. *Alaba blanfordi* A. Adams 1862

168. *Alaba rectangulata* Craven, 1880

Family SCALIOLIDAE Jousseaume, 1912

169. *Finella pupoides* A. Adams, 1860

170. *Scaliola arenosa* A. Adams, 1869
Superfamily CONOIDEA Fleming, 1822
Family BORSONIIDAE Bellardi, 1875
171. *Tomopleura vertebrata* (Smith E.A., 1875)
Family CLATHURELLIDAE H. Adams & A. Adams, 1858
172. *Etrema denseplicata* (Dunker, 1871)
173. *Lienardia perplexa* (Nevill & Nevill, 1875)
Family CLAVATULIDAE Gray, 1853
174. *Clavatula virgineus* (Dillwyn, 1817)
175. *Turricula javana* (Linnaeus, 1767)
176. *Turricula nelliae spurius* (Hedley, 1922)
177. *Turricula tornatus fulminatus* (Kiener, 1839)
178. *Turricula tornatus tornatus* (Dillwyn, 1817)
Family CONIDAE Fleming, 1822
179. *Conus achatinus* Gmelin, 1791
180. *Conus acutangulus* Lamarck, 1810
181. *Conus amadis* Gmelin, 1791
182. *Conus arenatus* Hwass in Bruguière, 1792
183. *Conus biliosus* (Röding, 1798)
184. *Conus coronatus* Gmelin, 1791
185. *Conus cumingii* Reeve, 1848
186. *Conus erythraeensis dillwynii* Reeve, 1849
187. *Conus figulinus* Linnaeus, 1758
188. *Conus glans* Hwass in Bruguière, 1792
189. *Conus hyaena* Hwass in Bruguière, 1792
190. *Conus inscriptus* Reeve, 1843
191. *Conus lentiginosus* Reeve, 1844
192. *Conus locumtenens* Blumenbach, 1791
193. *Conus monile* Hwass in Bruguière, 1792
194. *Conus praecellens* A. Adams, 1855
195. *Conus textile* Linnaeus, 1758
196. *Conus virgo* Linnaeus, 1758
Family DRILLIIDAE Olsson, 1964
197. *Clavus (Tylotiella) sacra* (Reeve, 1845)
198. *Drillia crassa* (Smith, 1888)
199. *Splendrillia praeclara* (Sowerby III, 1915)
Family MANGELLIDAE P. Fischer, 1883
200. *Eucithara gradata* (Nevill & Nevill, 1875)
201. *Mangelia decipiens* Smith, 1888
202. *Mangelia fulvocincta* (G. Nevill & H. Nevill, 1875)
Family PSEUDOMELATOMIDAE Morrison, 1966
203. *Ptychobela nodulosa* (Gmelin, 1791)
Family RAPHITOMIDAE Bellardi, 1875
204. *Kermia foraminata* (Reeve, 1845)
205. *Philbertia (Pseudodaphnella) lucida* Smith, 1884
206. *Pseudorhaphitoma fairbanki* (G. Nevill & H. Nevill, 1875)
207. *Pseudorhaphitoma fortistriata* (Smith, 1888)
Family TEREBRIDAE Mörch, 1852
208. *Duplicaria duplicata* (Linnaeus, 1758)
209. *Euterebra capensis* (E.A. Smith, 1873)
210. *Granuliterebra bathyrhapse* (E.A. Smith, 1875)
211. *Hastula tenera* (Hinds, 1844)
212. *Myurella cinctella* (Deshayes, 1859)
213. *Oxymeris areolata* (Link, 1807)
214. *Terebra affinis* Gray, 1834
215. *Terebra duplicata* (Linnaeus, 1758)
216. *Terebra spectabilis* Hinds, 1844 (*species inquirenda*)
217. *Terebra tricincta* E.A. Smith, 1877
Family TURRIDAE H. Adams & A. Adams, 1853 (1838)
218. *Lophiotoma indica* (Röding, 1798)
219. *Turris amicta* (E.A. Smith, 1877)
220. *Turris annulata* (Reeve, 1843)
Superfamily MURICOIDEA Rafinesque, 1815
Family BABYLONIIDAE Kuroda, Habe & Oyama, 1971
221. *Babylonia spirata* (Linnaeus, 1758)
222. *Babylonia zeylanica* (Bruguière, 1789)
Family COSTELLARIIDAE MacDonald, 1860
223. *Vexillum (Costellaria) obeliscus* (Reeve, 1844)

- Family HARPIDAE Bronn, 1849
 Subfamily HARPINAE Bronn, 1849
 224. *Harpa major* Röding, 1798
 Family MARGINELLIDAE Fleming, 1828
 225. *Volvarina angustata* (G.B. Sowerby, 1846)
 Subfamily MARGINELLINAE Fleming, 1828
 226. *Marginella mazagonica* Melvill, 1893
 227. *Mesoginella inconspicua* (G.B. Sowerby, 1846)
 228. *Serrata mustelina* (Angas, 1871)
 Family MITRIDAE Swainson, 1829
 229. *Mitra (Mitra) ambigua* Swainson, 1829
 230. *Mitra (Mitra) chinensis* Griffith & Pidgeon, 1834
 231. *Mitra (Mitra) guttata* Swainson, 1824
 232. *Mitra (Nebularia) chrysostoma* Broderip, 1936
 233. *Mitra (Nebularia) proscissa* Reeve, 1844
 234. *Mitra (Strigatella) scutulata* (Gmelin, 1791)
 235. *Neocancilla circula* (Kiener, 1838)
 Family MURICIDAE Rafinesque, 1815
 Subfamily CORALLIOPHILINAE Chenu, 1859
 236. *Coralliophila costularis* (Lamarck, 1816)
 237. *Coralliophila jeffreysi* E.A. Smith, 1879
 Subfamily ERGALATAXINAE Kuroda, Habe & Oyama, 1971
 238. *Drupella rugosa* (Born, 1778)
 239. *Ergalatax contracta* (Reeve, 1846)
 240. *Lataxiena bombayana* (Melvill, 1893)
 241. *Morula (Morula) anaxares* (Kiener, 1835)
 242. *Morula (Morula) granulata* (Duclos, 1832)
 243. *Morula (Morula) subnodulosa* (Melvill, 1893)
 244. *Orania xuthedra* (Melvill, 1893)
 Subfamily MURICINAE Rafinesque, 1815
 245. *Chicoreus brunneus* (Link, 1807)
 246. *Chicoreus maurus* (Broderip, 1833)
 247. *Chicoreus torrefactus* (G.B. Sowerby II, 1841)
 248. *Hexaplex cichoreum* (Gmelin, 1791)
 249. *Hexaplex kusterianus* (Tapparone-Canefri, 1875)
 250. *Murex (Murex) carbonnieri* (Jousseau, 1881)
 251. *Murex (Murex) ternispina* Lamarck, 1822
 252. *Murex (Murex) trapa* Röding, 1798
 253. *Murex (Murex) tribulus* Linnaeus, 1758
 254. *Vokesimurex malabaricus* (E.A. Smith, 1894)
 Subfamily MURICOPSINAE Radwin & d'Attilio, 1971
 255. *Muricopsis (Muricopsis) bombayanus* (Melvill, J.C., 1893)
 Subfamily RAPANINAE Gray, 1853
 256. *Nassa hepatica* Montagu
 257. *Purpura bufo* Lamarck, 1822
 258. *Purpura persica* (Linnaeus, 1758)
 259. *Rapana bulbosa* (Solander, 1817)
 260. *Semiricinula konkanensis* (Melvill, 1893)
 261. *Semiricinula marginatra* (Blainville, 1832)
 262. *Stramonita carinifera* (Lamarck, 1816)
 263. *Thais (Thalessa) virgata* (Dillwyn, 1817)
 264. *Thais echinulata* (Lamarck, 1822)
 265. *Thaisella blanfordi* (Melvill, 1893)
 266. *Thaisella lacera* (Born, 1778)
 267. *Thaisella sacellum* (Gmelin, 1791)
 268. *Thaisella tissoti* (Petit de la Saussaye, 1852)
 269. *Vexilla vexillum* (Gmelin, 1791)
 Family TURBINELLIDAE Swainson, 1835
 Subfamily TURBINELLINAE Swainson, 1835
 270. *Turbinella pyrum* (Linnaeus, 1767)
 Superfamily OLIVOIDEA Latreille, 1825
 Family OLIVIDAE Latreille, 1825
 271. *Agaronia gibbosa* (Born, 1778)
 272. *Agaronia nebulosa* (Lamarck, 1811)
 273. *Agaronia plicaria* Lamarck, 1811
 274. *Cupidoliva nympha* (A. Adams & Angas, 1864)
 275. *Oliva caerulea* (Röding, 1798)
 276. *Oliva oliva* (Linnaeus, 1758)

277. *Oliva todosina* Duclos, 1840

278. *Oliva vidua* (Röding, 1798)

Order Unassigned CAENOGASTROPODA
Cox, 1960

Superfamily CERITHIOIDEA Fleming, 1822

Family CERITHIIDAE Fleming, 1822

Subfamily CERITHIINAE Fleming, 1822

279. *Rhinoclavis* (*Rhinoclavis*) *sinensis* (Gmelin, 1791)

Family PLANAXIDAE Gray, 1850

Subfamily FOSSARINAE A. Adams, 1860

280. *Fossarus fenestratus* A. Adams, 1863

281. *Fossarus reticulatus* S. Wood, 1885

282. *Fossarus tornatilis* (Gould, 1859)

283. *Fossarus trochlearis* (A. Adams, 1855)

Subfamily PLANAXINAE Gray, 1850

284. *Couthouya subreticulatus* (Nevill, 1884)

285. *Couthouya styliiferinus* (Nevill, 1884)

286. *Planaxis niger* Quoy & Gaimard, 1833

287. *Planaxis sulcatus* (Born, 1778)

Family POTAMIDIDAE H. Adams &
A. Adams, 1854

288. *Cerithidea cingulata* (Gmelin, 1791)

289. *Potamides conicus* (Blainville, 1829)

290. *Telescopium telescopium* (Linnaeus, 1758)

Family THIARIDAE Gill, 1871 (1823)

291. *Larina burmana* (Blanford, 1867)

Family TURRITELLIDAE Lovén, 1847

Subfamily TURRITELLINAE Lovén, 1847

292. *Turritella attenuata* Reeve, 1849

293. *Turritella bacillum* Kiener, 1846

294. *Turritella columnaris* Kiener, 1843

295. *Turritella duplicata* (Linnaeus, 1758)

296. *Turritella terebra* (Linnaeus, 1758)

297. *Turritella terebra cerea* Reeve, 1849

Superfamily EPITONIOIDEA Berry, 1910 (1812)

Family EPITONIIDAE Berry, 1910 (1812)

298. *Amaea minor* (Sowerby II, 1873)

299. *Eglisia tricarinata* Adams & Reeve, 1850

300. *Epitonium immaculatum* (G.B. Sowerby II, 1844)

301. *Epitonium lamellosum* (Lamarck, 1822)

302. *Epitonium latifasciatum* (Sowerby, 1874)

303. *Epitonium muricatum* (Risso, 1826)

304. *Epitonium scalare* (Linnaeus, 1758)

305. *Epitonium subauriculatum* (Souverbie, 1866)

Family JANTHINIDAE Lamarck, 1822

306. *Janthina globosa* Swainson, 1822

307. *Janthina janthina* (Linnaeus, 1758)

308. *Recluzia rollandiana* Petit de la Saussaye, 1853

Superfamily EULIMOIDEA Philippi, 1853

Family ACLIDIDAE G.O. Sars, 1878

309. *Aclis eoa* Melvill, 1896

Family EULIMIDAE Philippi, 1853

310. *Curveulima denscolubri* (Melvill, 1896)

311. *Pyramidelloides mirandus* (A. Adams, 1861)

Superfamily TRIPHOROIDEA Gray, 1847

Family CERITHIOPSIDAE H. Adams &
A. Adams, 1853

312. *Cerithiopsis pulcherrima* Melvill, 1896

313. *Cerithiopsis rubricincta* Melvill, 1896

314. *Cerithiopsis sykesii* Melvill, 1896

315. *Seila bandorensis* Melvill, 1893

Family TRIPHORIDAE Gray, 1847

316. *Triphora acuta* (Kiener, 1841)

Subclass HETEROBRANCHIA Burmeister, 1837

Order Unassigned

Superfamily ARCHITECTONICOIDEA
Gray, 1850

Family ARCHITECTONICIDAE Gray, 1850

317. *Architectonica laevigata* (Lamarck, 1816)

318. *Heliacus* (*Torinista*) *implexus implexus*
(Mighels, J.W., 1845)

319. *Pseudotorinia delectabilis* (Melvill, 1893)

Superfamily PYRAMIDELLOIDEA Gray, 1840

Family PYRAMIDELLIDAE Gray, 1840

320. *Amathis filia* Melvill, 1893

321. *Chrysallida* (*Pyrgulina*) *callista* (Melvill, 1893)

322. *Chrysallida (Pyrgulina) edgarii* (Melvill, 1897)
 323. *Chrysallida (Pyrgulina) pyrgomella* (Melvill, 1896)
 324. *Chrysallida eximia* (Jeffreys, 1849)
 325. *Cingulina archimedes* Melvill
 326. *Costabieta epentroma* (Melvill, 1896)
 327. *Miralda idalima* Melvill, 1896
 328. *Monotygmia fulva* (Adams A., 1851)
 329. *Odostomia antelia* Melvill, 1896
 330. *Odostomia decorata* Philippi
 331. *Odostomia syrnoloides* Melvill, 1896
 332. *Oscilla indica* Melvill, 1896
 333. *Oscilla tornata* (A.E. Verrill, 1884)
 334. *Pyramidella pulchella* (A. Adams in Sowerby, 1854)
 335. *Pyrgulina casta* (A. Adams, 1861)
 336. *Syrnola metria* Melvill, 1896
 Subfamily TURBONILLINAE Bronn, 1849
 337. *Kleinella (Actaeopyramis) gavis* (Melvill, 1896)
 338. *Kleinella amoena* (A. Adams, 1853)
 339. *Turbonilla abercrombiei* Melvill, 1897
 340. *Turbonilla emiliae* Melvill, 1896
 341. *Turbonilla sororia* Melvill, 1896
 342. *Turbonilla terebrina* Melvill, 1896
 Superfamily RINGICULOIDEA Philippi, 1853
 Family RINGICULIDAE Philippi, 1853
 343. *Ringicula minuta* Adams, 1872
 344. *Ringicula propinquans* Hinds, 1844
 Superfamily SIPHONARIOIDEA Gray, 1827
 Family SIPHONARIIDAE Gray, 1827
 345. *Siphonaria atra* Quoy & Gaimard, 1833
 346. *Siphonaria basseinensis* Melvill, 1893
 347. *Siphonaria kurracheensis* (Reeve, 1856)
 348. *Siphonaria laciniosa* (Linnaeus, 1758)
 Order ANASPIDEA P. Fisher, 1883
 Superfamily APLYSIOIDEA Lamarck, 1809
 Family APLYSIIDAE Lamarck, 1809
 349. *Aplysia benedicti* Eliot, 1899

- Order CEPHALASPIDEA P. Fischer, 1883
 Superfamily BULLOIDEA Gray, 1827
 Family BULLIDAE Gray, 1827
 350. *Bulla ampulla* Linnaeus, 1758
 Superfamily HAMINOEOIDEA Pilsbry, 1895
 HAMINOEIDAE Pilsbry, 1895
 351. *Cylichna cylindracea* (Pennant, 1777)
 352. *Haminoea galba* Pease, 1861
 Superfamily PHILINOIDEA Gray, 1850 (1815)
 Family CYLICHNIDAE H. Adams & A. Adams, 1854
 353. *Smaragdinella andersoni* (G. & H. Nevill, 1871)
 354. *Tornatina townsendi* Melvill, 1898
 Family RETUSIDAE Thiele, 1825
 355. *Retusa involuta* Nevill and Nevill
 356. *Retusa pellyi* (Smith, 1872)
 Order NUDIBRANCHIA Cuvier, 1817
 Superfamily DORIDOIDEA Rafinesque, 1815
 Family CHROMODORIDIDAE Bergh, 1891
 357. *Chromodoris trimarginata* (Winckworth, 1946)
 358. *Glossodoris bombayana* Winckworth, 1946
 359. *Glossodoris poecila* Winckworth, 1946
 360. *Hypselodoris infucata* (Rüppell & Leuckart, 1831)
 361. *Hypselodoris nigrostriata* (Eliot, 1904)
 Superfamily ONCHIDORIDOIDEA Gray, 1827
 Family GONIODORIDIDAE H. Adams & A. Adams, 1854
 362. *Goniodoris kolabana* Winckworth, 1946
 Order SYSTELLOMMATOPHORA Pilsbry, 1948
 Superfamily ONCHIDIOIDEA Rafinesque, 1815
 Family ONCHIDIIDAE Rafinesque, 1815
 363. *Peronia verruculata* (Cuvier, 1830)
 Order THECOSOMATA Blainville, 1824
 Superfamily CAVOLINIOIDEA Gray, 1850 (1815)
 Family CAVOLINIIDAE Gray, 1850 (1815)
 364. *Diacavolinia longirostris* (Blainville, 1821)

- Order Unassigned PULMONATA Cuvier, 1814
 Superfamily ELLOBIOIDEA L. Pfeiffer, 1854 (1822)
 Family ELLOBIIDAE L. Pfeiffer, 1854 (1822)
 365. *Cassidula nucleus* (Gmelin, 1791)
 366. *Ellobium aurisjudae* (Linnaeus, 1758)
 367. *Ellobium gangeticum* Pfeiffer, 1855
 368. *Melampus (Melampus) flavus* Gmelin, 1791
 369. *Melampus ceylonicus* Petit, 1841
 370. *Melampus ?coffea* (Linnaeus, 1758)
 371. *Melampus fasciatus* (Deshayes, 1830)
 372. *Melampus pulchellus* (Petit de la Saussaye, 1843)
 373. *Melampus singaporensis* Pfeiffer, 1855
 Subclass NERITIMORPHA Golikov & Starobogatov, 1975
 Order CYCLONERITIMORPHA Frýda, 1998
 Superfamily HELICINOIDEA Férussac, 1822
 Family NERITILIIDAE Schepman, 1908
 374. *Micronerita pulchella* Kano & Kase, 2008
 Superfamily NERITOIDEA Rafinesque, 1815
 Family NERITIDAE Rafinesque, 1815
 375. *Nerita (Argonerita) chamaeleon* Linnaeus, 1758
 376. *Nerita (Argonerita) oryzae* Récluz, 1841
 377. *Nerita (Linnerita) polita* Linnaeus, 1758
 378. *Nerita albicilla* Linnaeus, 1758
 379. *Nerita undata* Linnaeus, 1758
 380. *Neritina (Dostia) crepidularia* (Lamarck, 1822)
 381. *Neritina (Dostia) violacea* Gmelin, 1791
 Subclass PATELLOGASTROPODA Lindberg, 1986
 Order Unassigned
 Superfamily LOTTIOIDEA Gray, 1840
 382. *Cellana radiata* (Born, 1778)
 383. *Cellana radiata radiata* (Born, 1778)
 Subclass VETIGASTROPODA Salvini-Plawen, 1980
 Order Unassigned
 Superfamily TROCHOIDEA Rafinesque, 1815
 Family TURBINIDAE Rafinesque, 1815
 Subfamily TURBININAE Rafinesque, 1815
 384. *Astraliu semicostatum* (P. Fischer, 1875)
 385. *Astraliu stellare* (Gmelin, 1791)
 Superfamily FISSURELLOIDEA Fleming, 1822
 Family FISSURELLIDAE Fleming, 1822
 Subfamily HEMITOMINAE Kuroda, Habe & Oyama, 1971
 386. *Clypidina notata* (Linnaeus, 1785)
 Subfamily DIODORINAE Odhner, 1932
 387. *Diodora bombayana* (Sowerby, 1862)
 388. *Diodora lima* (G.B. Sowerby II, 1862)
 389. *Diodora singaporensis* (Reeve, 1850)
 Subfamily EMARGINULINAE Children, 1834
 390. *Emarginula dilecta* A. Adams, 1852
 391. *Emarginula elongata* O.G. Costa, 1829
 392. *Scutus unguis* (Linnaeus, 1758)
 Subfamily HEMITOMINAE Kuroda, Habe & Oyama, 1971
 393. *Montfortula rugosa* (Quoy & Gaimard, 1834)
 Superfamily HALIOTOIDEA Rafinesque, 1815
 Family HALIOTIDAE Rafinesque, 1815
 394. *Haliotis rufescens* Swainson, 1822
 395. *Haliotis varia* Linnaeus, 1758
 Superfamily PHASIANELLOIDEA Swainson, 1840
 Family PHASIANELLIDAE Swainson, 1840
 396. *Tricolia fordiana* (Pilsbry, 1888)
 397. *Tricolia indica* Winckworth, 1940
 Superfamily SEGUENZIOIDEA Verrill, 1884
 Family CHILODONTIDAE Wenz, 1938
 398. *Euchelus asper* (Gmelin, 1791)
 399. *Euchelus horridus* (Philippi, 1846)
 400. *Euchelus quadricarinatus* (Holten, 1802)
 401. *Euchelus tricarinata* (Lamarck, 1822)
 Family CALLIOTROPIDAE Hickman & McLean, 1990
 402. *Putzeysia wiseri* (Calcare, 1842)

- Superfamily TROCHOIDEA Rafinesque, 1815
 Family CALLIOSTOMATIDAE Thiele, 1924 (1847)
 Subfamily CALLIOSTOMATINAE Thiele, 1924 (1847)
 403. *Calliostoma scobinatum* (A. Adams in Reeve, 1863)
 Family CYCLOSTREMATIDAE P. Fischer, 1885
 404. *Cyclostrema cingulatum* Philippi, 1853
 405. *Cyclostrema micans* A. Adams, 1850
 406. *Cyclostrema solariellum* Melvill, 1893
 Family SOLARIELLIDAE Powell, 1951
 407. *Solariella sataparaensis* Preston, 1914
 Family TROCHIDAE Rafinesque, 1815
 Subfamily CANTHARIDINAE Gray, 1857
 408. *Gibbula swainsonii* A. Adams
 Subfamily TEGULINAE Kuroda, Habe & Oyama, 1971
 409. *Tectus tentorium* (Gmelin, 1791)
 Subfamily TROCHINAE Rafinesque, 1815
 410. *Clanculus ceylonicus* G. Nevill & H. Nevill, 1863
 411. *Clanculus depictus* Adams, 1854
 412. *Clanculus sulcarius* (Blanford)
 413. *Trochus radiatus* Gmelin, 1791
 414. *Trochus stellatus* Gmelin, 1791
 Subfamily TURBININAE Rafinesque, 1815
 415. *Turbo bruneus* (Röding, 1798)
 416. *Turbo intercostalis* Menke, 1846
 Subfamily UMBONIINAE H. Adams & A. Adams, 1854
 417. *Isanda crenulifera* Adams, 1854
 418. *Umbonium vestiarium* (Linnaeus, 1758)

SUMMARY

Marine gastropod fauna of Maharashtra is represented by 418 species/subspecies belonging to 221 genera in 40 subfamilies and 87 families under 44 superfamilies of 10 orders and 5 subclasses.

REFERENCES

- Apte, D. 1998. *The book of Indian shells*. Oxford University Press: 115 pp.
- Benjamin Franklin, J., Antony Fernando, S., Chalke, B.A. and Krishnan, K.S. 2007. Radular morphology of *Conus* (Gastropoda : Caenogastropoda : Conidae) from India. *Molluscan Research*, **27**(3) : 111-122.
- Benjamin Franklin, J., Subramanian, K.A., Antony Fernando, S. and Krishnan, K.S. 2009. Diversity and Distribution of Conidae from the TamilNadu Coast of India (Mollusca : Caenogastropoda : Conidae). *Zootaxa*, **2250** : 1-63.
- Bertsch, H. and D'Attilio, A. 1980. New species of Muricidae (Gastropoda) from the Indian Ocean, the Philippines and Brasil. *Venus*, **39**(3) : 131-138.
- Bouchet, P. and Rocroi, J.-P. 2005. Classification and nomenclator of gastropod families. *Malacologia*, **47**(1-2) : 1-397.
- Dutta, S.N., Chakraborty, S.K., Jaiswar, A.K. and Venkateshvaran, K. 2008. Temporal and spatial differences in species diversity in the intertidal region of south Mumbai. *Journal of the Marine Biological Association of India*, **50**(1) : 29-37.
- Dutta, S.N., Chakraborty, S.K., Jaiswar, A.K. and Ziauddin, G. 2010. A comparative study on intertidal faunal biodiversity of selected beaches of Mumbai coast. *Journal of Environmental Biology*, **31**(6) : 981-986.
- Ganesh, T., Raman, A.V. and Surya Rao, K.V. 2006. New records of marine molluscs from the northeast coast of India, Bay of Bengal. *Journal of the Bombay Natural History Society*, **103**(1) : 29-33.

- Gaonkar, Chetan A., Sawant, Subhash S., Anil, Arga Chandrashekar., Krishnamurthy, Venkat. and Harkantra, Sadanand N. 2010. Changes in the occurrence of hard substratum fauna : A case study from Mumbai harbour, India. *Indian Journal of Marine Sciences*, **39**(1) : 74-84.
- Hornell, J. 1951. *Indian Molluscs*. The Bombay Natural History Society, Bombay : 96pp.
- Jaiswar, A.K. and Kulkarni, B.G. 2001. Vertical distribution of molluscs in the intertidal area in and around Mumbai, India. *Journal of Indian fisheries association*, **28** : 93-100.
- Jaiswar, A.K. and Kulkarni, B.G. 2002. Length-Weight relationship of intertidal Molluscs from Mumbai, India. *Journal of Indian fisheries association*, **29** : 55-63.
- Joshi, M.C. 1969. The marine mollusca of the Konkan Coast. *Journal of Shivaji University*, **2**(4) : 47-54.
- Kurve, P. and Kurve, N.K. 2010. Occurrence of macro-fauna from intertidal zone along the coastline of village Akshi, district Raigad, Maharashtra. *The Ecoscan*, **4**(2&3) : 207-208.
- Mahapatra, A. 2008. Mollusca. In : *Fauna of Krishna estuary, Estuarine Ecosystem Services, Zoological Survey of India*, **5** : 105-173.
- Mathew, A. and Govindan, K. 1995. Macrobenthos in the nearshore coastal system of Bombay. *Proceedings of the National Academy of Sciences, India (Biological Sciences)*, **65**(IV) : 411-430.
- Melvill, J.C. 1893. Descriptions of 25 new species of marine shells from Bombay. *Memoirs and Proceedings of the Manchester Literary and Philosophical Society*, Series 4, **VII** : 52-66.
- Melvill, J.C. 1894. Descriptions of a new species of *Engina* (*E. epidromidea*) from Bombay. *Proceedings of the Malacological Society*, **I** : p. 162.
- Melvill, J.C. 1896. Descriptions of new species of minute marine shells from Bombay. *Proceedings of the Malacological Society*, **II** : 108-116.
- Melvill, J.C. 1928. The marine mollusca of Persian Gulf, Gulf of Oman and Arabian Sea, as evidenced mainly through the collections of Captain F.W. Townsend, 1893-1894. Addenda corrigenda and emendenda. *Proceedings of the Malacological Society of London*, **18** : 93-117.
- Melvill, J.C. and Abercrombie, A. 1893. The marine mollusca of Bombay. *Memoirs and Proceedings of the Manchester Literary and Philosophical Society*, Series 4, **VII** : 17-51.
- Melvill, J.C. and Standen, R. 1901. The mollusca of the Persian Gulf, Gulf of Oman and Arabian Sea as evidenced mainly through F.W. Townsend 1893-1900, with descriptions of new species. *Proceedings of Zoological Society of London*, **2** : 327-460.
- Mohapatra, A. 2001. Mollusca. In : *Fauna of Godavari estuary, Estuarine Ecosystem Services, Zoological Survey of India*, **4** : 55-82.
- Mohapatra, A. 2010. Mollusca. In : *Fauna of Vamsadhara and Nagavali estuaries, Andhra Pradesh, Estuarine Ecosystem Services, Zoological Survey of India*, **6** : 47-72.
- Mookherjee, H.P. 1985. Contributions to the molluscan fauna of India. Part-III. Marine molluscs of the Coromandel coast, Palk Bay and Gulf of Mannar- Gastropoda : Mesogastropoda (Part-2). *Records of the Zoological Survey of India, Miscellaneous Publication, Occasional Paper No. 75* : 1-93.
- Nevill, G. 1884. *Hand list of Mollusca in the Indian Museum, Calcutta. Part II. Gastropoda. Prosobranchia-Neurobranchia (contd.)*. Calcutta : 306pp.

- Rajagopal, A.S. and Mookherjee, H.P. 1978. Contributions to the molluscan fauna of India. Part-I. Marine molluscs of the Coromandel coast, Palk Strait and Gulf of Mannar- Gastropoda : Archaeogastropoda. *Records of the Zoological Survey of India, Miscellaneous Publication, Occasional Paper No. 12* : 1-48.
- Rajagopal, A.S. and Mookherjee, H.P. 1982. Contributions to the molluscan fauna of India. Part-II. Marine molluscs of the Coromandel coast, Palk Strait and Gulf of Mannar- Gastropoda : Mesogastropoda (Partim). *Records of the Zoological Survey of India, Miscellaneous Publication, Occasional Paper No. 28* : 1-53.
- Ramakrishna, Dey, A., Barua, S. and Mukhopadhyaya, A. 2007. Marine Molluscs : Polyplacophora and Gastropoda. In : *Fauna of Andhra Pradesh, State Fauna Series, Zoological Survey of India, 5(7)* : 1-148.
- Ray, Harish Chandra. 1977. Contribution to the knowledge of the molluscan fauna of Maungmagan, Lower Burma [with descriptions of one new genus and species of the Family Turridae (Gastropoda) 8]. *Indian Museum, Calcutta* : 1-150.
- Subba Rao, N.V. 2003. Indian Seashells (Part-1). Polyplacophora and Gastropoda. *Records of the Zoological Survey of India, Occasional Paper No. 192* : 416pp.
- Subba Rao, N.V. and Dey, A. 1984. Contribution to the knowledge of Indian Marine Molluscs. I. Family Mitridae. *Records of the Zoological Survey of India, Miscellaneous Publication, Occasional Paper No. 61* : 1-48.
- Subba Rao, N.V. and Dey, A. 2000. Catalogue of Marine Molluscs of Andaman and Nicobar Islands. *Records of the Zoological Survey of India, Occasional Paper No. 187* : 323pp.
- Subba Rao, N.V. and Surya Rao, K.V. 1993. Contribution to the knowledge of Indian Marine Molluscs- Part.3. Family : Muricidae. *Records of the Zoological Survey of India, Occasional Paper No. 153* : 1-133.
- Subba Rao, N.V., Dey, A. and Barua, S. 1992. Estuarine and Marine Molluscs. In : *Fauna of West Bengal, State Fauna Series, Zoological Survey of India, 3(Part-9)* : 129-268.
- Subba Rao, N.V., Surya Rao, K.V. and Maitra, S. 1991. Marine Molluscs. In : *Fauna of Orissa, State Fauna Series, Zoological Survey of India, 1(3)* : 1-175.
- Subrahmanyam, T.V., Karandikar, K.R. and Murti, N.N. 1951a. Marine Gastropoda of Bombay-Part I. *Journal of University of Bombay, (B) XX(3)* : 21-34.
- Subrahmanyam, T.V., Karandikar, K.R. and Murti, N.N. 1951b. Marine Gastropoda of Bombay-Part II. *Journal of University of Bombay, (B) XXI* : 26-73.
- Surya Rao, K.V. and Subba Rao, N.V. 1991. Mollusca. In : *Fauna of Lakshadweep, State Fauna Series, Zoological Survey of India, 2* : 273-362.
- Surya Rao, K.V., Maitra, Sipra, Barua, S. and Ramakrishna. 2004. Marine Mollusca (Part-I : Polyplacophora, Gastropoda and Scaphopoda). In : *Fauna of Gujarat, State Fauna Series, Zoological Survey of India, 8* : 263-331.
- Tikader, B.K. 1964. Marine fauna of Deogad Coast (Ratnagiri District) Maharashtra. Part I Mollusca. *Journal of the University of Poona, 28* : 43-48.
- Tikader, B.K., Daniel, A. and Subba Rao, N.V. 1986. *Sea shore animals of Andaman and Nicobar Islands*. The Director, Zoological Survey of India, Calcutta (ed.) : 188pp.
- Winckworth, H.C. 1946. *Glossodoris* from Bombay. *Journal of Molluscan Studies, 26(6)* : 155-160.

MARINE BIVALVES (MOLLUSCA : BIVALVIA)

S.K. PATI and R.M. SHARMA

Zoological Survey of India, Western Regional Centre, Vidya Nagar, Sector No. 29, P.C.N.T Post,
Rawet Road, Akurdi, Pune-411 044, India

INTRODUCTION

Bivalvia is an important class in the Phylum Mollusca having about 8000 marine and brackish water species in 99 families (Huber, 2010). Bivalvia is characterized by two asymmetrically valves jointed by hinge. They can occur as epifauna or as infauna either in sessile form or freely living or boring to a substratum. Since these animals are filter feeders, they have great ecological significance besides having many commercial values as in aquaculture. Thus, marine bivalves have been studied well in India (Ramakrishna and Dey, 2010). Many reports are also available on these animals from Maharashtra state (Melvill and Abercrombie, 1893; Hornell, 1951; Tikader, 1964; Jones, 1969; Joshi, 1969; Sundaram *et al.*, 1969; Algarswami and Narasimham, 1973; Nayar and Mahadevan, 1974; Ray, 1977; Subba Rao and Dey, 1986; Mane and Nagabhushanam, 1987; Subba Rao *et al.*, 1991, 1992; Mathew and Govindan, 1995; Apte, 1998; Donde *et al.*, 2001; Jaiswar and Kulkarni, 2001 and 2002; Dutta *et al.*, 2008 and 2010; Gaonkar *et al.*, 2010; Kurve and Kurve, 2010; Sundaram *et al.*, 2010 and Swami and Udhayakumar, 2010). So far, no complete list of marine bivalves is available for the state. Hence, efforts were made to collect information on bivalves of Maharashtra from above literatures and presented here in the form of a systematic list following recent classification system of Bouchet and Rocroi (2010).

SYSTEMATIC LIST

- Phylum MOLLUSCA Linnaeus, 1758
 - Class BIVALVIA Linnaeus, 1758
 - Subclass HETERODONTA Neumayr, 1884
 - Order ANOMALODESMATA Dall, 1889
 - Superfamily PANDOROIDEA Rafinesque, 1815
 - Family PANDORIDAE Rafinesque, 1815
 - 1. *Pandora flexuosa* G.B. Sowerby I, 1822
 - Superfamily THRACIOIDEA Stoliczka, 1870 (1839)
 - Family LATERNULIDAE Hedley, 1918 (1840)
 - 2. *Laternula anatina* (Linnaeus, 1758)
 - THRACIIDAE Stoliczka, 1870 (1839)
 - 3. *Thracia salsettensis* (Melvill, 1893)
 - Order CARDITOIDA Dall, 1889
 - Superfamily CARDITOIDEA Férussac, 1822
 - Family CARDITIDAE Férussac, 1822
 - 4. *Cardita calyculata* (Linnaeus, 1758)
 - 5. *Cardita variegata* Bruguière, 1792
 - 6. *Cardites antiquatus* (Linnaeus, 1758)
 - Order LUCINOIDA Gray, 1854
 - Superfamily LUCINOIDEA J. Fleming, 1828
 - Family LUCINIDAE Fleming, 1828
 - 7. *Lucina fibula* Reeve, 1850
 - Order MYOIDA Stoliczka, 1870
 - Superfamily MYOIDEA Lamarck, 1809
 - Family CORBULIDAE Lamarck, 1818
 - 8. *Corbula taitensis* Lamarck, 1818

- Family MYIDAE Lamarck, 1809
9. *Cryptomya philippinarum* (A. Adams, 1851)
- Superfamily PHOLADOIDEA Lamarck, 1809
- Family PHOLADIDAE Lamarck, 1809
- Subfamily MARTESIINAE Grant and Gale, 1931
10. *Martesia striata* (Linnaeus, 1758)
11. *Martesia nairi* Turner and Santhakumaran, 1989
- Subfamily PHOLADINAE Lamarck, 1809
12. *Barnea birmanica* (Philippi, 1849)
13. *Barnea candida* (Linnaeus, 1758)
14. *Pholas dactylus* Linnaeus, 1758
15. *Pholas orientalis* Gmelin, 1791
- Family TEREDINIDAE Rafinesque, 1815
- Subfamily BANKIINAE Turner, 1966
16. *Bankia campanellata* Moll and Roch, 1931
17. *Bankia carinata* (Gray, 1827)
18. *Bankia destructa* Clench and Turner, 1946
19. *Bankia gracilis* Moll, 1935
20. *Bankia nordi* Moll, 1935
21. *Bankia philippinensis* Bartsch, 1927
22. *Bankia rochi* Moll, 1931
23. *Nausitora hedleyi* Schepman, 1919
24. *Nototeredo edax* (Hedley, 1895)
- Subfamily TEREDININAE Rafinesque, 1815
25. *Bactronophorus thoracites* (Gould, 1856)
26. *Dicyathifer manni* (Wright, 1866)
27. *Lyrodus pedicellatus* (Quatrefages, 1849)
28. *Lyrodus singaporeana* Roch, 1935
29. *Teredo clappi* Bartsch, 1923
30. *Teredo fulleri* Clapp, 1924
31. *Teredo furcifera* von Martens, 1894
32. *Teredo indomalaiica* Roch, 1935
33. *Teredo parksi* Bartsch, 1921
34. *Teredora princesae* (Sivickis, 1928)
- Order Unassigned EUHETERODONTA
- Superfamily SOLENOIDEA Lamarck, 1809
- Family PHARIDAE H. Adams & A. Adams, 1856
35. *Siliqua albida* (Adams & Reeve, 1850)
36. *Siliqua radiata* (Linnaeus, 1758)
- Family SOLENIDAE Lamarck, 1809
37. *Solen annandalei* Preston, 1915
38. *Solen kempfi* Preston, 1915
39. *Solen lamarckii* Chenu, 1843
40. *Solen vagina* Linnaeus, 1758
- Order VENEROIDA Gray, 1854
- Superfamily ARCTICOIDEA Newton, 1891 (1844)
- Family TRAPEZIDAE Lamy, 1920 (1895)
41. *Trapezium sublevigatum* (Lamarck, 1819)
- Superfamily CHAMOIDEA Lamarck, 1809
- Family CHAMIDAE Lamarck, 1809
42. *Chama lazarus* Linnaeus, 1758
43. *Chama pacifica* Broderip, 1835
- Superfamily CARDIOIDEA Lamarck, 1809
- Family CARDIIDAE Lamarck, 1809
- Subfamily CARDIINAE Lamarck, 1809
44. *Acanthocardia coronata* (Schroeter, 1786)
45. *Vepricardium asiaticum* (Bruguère, 1789)
- Subfamily TRACHYCARDIINAE Stewart, 1930
46. *Acrosterigma variegatum* (G.B. Sowerby II, 1840)
47. *Papyridea lata* (Born, 1778)
48. *Vasticardium flavum flavum* (Linnaeus, 1758)
- Superfamily CYRENOIDEA Gray, 1840
- Family CYRENIDAE Gray, 1847
49. *Polymesoda erosa* (Solander, 1786)
- Family GLAUCONOMIDAE Gray, 1853
50. *Glauconome cerea* Reeve, 1844
- Superfamily DREISSENOIDEA Gray, 1840
- Family DREISSENIDAE Gray, 1840
51. *Mytilopsis sallei* (Récluz, 1849)
- Superfamily GALEOMMATOIDEA J.E. Gray, 1840
- Family LASAEIDAE Gray, 1842
52. *Raeta pellicula* (Reeve, 1854)
- Superfamily MACTROIDEA Lamarck, 1809
- Family MACTRIDAE Lamarck, 1809
53. *Lutraria complanata* (Gmelin, 1791)

54. *Macra antiquata* Spengler, 1802
55. *Macra grandis* Gmelin, 1791
56. *Macra luzonica* Reeve, 1854
57. *Macrinula plicataria* (Linnaeus, 1767)
58. *Mactromeris polynyma* (Stimpson, 1860)
59. *Meropesta capillacea* (Reeve, 1854)
60. *Standella pellucida* (Gmelin, 1791)
- Family MESODESMATIDAE Gray, 1840
61. *Coecella horsfieldii* Gray, 1853
- Superfamily TELLINOIDEA Blainville, 1814
- Family DONACIDAE Fleming, 1828
62. *Donax cuneatus* Linnaeus, 1758
63. *Donax faba* Gmelin, 1791
64. *Donax incarnatus* Gmelin, 1791
65. *Donax lubricus* Hanley, 1845
66. *Donax scortum* (Linnaeus, 1758)
- Family PSAMMOBIIDAE Fleming, 1828
67. *Asaphis deflorata* (Linnaeus, 1758)
68. *Gari lessoni* (Blainville, 1826)
69. *Sanguinolaria atrata* Deshayes, 1857
70. *Soletellina atrata* Reeve, 1857
71. *Soletellina diphos* (Linnaeus, 1771)
- Family SEMELIDAE Stoliczka, 1870 (1825)
72. *Abra regularis* (E.A. Smith, 1885)
73. *Semele cordiformis* (Holten, 1802)
74. *Theora opalina* (Hinds, 1843)
- Family SOLECURTIDAE d'Orbigny, 1846
75. *Solecurtus exaratus* (Philippi, 1849)
- Family TELLINIDAE Blainville, 1814
76. *Gastrana polygona* Gmelin
77. *Macalia bruguieri* (Hanley, 1844)
78. *Merisca subtruncata* (Hanley, 1844)
79. *Psammotreta ala* (Hanley, 1844)
80. *Psammotreta gubernaculum* (Hanley, 1844)
81. *Tellina capsoides* Lamarck, 1818
82. *Tellina edentula* Spengler 1794
83. *Tellina emarginata* Sowerby, 1825
84. *Tellina inflata* Gmelin, 1791
85. *Tellina palatum* Iredale 1929
86. *Tellina pinguis* Hanley, 1844
87. *Tellina rubella* Deshayes, 1854
88. *Tellina scobinata* Linnaeus, 1758
89. *Tellina sinuata* Spengler, 1798
90. *Tellinella virgata* (Linnaeus, 1758)
- Subfamily MACOMINAE Olsson, 1961
91. *Apolymetis papyracea* (Gmelin, 1791)
- Superfamily UNGULINOIDEA ray, 1854
- Family UNGULINIDAE ray, 1854
92. *Diplodonta indica* (Deshayes, 1832)
93. *Diplodonta rotundata* (Montagu, 1803)
- Superfamily VENEROIDEA Rafinesque, 1815
- Family VENERIDAE Rafinesque, 1815
94. *Callista erycina* (Linnaeus, 1758)
95. *Clementia papyracea* (Gmelin, 1791)
96. *Dosinia cretacea* (Reeve, 1850)
97. *Dosinia prostrata* (Linnaeus, 1758)
98. *Dosinia pubescens* (Philippi, 1847)
99. *Dosinia tumida* (Gray, 1838)
100. *Gafrarium divaricatum* (Gmelin, 1791)
101. *Gafrarium pectinatum* (Linnaeus, 1758)
102. *Irus irus* (Linnaeus, 1758)
103. *Marcia opima* (Gmelin, 1791)
104. *Marcia recens* (Holten, 1802)
105. *Meretrix casta* (Gmelin, 1791)
106. *Meretrix meretrix* (Linnaeus, 1758)
107. *Paphia textile* (Gmelin, 1791)
108. *Paphia undulata* (Born, 1778)
109. *Pelecypora excisa* (Röding, 1798)
110. *Pelecypora nana* (Reeve, 1850)
111. *Placamen calophyllum* (Philippi, 1836)
112. *Placamen isabellina* (Philippi, 1849)
113. *Protapes cor* (G.B. Sowerby II, 1853)
114. *Protapes gallus* (Gmelin, 1791)
115. *Sunetta donacina* (Gmelin, 1791)
116. *Sunetta effossa* (Hanley, 1843)
117. *Sunetta excavata* (Hanley, 1843)
118. *Sunetta meroë* (Linnaeus, 1758)
119. *Sunetta scripta* (Linnaeus, 1758)

120. *Sunetta solanderii* (Gray, 1825)
121. *Tapes literatus* (Linnaeus, 1758)
122. *Timoclea imbricata* (G.B. Sowerby II, 1853)
123. *Timoclea layardi* (Reeve, 1864)
124. *Venerupis philippinarum* (A. Adams & Reeve, 1850)
Subfamily PETRICOLINAE d'Orbigny, 1840
125. *Petricola fabagella* Lamarck, 1818
Subclass PROTOBRANCHIA Pelseneer, 1889
Order NUCULANOIDA Carter, D.C. Campbell & M.R. Campbell, 2000
Superfamily NUCULANOIDEA H. Adams & A. Adams, 1858 (1854)
Family NUCULANIDAE H. Adams & A. Adams, 1858 (1854)
Subfamily NUCULANINAE H. Adams & A. Adams, 1858 (1854)
126. *Nuculana mauritiana* (G.B. Sowerby I, 1833)
Family YOLDIIDAE Dall, 1908
127. *Scissilella nicobarica* (Bruguère, 1789)
Order NUCULIDA Dall, 1889
Superfamily NUCULOIDEA Gray, 1824
Family NUCULIDAE Gray, 1824
128. *Nucula layardi* A. Adams, 1856
Subclass PTERIOMORPHIA Beurlen, 1944
Order ARCOIDA Stoliczka, 1871
Superfamily ARCOIDEA Lamarck, 1809
Family ARCIDAE Lamarck, 1809
129. *Anadara indica* (Gmelin, 1791)
130. *Arca patriarchalis* Röding, 1798
131. *Barbatia (Barbatia) obliquata* (W. Wood, 1828)
132. *Mesocibota bistrigata* (Dunker, 1866)
133. *Scapharca inaequalis* (Bruguère, 1789)
134. *Tegillarca granosa* (Linnaeus, 1758)
135. *Tegillarca rhombea* (Born, 1778)
Family NOETIIDAE Stewart, 1930
136. *Didimacra tenebrica* (Reeve, 1844)
137. *Striarca lactea* (Linnaeus, 1758)
138. *Striarca symmetrica* (Reeve, 1844)
Order MYTILOIDA Ferussac, 1822
Superfamily MYTILOIDEA Rafinesque, 1815
Family MYTILIDAE Rafinesque, 1815
139. *Brachidontes striatulus* (Hanley, 1843)
140. *Brachidontes ustulatus* (Lamarck, 1819)
141. *Perna viridis* (Linnaeus, 1758)
Order OSTREOIDEA Férussac, 1822
Superfamily OSTREOIDEA Rafinesque, 1815
Family OSTREIDAE Rafinesque, 1815
Subfamily CRASSOSTREINAE Scarlato & Starobogatov, 1979
142. *Crassostrea belcheri* (G.B. Sowerby II, 1871)
143. *Crassostrea bilineata* (Röding, 1798)
144. *Crassostrea gryphoides* (Schlotheim, 1813)
145. *Crassostrea rivularis* (Gould, 1861)
146. *Crassostrea tulipa* (Lamarck, 1819)
147. *Saccostrea cucullata* (Born, 1778)
Subfamily LOPHINAE Vialov, 1936
148. *Dendostrea sandvicensis* (Sowerby II, 1871)
149. *Dendostrea senegalensis* (Gmelin, 1791)
Order PECTINOIDEA Gray, 1854
Superfamily ANOMIOIDEA Rafinesque, 1815
Family ANOMIIDAE Rafinesque, 1815
150. *Anomia achaea* Gray, 1850
151. *Enigmonia aenigmatica* (Holten, 1802)
Family PLACUNIDAE Rafinesque, 1815
152. *Placuna placenta* (Linnaeus, 1758)
Superfamily PECTINOIDEA Rafinesque, 1815
Family PECTINIDAE Rafinesque, 1815
Subfamily CHLAMYDINAE von Teppner, 1922
153. *Chlamys senatoria* (Gmelin, 1791)
Subfamily PECTININAE Wilkes, 1810
154. *Amusium pleuronectes* (Linnaeus, 1758)
155. *Volachlamys singaporina* (Sowerby II, 1842)
156. *Volachlamys tranquebarica* (Gmelin, 1791)
Family SPONDYLIDAE Gray, 1826
157. *Spondylus layardi* Reeve, 1856

158. *Spondylus nicobaricus* Schreibers, 1793

159. *Spondylus rubicundus* Reeve, 1856

Order PTERIOIDA Newell, 1965

Superfamily PINNOIDEA Leach, 1819

Family PINNIDAE Leach, 1819

160. *Pinna nigra* Chemnitz in Schröter, 1788

Superfamily PTERIOIDEA Gray, 1847 (1820)

Family PTERIIDAE Gray, 1847 (1820)

161. *Pinctada albina* (Lamarck, 1819)

162. *Pinctada chemnitzii* (Philippi, 1849)

SUMMARY

Maine bivalves of Maharashtra are represented by 162 species, belonging to 86 genera in 13 subfamilies and 40 families under 26 superfamilies of 13 orders and 3 subclasses.

REFERENCES

- Alagarwami, K. and Narasimham, K.A. 1973. Clam, cockle and oyster resources of the Indian coasts. *Living resources of the seas around India, CMFRI, Cochin* : 648-658.
- Apte, D. 1998. *The book of Indian shells. Oxford University Press* : 115 pp.
- Bouchet, Philippe and Rocroi, Jean-Perre. (eds.) 2010. Nomenclator of bivalve families. *Malacologia*, **52**(2) : 1-184.
- Datta, S.N., Chakraborty, S.K., Jaiswar, A.K. and Venkateshvaran, K. 2008. Temporal and spatial differences in species diversity in the intertidal region of south Mumbai. *Journal of the Marine Biological Association of India*, **50**(1) : 29-37.
- Datta, S.N., Chakraborty, S.K., Jaiswar, A.K. and Ziauddin, G. 2010. A comparative study on intertidal faunal biodiversity of selected beaches of Mumbai coast. *Journal of Environmental Biology*, **31**(6) : 981-986.
- Donde, S.S., Nayak, R.R. and Sawant, K.B. 2001. Accumulation and depuration of petroleum hydrocarbons from WSFS of Bombay High crude oil by the marine bivalve *Gafrarium divaricatum* (Gmelin). *Journal of the Marine Biological Association of India*, **43**(1&2) : 197-201.
- Gaonkar, Chetan A., Sawant, Subhash S., Anil, Arga Chandrashekar., Krishnamurthy, Venkat. and Harkantra, Sadanand N. 2010. Changes in the occurrence of hard substratum fauna : A case study from Mumbai harbour, India. *Indian Journal of Marine Sciences*, **39**(1) : 74-84.
- Hornell, J. 1951. *Indian Molluscs*. The Bombay Natural History Society, Bombay : 96 pp.
- Huber, Markus. 2010. *Compendium of Bivalves. A Full-color Guide to 3'300 of the World's Marine Bivalves. A Status on Bivalvia after 250 Years of Research*. Hackenheim : Conch Books. pp. 901.
- Jaiswar, A.K. and Kulkarni, B.G. 2001. Vertical distribution of molluscs in the intertidal area in and around Mumbai, India. *Journal of Indian fisheries association*, **28** : 93-100.
- Jaiswar, A.K. and Kulkarni, B.G. 2002. Length-Weight relationship of intertidal Molluscs from Mumbai, India. *Journal of Indian fisheries association*, **29** : 55-63.
- Jones, S. 1969. The molluscan fishery resources of India. *Proceedings of the Symposium on Mollusca, CMFRI, Cochin* : 906-918.
- Joshi, M.C. 1969. The marine mollusca of the Kōnkan Coast. *Journal of Shivaji University*, **2**(4) : 47-54.

- Kurve, P. and Kurve, N.K. 2010. Occurrence of macro-fauna from intertidal zone along the coastline of village Akshi, district Raigad, Maharashtra. *The Ecoscan*, 4(2&3) : 207-208.
- Mane, U.H. and Nagabhushanam, R. 1987. Reproduction in edible bivalve shellfishes of Ratnagiri coast. *National seminar on shellfish resources and farming, C.M.F.R.I., Cochin*, p. 167-176.
- Mathew, A. and Govindan, K. 1995. Macrobenthos in the nearshore coastal system of Bombay. *Proceedings of the National Academy of Sciences, India (Biological Sciences)*, 65(IV) : 411-430.
- Melvill, J.C. and Abercrombie, A. 1893. The marine mollusca of Bombay. *Memoirs and Proceedings of the Manchester Literary and Philosophical Society*, Series 4, VII : 17-51.
- Nayar, K.N. and Mahadevan, S. 1974. Edible Bivalves; Clams and others—The commercial molluscs of India. *Bulletin of Central Marine Fisheries Research Institute, CMFRI, Cochin*, 25 : 40-53.
- Ramakrishna. and Dey, A. 2010. Annotated Checklist of Indian Marine Molluscs (Cephalopoda, Bivalvia and Scaphopoda): Part-1. *Records of the Zoological Survey of India, Occasional Paper No.*, 320 : 1-357. (Published by the Director, Zoological Survey of India, Kolkata)
- Ray, Harish Chandra. 1977. Contribution to the knowledge of the molluscan fauna of Maungmagan, Lower Burma [with descriptions of one new genus and species of the Family Turridae (Gastropoda) 8]. *Indian Museum, Calcutta*: 1-150.
- Subba Rao, N.V. and Dey, A. 1986. Contribution to the knowledge of Indian marine molluscs. 2. Family Donacidae. *Records of the Zoological Survey of India, Occasional Paper No.*, 91 : 1-30.
- Subba Rao, N.V., Dey, A. and Barua, S. 1992. Estuarine and Marine Molluscs. In: *Fauna of West Bengal, State Fauna Series, Zoological Survey of India*, 3(Part-9) : 129-268.
- Subba Rao, N.V., Surya Rao, K.V. and Maitra, S. 1991. Marine Molluscs. In: *Fauna of Orissa, State Fauna Series, Zoological Survey of India*, 1(3) : 1-175.
- Sundaram, K.S., Sarvesan, R., Mohamed, K.H. and Shanbhogue, S.L. 1969. Catalogue of molluscs, prawns, stomatopods and marine algae in the reference collections of the Central Marine Fisheries Research Institute. *Bulletin of Central Marine Fisheries Research Institute, CMFRI, Cochin*, 9 : 1-52.
- Sundaram, S., Deshmukh, V.D. and Raje, S.G. 2010. Population eruption of sunset shell *Siliqua radiata* (Linnaeus, 1758) along Versova beach in Mumbai. *Journal of the Marine Biological Association of India*, 52(1) : 99-101.
- Swami, B.S. and Udhayakumar, M. 2010. Seasonal influence on settlement, distribution and diversity of fouling organisms at Mumbai harbour. *Indian Journal of Marine Sciences*, 39(1) : 57-67.
- Tikader, B.K. 1964. Marine fauna of Deogad Coast (Ratnagiri District) Maharashtra. Part I Mollusca *Journal of the University of Poona*, 28 : 43-48.

FRESHWATER OSTRACODS

S.G. PATIL and S.S. TALMALE

Western Regional Centre, Zoological Survey of India, Vidyanagar, Sector-29, Pune-411 044

INTRODUCTION

The subclass Ostracoda inhabits in both marine and freshwater environment. The freshwater ostracods are mainly benthonic while some of them occur among aquatic vegetation algal mats and few are planktonic. Class Crustacea is characterized by two pairs of antennae and they perform respiration by gills or body surface. Especially in subclass Ostracoda the two (or 3) pairs of thoracic appendages are important. The body is compressed and enclosed with bivalve carapace. These tiny organisms are also called as seed shrimps.

Indian species range between 0.5 mm to 2 mm in length. There are nearly 1700 species of which nearly one third occur in freshwater. Studies on Ostracods fauna of Maharashtra : Baird (1859) described three species viz. *Cypris subglobosa*, *Stenocypris major* and *Heterocypris dentatomarginalis* from Nagpur. Hartmann (1964) made addition to the list of Ostracods of Maharashtra. Deb (1973, 1983) described total 16 new species from Maharashtra. Victor and Fernando (1979) enlisted Indian freshwater species of Ostracods from this region. Patil (2002a, b) studied Ostracods of Ujani and Western Ghat part of Maharashtra. Patil and Talmale (2005a) Studied Ostracods from Nathsagar Wetland and further contributed nine species of Ostracods to the Ostracod fauna of this region. Further Patil and Talmale (2005b) published checklist of 38 species of ostracods from Maharashtra State.

A classified checklist on Ostracod fauna of

Maharashtra is given below on the basis of past and present records reveal the existence of 38 species belonging to 15 genera over 4 families.

SYSTEMATIC LIST

Phylum ARTHROPODA

Class CRUSTACEA

Subclass OSTRACODA

Suborder PODOCOPA

Family CYPRIDIDAE

Subfamily CYPRIDINAE

Genus *Cypris* O.F. Muller 1776

1. *Cypris subglobosa* Sowerby
2. *Cypris dravidensis* Victor and Michael
3. *Cypris debi* Deb
4. *Cypris elongata* Deb
5. *Cypris globosa* Deb

Genus *Sataracypris* Deb 1983

6. *Sataracypris gibbosa* (Baird)

Genus *Eucypris* Vavra 1891

7. *Eucypris sonia* Deb
8. *Eucypris compressa* Deb
9. *Eucypris gomati* Deb
10. *Eucypris munia* Deb
11. *Eucypris indica* Deb
12. *Eucypris inequalis* Deb
13. *Eucypris himani* Deb

Genus *Strandesia* Stuhlmann, 1888

14. *Strandesia labiata* Hartmann

15. *Strandesia parva* Hartmann
16. *Strandesia saetosa* Hartmann
17. *Strandesia rotunda* Hartmann
Genus *Cyprinotus* Brady, 1886.
18. *Cyprinotus cingalensis* Brady
19. *Cyprinotus incongruens* (Ramdohr)
20. *Cyprinotus malini* Deb
Genus *Cypricerus* Sars, 1894
21. *Cypricerus indrani* Deb
Genus *Heterocypris* Claus, 1892
22. *Heterocypris dentatomarginalis* (Baird)
Genus *Hemicypris* Sars, 1903
23. *Hemicypris anomala* (Klie)
Subfamily CYPRETTINAE
Genus *Cypretta* Vavra 1895
24. *Cypretta fontinalis* Hartmann
25. *Cypretta gargi* Deb
26. *Cypretta globulus* (Sars)
Subfamily STENOCYPRINAE
Genus *Stenocypris* sars 1889
27. *Stenocypris major* (Baird)
28. *Stenocypris derupta* Vavra
29. *Stenocypris hislopi* Ferguson
30. *Stenocypris khopoliensis* Deb
31. *Stenocypris sohni* Deb
Genus *Chrissia* Hartmann, 1957
32. *Chrissia humilis indica* (Klie)
33. *Chrissia krishnakantai* (Deb)
Genus *Parastenocypris* Hartmann
34. *Parastenocypris canaliculata* Hartmann.
Subfamily CYPRIDOPSINAE
Genus *Cypridopsis* Brady, 1868
35. *Cypridopsis dispar* Hartmann
Family CYCLOCYPRIDIDAE
Genus *Physocypris* Vavra, 1897
36. *Physocypris furfuracea* (Brady)
Family NOTODROMADIDAE
Genus *Indiacypris* Hartmann, 1964
37. *Indiacypris dispar* Hartmann

Family ILYOCYPRIDIDAE

Genus *Ilyocypris* Brady and Norman, 1889

- 38.
- Ilyocypris australiensis*
- Sars.

SYSTEMATIC ACCOUNT

Phylum ARTHROPODA

Class CRUSTACEA

Subclass OSTRACODA

Suborder PODOCOPA

Family CYPRIDIDAE

Subfamily CYPRIDINAE

Genus *Cypris* O.G. Muller 17761. *Cypris subglobosa* Sowerby

1840. *Cypris subglobosa*, Baird, 1859., P 232, Pl.63, Fig. 2.
1898. *Cypris granulata*, Daday, 1898, P. 73, Abb. 36.
1906. *Eucypris subglobosa*, Vavra, P. 420, Taf. 24, Fig. 9-13.
1932. *Cypris subglobosa* Sowerby, 1840, Klie, P. 458. 1938 P 22.
1964. *Cypris subglobosa* Sowerby, 1840, Hartmann; P. 92, Abb. 34, a, b.

Diagnostic characters : Valves subglobular, tumid, both anterior and posterior margins broadly rounded; dorsum convex. Natatory setae of the second antenna setulate, claws pectinate. Fureal ramai symmetrical slender; subterminal claws slightly more than ½ the length of terminal claw. This can be distinguished from the other species by its tumid valves with the characteristic timble shaped depressions on the valve surface.

Material examined/Source : Victor and Fernando (1979); Patil (2002a), Patil and Talmale (2005a,b).

Distribution : Maharashtra : Nagpur, Bombay, Solapur Dist. : Pandharpur, Ujani and Aurangabad Dist. : Nathsagar Wetlands.

Elsewhere : Andhra Pradesh; Kerala; Madhya Pradesh; Tamil Nadu.

2. *Cypris dravidensis* Victor and Michael

1975. *Cypris globosa*, Victor and Michael, *J. Nat. Hist.*, 9 : 366.

1979. *Cypris dravidensis*, Victor and Fernando, *Rec. zool. Surv. Ind.*, 74(2) : 163-165.

Diagnostic characters : Valve very tumid, globular; dorsum markedly arched; right valve with a distinct flange; equivalved; ventral margin straight; marginal hairs prominent on anterior and posterior extremities; valve surface punctate. Length 1.38-1.50 mm; height 0.88-1.10 mm and width 1.20-1.35 mm. Natatory setae of the second antenna well developed, setulate, usually reaching the tips of the terminal claws; claws toothed. Furcal rami symmetrical. Male smaller than female; first leg modified as prehensile palps. Hemipenis subtriangular, lobe blunt.

Material examined/Source : Victor and Fernando (1979); Patil (2002a); Patil and Talmale (2005b).

Distribution : Maharashtra : Solapur Dist. : Ujani Wetland, Pandharpur.

Elsewhere : Tamil Nadu.

3. *Cypris debi* Deb

1983. *Cypris debi* Deb, *Rec. zool. Surv. India*, 81 : 137-138.

Diagnostic characters : Shell valve with minute, scattered, tubercles; margins without spines. Length 1.87 mm; height 1 mm and width 1.37 mm. In dorsal view, anterior end acutely pointed. Swimming setae of second antenna slightly longer than the tips of terminal claws. Furcal rami long, narrow and nearly straight; ventral claw slightly more than half of the ramus in length, ventral setae minute.

Material examined/Source : Deb (1983); Patil and Talmale (2005b).

Distribution : Maharashtra : Satara Dist. : Karad.

Remarks : Known only from type locality.

4. *Cypris elongata* Deb

1983. *Cypris elongata* Deb, *Rec. zool. Surv. India*, 81 : 138-139.

Diagnostic characters : Shell tumid, pear

shaped, oblong, elongate, maximum width occurs behind the middle. Length 1.75 mm, Height 1 mm and width 1.25 mm. In dorsal view anterior end obtusely rounded. Surface of shell unsculptured, finely hairy. Swimming setae of second antenna longer than the terminal claws. Furcal rami straight, long, narrow; ventral claw more than half of ramus.

Material examined/Source : Deb (1983); Patil and Talmale (2005b).

Distribution : Maharashtra : Pond inside Satara Fort.

Remarks : Known only from type locality.

5. *Cypris globosa* Deb.

1983. *Cypris globosa* Deb, *Rec. zool. Surv. India*, 81 : 139-140.

Diagnostic characters : Shell short and globular. Length less than 1.50 mm, Width 1 mm. Valves unequal, left valve overlaps the right, margin entire, thin, delicate. Surface of shell unsculptured, finely hairy. Swimming setae of second antenna slightly longer than the tips of terminal claws. Furcal rami short, stout and curved; terminal claw more than half of the ramus in length. Ventral setae minute.

Material examined/Source : Deb (1983); Patil and Talmale (2005b).

Distribution : Maharashtra : Satara Dist. : Satara.

Remarks : Known only from type locality.

Genus *Sataracypris* Deb 1983

6. *Sataracypris gibbosa* (Baird)

1837. *Cypris gibbosa* Baird, *Mag. Zool. and Bot.*, 1 : 137.

1983. *Sataracypris gibbosa* (Baird), Deb, *Rec. zool. Surv. India*, 81 : 160-161.

Diagnostic characters : Shell moderately tumid. In dorsal view, shell elongate, oval, anterior end acutely pointed, posterior end broadly rounded. Left valve slightly larger and overlaps the right. Length 1.50 mm, Height 0.6 mm, Width 0.5 mm. Surface of the shell without sculpture. Thin scanty hairs present on the surface. Swimming setae of

second antenna extend much beyond the tips of terminal setae. Furcal ramus short, stout and similar; ventral claw two third of the ramus in length.

Material examined/Source : Deb (1983); Patil and Talmale (2005b).

Distribution : Maharashtra : Satara Dist. : Satara, Panchgani.

Elsewhere : United Kingdom.

Genus *Eucypris* Vavra 1891

7. *Eucypris sonia* Deb

1983. *Eucypris sonia* Deb, *Rec. zool. Surv. India*, **81** : 142-143.

Diagnostic characters : Shell tumid, oblong oval in shap. Shell longer than 2 mm. Length 2.12 mm, Height 1.25 mm, Width 1.12 mm. Shell covered with fine hairs only. Swimming setae of second antenna as long as the terminal claws. Furcal rami short, stout and curved in middle, dorsal edge of ramus and claws smooth. Ventral claw more than half of the ramus in length, ventral seta minute.

Material examined/Source : Deb (1983); Patil and Talmale (2005b).

Distribution : Maharashtra : Satara Dist. : Satara.

Remarks : Known from type locality.

8. *Eucypris compressa* Deb

1983. *Eucypris compressa* Deb, *Rec. zool. Surv. India*, **81** : 141-142.

Diagnostic characters : Shell rather compressed. Oblong, both the ends obtusely rounded, anterior end narrower than the posterior. Right valve bigger than and overlaps the left. Length 0.87 mm, Height 0.50 mm and Width 0.50 mm. Surface unsculptured, fine hairs and pore canals present on the surface, valve margin entire. Swimming setae of second antenna longer than the tips of terminal claws, third maxillary process with two strong smooth setae. Furcal rami well developed, long and curved. Dorsal edge of ramus and claws hairy.

Material examined/Source : Deb (1983); Patil and Talmale (2005b).

Distribution : Maharashtra : Satara Dist. : Panchgani near Mahabaleshwar.

Remarks : Known only from the type locality.

9. *Eucypris gomati* Deb

1983. *Eucypris gomti* Deb, *Rec. zool. Surv. India*, **81** : 143-145.

Diagnostic characters : Shell tumid, oblong. In dorsal view, eye shaped, widest in the middle and maximum width slightly more than half of length, posterior end broadly rounded. Length 1.25mm, Height 0.62mm and Width 0.68mm. Valves thin, margin entire, surface unsculptured with scattered hairs and pore canals. Swimming setae of second antenna slightly longer than the terminal claws. Furcal rami short, narrow, curved proximally.

Material examined/Source : Deb (1983); Patil and Talmale (2005b).

Distribution : Maharashtra : Satara Dist. : Satara.

Remarks : Known only from the type locality.

10. *Eucypris munia* Deb

1983. *Eucypris munia* Deb, *Rec. zool. Surv. India*, **81** : 145-146.

Diagnostic characters : Shell elongate, rather cylindrical in shape. Length 2.0 mm, Height 1.12mm and Width 1 mm. Left valve markedly smaller than right, abruptly compressed and then recurved outwards, margin entire with a narrow flap. Both the ends broadly and equally rounded. Surface unsculptured, with thin scattered hairs and porecanals. Swimming setae of second antenna a bit longer than the terminal claws. Furcal rami short, stout and curved in the middle; distal claw more than half of the ramus in length, ventral seta minute.

Material examined/Source : Deb (1983); Patil and Talmale (2005b).

Distribution : Maharashtra : Satara Dist. : Satara.

Remarks : Known only from the type locality.

11. *Eucypris indica* Deb

1983. *Eucypris indica* Deb, *Rec. zool. Surv. India*, **81** : 146-147.

Diagnostic characters : Shell tumid, profusely hairy, hairs strong and stiff. On postero-lateral side of shell few blunt finger like process present in between hairs. Dorsally, both ends obtusely rounded, anterior end narrower than posterior, maximum width occurs in middle. Left valve larger than right which it overlaps. Swimming setae of second antenna longer than terminal claws. Furcal rami long, narrow, curved proximally, distal claw nearly half of ramus in length, dorsal seta minute.

Material examined/Source : Deb (1983); Patil and Talmale (2005b).

Distribution : Maharashtra : Satara Dist. : Panchgani,

Remarks : Known only from the type locality.

12. *Eucypris inequalis* Deb

1983. *Eucypris inequalis* Deb, *Rec. zool. Surv. India*, **81** : 148-149.

Diagnostic characters : Shell spindle shaped dorsally. Left valve much bigger than the right. Length 1.75 mm, width 1.25 mm and height 1mm. Swimming setae of second antenna as long as terminal claws. Furcal rami short, stout, curved proximally.

Material examined/Source : Deb (1983); Patil and Talmale (2005b).

Distribution : Maharashtra : Satara Dist. : Pachgani.

Remarks : Known only from the type locality.

13. *Eucypris himani* Deb

1983. *Eucypris himani* Deb, *Rec. zool. Surv. India*, **81** : 150-151.

Diagnostic characters : Shell elliptical in shape dorsally. Left valve slightly larger than the right. Valve margin entire. Length 1.25 mm, width 0.62

mm and height 0.62 mm. Surface of shell thickly pitted, hairs thin and scattered. Swimming setae of second antenna slightly shorter than the terminal claws. Furcal rami long, narrow and slightly curved basally.

Material examined/Source : Deb (1983); Patil and Talmale (2005b).

Distribution : Maharashtra : Pune Dist. : Pune.

Remarks : Known only from the type locality.

Genus *Strandesia* Stuhlmann, 1888

14. *Strandesia labiata* Hartmann

1964. *Strandesia labiata* Hartmann, *Int. Rev. Gesamten Hydrobiol. Syst. Beith.*, **3** : 1-55.

1979. *Strandesia labiata*, Victor and Fernando, *Rec. zool. Surv. India*, **74**(2) : 175-176.

Diagnostic characters : Valves tuberculate, right valve with an anteroventral tip like projection. Furcal romus with a terminal seta which is shorter than claws. Male smaller than female.

Material examined/Source : Victor and Fernando (1979), Patil and Talmale (2005a,b).

Distribution : Maharashtra : Bombay (= Mumbai), Nathsagar Wetland, Aurangabad and Ahmednagar Districts.

Elsewhere : Andhra Pradesh, Kerala, Sikkim, Tamil Nadu.

15. *Strandesia parva* Hartmann

1964. *Strandesia parva* Hartmann, *Int. Rev. Gesamten Hydrobiol. Syst. Beith.*, **3** : 1-55.

1979. *Strandesia parva* Hartmann, Victor and Fernando, *Rec. zool. Surv. Ind.*, **74**(2) : 176-177.

Diagnostic characters : Left valve overlaps the right; angular dorsum, both the claws smooth; dorsal margin armed with inconspicuous spines along the entire length.

Material examined/Source : Victor and Fernando (1979), Patil (2002a), Patil and Talmale (2005a,b).

Distribution : Maharashtra : Bombay, Solapur Dist.: Ujani Wetland and Aurangabad Dist. : Nathsagar Wetland.

Elsewhere : Kerala, Rajasthan, Tamil Nadu.

16. *Strandesia saetosa* Hartmann

1964. *Strandesia saetosa* Hartmann, *Int. Rev. Gesamten Hydrobiol. Syst. Beith.*, 3 : 1-155.

1979. *Strandesia saetosa* Hartmann, Victor and Fernando, *Rec. zool. Surv. Ind.*, 74(2) : 177.

Diagnostic characters : Elongate valves; left overlapping the right; anterior margin broadly rounded than the posterior; Valve surface with dense distribution of hairs.

Material examined/Source : Victor and Fernando (1979), Patil and Talmale (2005b).

Distribution : Maharashtra : Barsi.

Elsewhere : Kerala.

17. *Strandesia rotunda* Hartmann

1964. *Strandesia rotunda* Hartmann, *Int. Rev. Gesamten Hydrobiol. Syst. Beith.*, 3 : 1-155.

1979. *Strandesia rotunda* Hartmann, Victor and Fernando, *Rec. zool. Surv. Ind.*, 74(2) : 177.

Diagnostic characters : Valves ovate; valve surface sparsely hairy; Terminal seta of the furca $\frac{3}{4}$ the length of the terminal claw, smooth.

Material examined/Source : Victor and Fernando (1979); Patil and Talmale (2005b).

Distribution : Maharashtra : Bombay.

Elsewhere : Gujarat; Kerala; Pondichery; Tamil Nadu.

Genus *Cyprinotus* Brady, 1886

18. *Cyprinotus cingalensis* Brady

1886. *Cyprinotus cingalensis* Brady, *J. Linn. Soc. Zool.*, 19 : 302.

1979. *Cyprinotus cingalensis*, Victor and Fernando, *Rec. zool. Surv. Ind.*, 74(2) : 180-181.

Diagnostic characters : Right valve tuberculated margin of the left valve smooth, valve surface smooth with scultered hairs and natatory setae of II antenna extends beyond the tip of terminal claws.

Material examined/Source : Victor and Fernando (1979); Patil (2002a), Patil and Talmale (2005a,b).

Distribution : Maharashtra : Pune Dist. : Pune, Solapur Dist. : Ujani and Aurangabad Dist. : Nathsagar Wetland.

19. *Cyprinotus incongruens* (Ramdohr, 1808)

1979. *Cyprinotus incongruens* (Ramdohr) : Victor & Fernando, *Rec. zool. Surv. India*, 74(2) : 180-181.

Diagnostic characters : Valve irregularly ovate, unequal. Length ranging from 1.40-1.75 mm. Maxillary spines toothed. Furcal rami symmetrical, short and straight.

Material examined/Source : Victor and Fernando (1979); Patil and Talmale (2005b).

Distribution : Cosmopolitan in occurrence. Maharashtra : Aurangabad.

20. *Cyprinotus malini* Deb

1983. *Cyprinotus malini* Deb, *Rec. zool. Surv. India*, 81 : 152-153.

Diagnostic characters : Shell elliptical in shape. Both the ends obtusely pointed. Left valve of the shell slightly smaller than the right valve. Length 1.15mm and height 0.68mm. Swimming setae of second antenna much longer than terminal claws. Furcal rami short, stout, strongly curved in the middle.

Material examined/Source : Deb (1983); Patil and Talmale (2005b).

Distribution : Maharashtra : Pune Dist. : Pune.

Remarks : Reported from type locality only.

Genus *Cypricerus* Sars, 1894

21. *Cypricerus indrani* Deb

1983. *Cypricerus indrani* Deb, *Rec. zool. Surv. India*, 81 : 154-155.

Diagnostic characters : Shell oblong, elongate and oval in shape. Length 1.32 mm; width 0.66

mm and height 0.62 mm. Surface without any sculpture. Swimming setae of second antenna slightly longer than terminal claws. Furcal rami very long, narrow, curved proximally. Dorsal edge of ramus and claws hairy.

Material examined/Source : Deb (1983); Patil and Talmale (2005b).

Distribution : Maharashtra : Satara dist. : Mahabaleswar.

Remarks : Reported from type locality only.

Genus *Heterocypris* Claus, 1892

22. *Heterocypris dentatmarginatus* (Baird)

1859. *Cypris dentatmarginatus* Baird : Baird, 1859, p. 233, Pl. LXIII, Fig. 5.

1979. *Heterocypris dentatmarginatus*, Victor and Fernando, *Rec. zool. Surv. Ind.*, 74(2) : 182-183.

Diagnostic characters : Valve subovate, greatest height slightly posterior to the middle, tuberculated, left valve overlapping the right.

Material examined/Source : Victor and Fernando (1979); Patil and Talmale (2005b).

Distribution : Maharashtra : From Nagpur, Vidharba.

Genus *Hemicypris* Sars, 1903

23. *Hemicypris anomala* (Klie)

1938. *Heterocypris anomala* Klie, *Bull. Biogeogr. Soc. Jpn.*, 8 : 23.

1979. *Heterocypris anomala* Klie, Victor and Fernando, *Rec. zool. Surv. Ind.*, 74(2) : 183-184.

Diagnostic characters : Valve subtriangular, unequal; right valve larger, left valve tuberculate; Length of the valves 0.70-0.75 mm. Furca symmetrical, straight. Dorsal seta more than $\frac{3}{4}$ the length of subterminal claw.

Material examined/Source : Victor and Fernando (1979); Patil and Talmale (2005b).

Distribution : Maharashtra : South Bombay.

Elsewhere : Kerala; Tamil Nadu.

Subfamily CYPRETTINAE

Genus *Cypretta* Vavra 1895

24. *Cypretta fontinalis* Hartmann

1964. *Cypretta fontinalis* Hartmann, *Int. Rev. Gesamten Hydrobiol. Syst. Beith.*, 3 : 1-155.

1979. *Cypretta fontinalis*, Victor and Fernando, *Rec. zool. Surv. India*, 74(2) : 190-191.

Diagnostic characters : Valves tumid. Right valve overlapping on the left. Surface hairy. Anterior margin with a well defined septa. Length 0.83-0.86 mm, width 0.60-0.62 and height 0.52-0.54mm. Furcal rami symmetrical. Dorsal seta less than $\frac{1}{4}$ the length of sub-terminal claw and terminal seta rudimentary.

Material examined/Source : Victor and Fernando (1979); Patil and Talmale (2005b).

Distribution : Maharashtra : Mountainous terrains of Maharashtra.

Elsewhere : Tamil Nadu.

25. *Cypretta gargi* Deb

1983. *Cypretta gargi* Deb, *Rec. zool. Surv. India*, 81 : 163-164.

Diagnostic characters : Shell very tumid. Anterior end obtusely pointed, posterior end more broadly rounded. Valves unequal, right valve slightly larger than the left and overlapping on it. Swimming setae of second antenna slightly longer than terminal claws. Furcal rami straight, short, comparatively strong, with two long claws and two small setae.

Material examined/Source : Deb (1983); Patil and Talmale (2005b).

Distribution : Maharashtra : Pune Dist. : Karla.

Remarks : Reported from type locality only.

26. *Cypretta globulus* (Sars)

1889. *Cypridopsis globulus* Sars, *Arch. Math. Naturv. Kristiana* 8 : 53, Pl. II, Fig. 9, 10; Pl. VII, Figs. 1-11.

1931. *Cypretta globulus* Sars, Arora, *Bull. Dept. Zool. Punjab Univ.*, 1 : 88.

1979. *Cypretta globulus*, Victor and Fernando, *Rec. zool. Surv. Ind.*, 74(2) : 191-192.

Diagnostic characters : Valves tumid; laterally somewhat triangular with greatest height in the middle. Length of valves about 0.70 mm. Furca symmetrical, small and straight. Dorsal seta little shorter than the subterminal claw and terminal seta very small.

Material examined/Source : Victor and Fernando (1979), Patil (2002a), Patil and Talmale (2005b).

Distribution : Maharashtra : Dist. Solapur : Ujani Wetland.

Elsewhere : Pakistan.

Subfamily STENOCYPRINAE

Genus *Stenocypris* Sars 1889

27. *Stenocypris major* (Baird)

1859. *Cypris cylindrica major* Baird, *Proc. zool. Soc. Lond.*, **389** : 233.

1979. *Stenocypris major*, Victor and Fernando, *Rec. zool. Surv. India*, **74**(2) : 193-194.

Diagnostic characters : Valve surface is variable either with punctuations alone or also with a sparse distribution of hairs. Furcal rami asymmetrical, terminal seta $\frac{1}{2}$ the length of terminal claw.

Material examined/Source : Victor and Fernando (1979); Patil (2002a), Patil and Talmale (2005a,b).

Distribution : Maharashtra : Mumbai Dist. : Bombay area, Solapur Dist. : Ujani wetland and Aurangabad Dist. : Nathsagar Wetlands.

Elsewhere : Gujarat; Kerala; Madhya Pradesh; Tamil Nadu and West Bengal.

28. *Stenocypris derupta* Vavra

1906. *Stenocypris derupta* Vavra, *Zool. Jb., (Syst.)* : **23** : 426.

1979. *Stenocypris derupta*, Victor and Fernando, *Rec. zool. Surv. India*, **74**(2) : 195-196.

Diagnostic characters : Valves elliptical; laterally elongate interiorly rounded and posteriorly pointed, natatory setae of second antenna setulate and does not extend upto the tip of the terminal claws. Furcal rami asymmetrical.

Material examined/Source : Victor and Fernando (1979); Patil and Talmale (2005a, b).

Distribution : Maharashtra : Solapur Dist. : Pandharpur, Aurangabad Dist. : Nathsagar Wetland.

Elsewhere : Andhra Pradesh; Tamil Nadu.

29. *Stenocypris hislopi* Ferguson

1969. *Stenocypris hislopi* Ferguson, *Oliver and Boyd. Edin.*, : 69.

1979. *Stenocypris hislopi*, Victor and Fernando, *Rec. zool. Surv. India*, **74**(2) : 196-197.

Diagnostic characters : The toothed end claw of the third thoracic leg is unique characters of this species, and the left furcal ramus of *S. hislopi* has smooth dorsal margin to separate it from the *S. major*.

Material examined/Source : Victor and Fernando (1979); Patil and Talmale (2005a,b).

Distribution : Maharashtra : Nagpur Dist. : Nagpur, Aurangabad Dist. : Nathsagar Wetland.

Elsewhere : Andhra Pradesh; Tamil Nadu.

30. *Stenocypris khopoliensis* Deb

1983. *Stenocypris khopoliensis* Deb, *Rec. zool. Surv. India*, **81** : 156-157.

Diagnostic characters : Shell elongate and oblong. Right valve overlaps left. Length 2.12 mm, width 0.72 mm and height 0.75 mm. Anterior and posterior ends broadly rounded. Valves without marginal band of radial porecanals. Swimming setae of second antenna as long as terminal claws. Right furcal ramus broad, curved and with dorsal pectination up to middle of ramus. Ventral seta slightly smaller than ventral claw.

Material examined/Source : Patil and Talmale (2005b).

Distribution : Maharashtra : Pune Dist. : Karla.

Remarks : Reported from type locality only.

31. *Stenocypris sohni* Deb

1983. *Stenocypris sohni* Deb, *Rec. zool. Surv. India*, **81** : 157-158.

Diagnostic characters : Anterior end of shell obtusely and posterior end acutely pointed. Valves equal, thin and transparent, margins with a very broad band of radial porecanals. Length 2.12 mm, width 0.72 mm and height 0.75 mm. Surface unsculptured, thinly hairy. Swimming setae of second antenna extend slightly above the tips of terminal claws. Furcal rami stout, right ramus broad, curved, spines on dorsal edge are in 7-8 groups.

Material examined/Source : Deb (1983), Patil and Talmale (2005b).

Distribution : Maharashtra : Kolhapur Dist. : Kolhapur.

Remarks : Reported from type locality only.

Genus *Chrissia* Hartmann, 1957

32. *Chrissia humilis indica* (Klie)

1964. *Chrissia humilis indica* Hartmann, *Int. Rev. Gesamten Hydrobiol. Syst. Beith.*, **3** : 122.

1979. *Chrissia humilis indica* Klie, Victor and Fernando, *Rec. zool. Surv. Ind.*, **74**(2) : 203..

Diagnostic characters : Left valve slightly larger than the right. Valve margins devoid of radial band of septa, surface hairy. Furcal rami asymmetrical.

Material examined/Source : Victor and Fernando (1979), Patil (2002a), Patil and Talmale (2005b).

Distribution : Maharashtra : Mumbai Dist. : Mumbai; Solapur Dist. : Ujani Wetland.

Elsewhere : Kerala, Tamil Nadu, West Bengal.

33. *Chrissia krishnakantai* (Deb)

1972. *Stenocypris krishnakantai* Deb, *J. zool. Soc. India*, **1** : 93.

1979. *Chrissia krishnakantai*, Victor and Fernando, *Rec. zool. Surv. India*, **74**(2) : 204-205.

Diagnostic characters : Large species. Length 5.37 mm, width 1.25 mm and height 1.87 mm. Anterior margin broadly rounded and posterior margin pointed, radial bond of septa absent;

surface hairy. Furcal rami asymmetrical and straight.

Material examined/Source : Deb (1972), Victor and Fernando (1979), Patil and Talmale (2005a,b).

Distribution : Maharashtra : Satara Dist. : Satara, Aurangabad Dist. : Nathsatgar Wetland.

Genus *Parastenocypris* Hartmann

34. *Parastenocypris canaliculata* Hartmann

1964. *Parastenocypris canaliculata* Hartmann, *Int. Rev. Gesamten Hydrobiol. Syst. Beith.*, **3** : 1-155.

1979. *Parastenocypris canaliculata* Hartmann, Victor and Fernando, *Rec. zool. Surv. Ind.*, **74**(2) : 205-206.

Diagnostic characters : Valves with irregular, continuous pore canals along the margins, surface with minute hairs. Furca asymmetrical.

Material examined/Source : Victor and Fernando (1979), Patil and Talmale (2005b).

Distribution : Maharashtra : Nagpur Dist. : Nagpur, Vidharba area.

Subfamily CYPRIDOPSINAE

Genus *Cypridopsis* Brady, 1868

35. *Cypridopsis dispar* Hartmann

1964. *Cypridopsis dispar* Hartmann, *Int. Rev. Gesamten Hydrobiol. Syst. Beith.*, **3** : 1-155.

1979. *Cypridopsis dispar* Hartmann, Victor and Fernando, *Rec. zool. Surv. Ind.*, **74**(2) : 205-206.

Diagnostic characters : Valves reniform; valve surface covered with minute hairs; four muscNatatory setae of the second antenna smooth, reaching to the tips of the terminal claws. Third thoracic leg with a beak-like claw and a reflexed seta.

Material examined/Source : Victor and Fernando (1979), Patil and Talmale (2005b).

Distribution : Maharashtra : Solapur Dist. : Pandharpur; Mumbai Suburban Dist. : Tulsi dam, Sanjay Gandhi National Park, Borivili, Bombay.

Elsewhere : Andhra Pradesh; Karnataka; Tamil Nadu.

Family CYCLOCYPRIDIDAE

Genus *Physocypris* Vavra, 189736. *Physocypris furfuracea* (Brady)1886. *Cypris furfuracea* Brady, *J. Linn. Soc. Zool.* **19** : 299.1979. *Physocypris furfuracea*, Victor and Fernando, *Rec. zool. Surv. India*, **74**(2) : 215-216.

Diagnostic characters : Valves subovate, left valve overlapping the right in the anterior extremity, anterior and posterior margins rounded. Natatory setae of the second antenna well developed, reaching well beyond the tips of the terminal claws

Material examined/Source : Victor and Fernando (1979), Patil and Talmale (2005a, b).

Distribution : Maharashtra : Solapur Dist. : Pandharpur and Aurangabad Dist.: Nathsagar Wetland.

Elsewhere : Andhra Pradesh, Gujarat, Tamil Nadu, Pondicheri.

Remarks : *Physocypris furfuracea* (Gurney) was widely known as *P. tuberosa* but it is redescribed as *P. furfuracea* Brady by Victor and Fernando (1979).

Family NOTODROMADIDAE

Genus *Indiacypris* Hartmann, 196437. *Indiacypris dispar* Hartmann1964. *Indiacypris dispar* Hartmann, *Int. Rev. Gesamten Hydrobiol. Syst. Beith.*, **3** : 1-155.1979. *Indiacypris dispar* Hartmann, Victor and Fernando, *Rec. zool. Surv. India*, **74**(2) : 221- 222.

Diagnostic characters : Female : Valves subrectangular, unequal; left valve completely overlaps the right; anterior margin of the left valve with distinctive septa. Length of the left valve 0.92–0.95 mm and the right 0.75–0.78 mm. Terminal podomere of third leg small with three setae, of which one is reflexed; dorsal and ventral margins of the third leg ornamented with spination. Furca symmetrical; dorsal seta placed near the proximal extremity, longer than the subterminal claw.

Material examined/Source : Victor and Fernando (1979), Patil and Talmale (2005b).

Distribution : Maharashtra : Dist. Aurangabad : Aurangabad, Solapur Dist. : Barsi.

Elsewhere : Kerala, Tamil Nadu.

Family ILYOCYPRIDIDAE

Genus *Ilyocypris* Brady And Norman, 188938. *Ilyocypris australiensis* Sars1889. *Ilyocypris australiensis* Sars, *Arch. Math. Naturv. Kristiana*, **8** : 53.1979. *Ilyocypris australiensis* Sars, Victor and Fernando, *Rec. zool. Surv. India*, **74**(2) : 226-227.

Diagnostic characters : Female : Valve oblongoquadrangular; laterally compressed; greatest height in front of the middle; anterior and posterior margins broadly rounded finely hairy, without protuberances; dorsum straight; venter sinuate. Length of valves 0.90 mm. Terminal segment of the third thoracic leg with three setae. Symmetrical furca; dorsal seta placed little below the middle of the ramus, nearly ½ the length of the subterminal claw. Male : smaller than female, length of valves 0.84 mm.

Material examined/Source : Victor and Fernando (1979); Patil and Talmale (2005b).

Distribution : Maharashtra : Aurangabad Dist. : Aurangabad.

Remarks : Known only from Aurangabad (Victor and Fernando, 1979).

SUMMARY

In the present study, attempts have been made to provides an initial picture of freshwater Ostracod species distribution in Maharashtra. Victor and Fernando (1979) have given a total record of 56 freshwater valid species from Indian Subcontinent however, in their above paper they have given distributional record of only 21 species from Maharashtra. Venkatraman and Krishnamoorthy (1998) while writing on faunal diversity of crustacean they have shown a record of 120 + species of freshwater and marine

Ostracods of India belonging to 24+ genera and 4 families which is very meager as compare to world Ostracod fauna. Paper on Ostracods by Deb (1983) added 16 species to the existing Ostracods fauna of Maharashtra, besides Patil (2002a) recorded 7 species of Ostracods in Ujani Wetland.

The present investigation is a checklist of 38 species of freshwater Ostracods belonging to 15 genera under 4 families of Maharashtra. Off course this is not a final picture and it seems that many species still remain to be described for which more

surveys are needed which will undoubtedly reveal the existence of much more species than what is known today.

ACKNOWLEDGEMENTS

We are thankful to the Dr. Ramakrishna, Director, Zoological Survey of India, Kolkata and Dr. Anil S. Mahabal, Scientist 'F' and Officer-in-Charge, Zoological Survey of India, Western Regional Centre Pune for facilities.

REFERENCES

- Baird, W. 1859. Description of some new Entomostraca from Nagpur, collected by Rev. S. Hislop. *Proc. zool. Soc. Lond.*, **389** : 231-234.
- Deb, M. 1972. Two new species of *Stenocypris* Sars, 1889. *J. zool. Soc. India*, **1** : 91-95.
- Deb, M. 1973. First record of the genus *Sclerocypris* Sars. 1924. (Crustacea : Ostracoda) from India with description of two new species. *J. zool. Soc. India*, **24**(1&2) : 47.
- Deb, M. 1983. Brief descriptions of new species of Ostracoda : Crustacea from Maharashtra State (India). *Rec. zool. Surv. India*, **81** : 135-166.
- Hartmann, G. 1964. Asiatische Ostracoden. Systematische und zoogeographische untersuchungen. *Int. Rev. gesamten Hydrobiol. Syst. Beih.*, **3** : 1-155.
- Patil, S.G. 2002a. Freshwater Ostracoda In : Fauna of Ujani. *Wetland Ecosystem Series* No. **3**, : 87-90. Published-Director, Zoological Survey of India, Kolkata.
- Patil, S.G. 2002b. In Book : Biodiversity of the Western Ghats of Maharashtra-Current knowledge. edited by Ajit Jagtap & N.P. Singh, *Bishen Singh Mahindrapalsing, Dehra Dun*, 82-87 & 282-285.
- Patil, S.G. & Talmale, S.S. 2005a. The freshwater Ostracoda. In : fauna of Nathsagar Wetland Maharashtra, Wetland ecosystem series No., **7** : 63-75. Published by Director, Zoological Survey of India, Kolkata.
- Patil, S.G. & Talmale, S.S. 2005b. A checklist of freshwater ostracods (Ostracoda : Crustacea) Maharashtra, India. *Zoos' Print Journal*, **20**(5) : 1872-1873.
- Venkataraman, K. and Krishnamoorthy. 1998. Crustacea In Faunal Diversity in India (Ed. Alfred. I.R.B; Das, A.K. and Sanyal, A.K.) : 134-144 published by ENVIS centre, Zoological survey of India, Calcutta.
- Victor, R. and Fernando, C.H. 1979. The freshwater Ostracods (Crustacea : Ostracoda) of India. *Rec. zool. Surv. India*, vol., **74**(2) : 147-242.

CLADOCERA

PRAMOD D. RANE

Zoological Survey of India, Western Regional Station, Akurdi, Pune-411044

INTRODUCTION

Maharashtra state having area of 3,07,690 sq. km. is the third largest state of Indian Union, presently comprising of 35 districts. The neighboring states are Goa and Karnataka towards south, Andhra Pradesh in the South-east, Madhya Pradesh in the North and Gujarat on North-east. The state has five well demarcated regions viz. Konkan, Desh or Deccan, Khandesh, Marathwada and Vidarbha. The state is divided into high and low level tracts by Western Ghats which run parallel to West coast. The Western Ghats of Maharashtra popularly known as the Sahyadris covers the area about 52,000 sq. kms. Main rivers Godavari, Krishna and their numerous tributaries originate from Western Ghats. The largest area of the state occupied by black soil and other soil types are laterite, red and grey soil and coastal alluvium. The temperature in the state varies between 10° C to 47° C and average mean humidity ranges between 56% to 74%. Annual rain fall from 449 mm to 7479 mm. The total forest area of the state is about 63,842 sq. km. Maharashtra state is situated between 15°36' and 22° N and 72°38'-88°55' East. Facing Arabian sea in West with coastline of 720 kms. and bounded by landmass over the other three sides.

MORPHOLOGY AND TERMINOLOGY

Cladocera, commonly termed as the Water Fleas are small, mostly microscopic animals and their body size generally ranges between 0.2 mm to 3.00 mm or even more. They comprise one of the primitive group of crustacean and present an

order of the subclass Branchiopoda to which the general name of Entomostraca was formerly applied. Cladocera are characterized by their two branched antenna which function as the main swimming organs. All have a distinct head and body covered by a fold of cuticle, which extends backward and downward from the dorsal of the head and constitutes a bivalve carapace. The junction of head and body is sometimes marked by a depression, the cervical sinus or notch. Cladocera have two light sensitive organs in the head, the large compound eye and the smaller ocellus. The eye is a most conspicuous organ, by its size. Its dark pigment and its constant motion during life, has numerous or few lenses and is capable of being rotated by three muscles on each side. The compound eye is usually present; the ocellus is more variable. The ocellus is sometimes absent, sometimes rudimentary; sometimes larger than eye; or may be the sole organ sensitive to light. In the head are the brain, the optic ganglion with numerous nerves to the eye, the antennal muscles, and the anterior part of the digestive tract. The head bears two pairs of sensory appendages; 1) first antennae or the antennules, which carries sense-hairs, the olfactory setae, usually placed at the end and also have one or more lateral sense hairs. 2) second antennae, usually called merely antennae in the Cladocera which are main organ of locomotion and has branched organ with many antennary setae carries long plumose setae. The type of locomotion depends on the size of antennae, the length and number of the setae and on the size of the muscles. The head also bears the mouthparts : the

mandibles, maxillules, maxillae and labrum. The mandible are stout, strongly chitinized organs, their opposing faces are toothed and ridged which grind the food effectively. The maxillules, a pair of small minute appendages bearing several curved setae, work like a pair of hands to push the food mass between the mandibles. Labrum is large and extend posteriorly covering the other mouthparts ventrally. The axis of head may continue that of body. The part front of the eye is called vertex. There is usually a beak in front of antennules is known as rostrum. The carapace, though called bivalve is really in one piece, bent along the back but never show any joint or division. It has very different shapes; may appear nearly square, oval, or round. It also be marked in the most various fashions. It may bear hairs, spines, along the ventral edge. The respiratory exchange through inner and outer walls and blood circulates freely in spaces between the walls. The heart, an oval or elongated sac on the dorsal side. Anterior part of valve lies with shell gland a flattened glandular tube which serves the function of excretion and osmoregulation. The body lies free within the valve and is divided into appendage bearing thorax and abdomen ending in to pygidium or postabdomen. Attached to the ventral side of the body are ordinarily five or sometimes six pairs of legs. Digestive system is simple with esophagus leading to stomach and intestine than to rectum and end with anus usually lies at or near the postabdomen. At the end of postabdomen bears two long abdominal setae with end with two terminal claw. Concave side of claw with spines and teeth of various sizes. There are basal spines near the base of claw and sometimes having denticulate pecten. The main function seems to be to comb the legs and kept them clean and free from foreign matter and themselves. During most of the year the females produce eggs which develop without being fertilized into more parthenogenetic females. Eggs are deposited in brood chamber, cavity on the dorsal side of valve. Here the eggs develop and hatch in a form quite like that of parent except smaller. Hence there is no free living larval forms in Cladocera. Parthenogenesis will continue until conditions

become unfavorable. When the food supply fails or ponds begin to dry. Some of the parthenogenetic eggs develop in to males instead of females. Sometime adult females produce different kind of egg called ephippium. These eggs extruded into brood chamber and fertilized. The ephippium close around the eggs and during the next molt eggs and carapace (or ephippium) are shed as a unit. The embryo inside will lie dormant, often with standing freezing or drying until the return of conditions suitable for continuation of development. Such type of eggs may also called as resting eggs and reproduction also called as sexual reproduction. The males are smaller than females. They are distinguished by larger antennules; the first foot is armed with a stout hook which serves to clasp the females. Cladocera almost live in all type of habitats. They may be found at limnetic region or littoral regions of open water, some species may commonly found in muddy pools or some are live near the substratum or bottom-dwellers of inland waters.

HISTORICAL REVIEW

The freshwater Cladocera are among the most common microcrustacean in freshwater wetlands of India but they are not so well known taxonomically. Perusal of available literature reveals that our knowledge about Cladocera fauna of various states of India is scattered and adequate. Most early study was started in 1860 by Baird worked out Cladocera from Nagpur (Old Central India); Gurney, 1906 and 1907 worked on West Bengal fauna; Daday, 1911 reported Bangalore-Karnataka fauna; Brehm, 1936, 1952, 1953, 1963 studied Cladocera fauna from Assam, West Bengal, Meghalaya, Central India, Kashmir, Nilgiri Hills, Bihar, Himachal Pradesh and Rewa of Madhya Pradesh; Biswas, 1964, 1966 and 1977 published account on fauna of Simla hills, Rajasthan and Nefra; Hudec, 1987 recorded new species *Moina oryzae* from Tamil Nadu; Fernando and Kanduru, 1984 recorded remarks on latitudinal distribution on Indian Cladocera; Nasar, 1977 worked Cladocera fauna of Bihar; Nayer, 1971 reported Cladocera of Rajasthan; Michael and Sharma,

1988 published fauna of India volume on Cladocera and listed 90 species from different localities all over India; Patil, 1976 worked on Meghalaya and Manipur fauna; Patil and Gouder, 1982 studied Cladocera from Dharwad-Karnataka; Petkovski, 1973 studied Cladocera from Gujarat state; Raghunathan, 1988 studied Cladocera from Kerala and high altitude freshwater from Tamil Nadu; Raghunathan and Rane, 2001 Cladocera from Nagarhole National park, Tamil Nadu; Rane, Jafrei and Rafiq, 1998, described a new species of *Daphnia katrajensis* from Pune district, Maharashtra; Rane, 1983, 1984, 1985, 1987, 1990 and Rane and Harshey, 1979 worked out Cladocera fauna from Madhya Pradesh; Rane, 1992, 1993, 2001, 2004, 2005, 2006, 2008, reported Cladocera from Maharashtra State; Saini and Singh, 1984 published account on fauna of Rewa-Madhya Pradesh; Sharma, 1978 studied Cladocera from West Bengal; Shirgur and Naik, 1977 recorded Cladocera from Bombay-Maharashtra; Venkatraman, 1983, 1991, 1992, 1993 studied Cladocera fauna from Andaman and Nicobar islands, Baraipur-Rajasthan; Tamil Nadu; Venkatraman and Das, 2000 studied Cladocera from Tripura state; Venkatraman, Das and Nandi, 2000 studied the zooplankton diversity of Haora distt. of West Bengal; Yousuf and Qadri, 1977 published good account of Cladocera from Kashmir state.

MATERIAL AND METHODS

This study focuses on taxonomy and distribution of Cladocera in Maharashtra state as a whole. In Maharashtra order Cladocera is represented by six families namely : Sididae, Daphniidae, Moinidae, Bosminidae, Macrothricidae and Chydoridae.

During this study 294 samples were collected throughout Maharashtra State from various freshwater habitats namely, ricefields, marshes, ponds, reservoirs, lakes, dams, streams, rivers and miscellaneous water bodies. Cladocera samples were collected using plankton nets with circular mouth of 45cm in diameter. The fauna were usually collected in shallow water among

vegetation and in open water. For deep waters an integrated vertical hauls from bottom to the surface were made to obtain the representative collections. In small shallow ponds, buckets of water could be hauled and poured through plankton net to collect limnetic species. For weed inhabiting and benthic fauna, a net with a long handle and wire-meshed lid to sieve off the obstructing algae and weeds were used. 5% of formalin was used for preserving the all planktonic samples in the field itself. Subsequent sorting and identification was done under Stereo-binocular microscope. Temporary slides were made using glycerin and important diagnostic characters of species were studied.

SYSTEMATIC ACCOUNT

Phylum ARTHROPODA

Class CRUSTACEA

Subclass BRANCHIOPODA

Superorder DIPLOSTRACA

Order CLADOCERA

Suborder EUCLADOCERA

Superfamily SIDOIDEA

Family I. SIDIDAE Baird, 1850

Genus (1) *Pseudosida* Herrick, 1884

1. *Pseudosida bidentata* var. *szalayii* (Daday, 1898)

Genus (2) *Latonopsis* Sars, 1888

2. *Latonopsis australis* Sars, 1888

Genus (3) *Diaphanosoma* Fischer, 1850

3. *Diaphanosoma sarsi* Richard, 1895
4. *Diaphanosoma excisum* Sars, 1885
5. *Diaphanosoma excisum longiremis* Ekman, 1904
6. *Diaphanosoma senegalensis* (Gauthier, 1951)

Family II. DAPHNIIDAE Straus, 1820

Genus (4) *Ceriodaphnia* Dana, 1853

7. *Ceriodaphnia cornuta* Sars, 1885
8. *Ceriodaphnia reticulata* (Jurine, 1820)
9. *Ceriodaphnia laticaudata* P.E. Muller, 1867

Genus (5) *Daphnia* O. F. Muller, 1785

10. *Daphnia carinata* King, 1853
11. *Daphnia longicephala* Herbert, 1977
12. *Daphnia katrajensis* Rane, Jafri and Rafiq, 1998
13. *Daphnia lumholtzi* Sars, 1885

Subfamily (i) SCAPHOLEBERINAE Dumont & Pensaert, 1983

Genus (6) *Scapholeberis* Schoedler, 1858

14. *Scapholeberis kingi* Sars, 1903b

Genus (7) *Simocephalus* Schoedler, 1858

15. *Simocephalus vetulus* (O.F. Muller, 1776)
16. *Simocephalus latirostris* Stingelin, 1906
17. *Simocephalus serrulatus* (Koch, 1851)

Family III. MOINIDAE

Genus (8) *Moina* Baird, 1850

18. *Moina micrura* Kurz, 1874
19. *Moina micrura dubia* Guerne and Richard, 1862
20. *Moina brachiata* (Jurine, 1820)

Family IV BOSMINIDAE Sars, 1865

Genus (9) *Bosmina* Baird, 1845

21. *Bosmina longirostris* (O.F. Muller, 1776)

Genus (10) *Bosminopsis* Richard, 1895

22. *Bosminopsis deitersi* Richard, 1895

Family V. MACROTHRICIDAE

Genus (11) *Macrothrix* Baird, 1843

23. *Macrothrix spinosa* King, 1853

Genus (12) *Echinisca* Lievin, 1848

24. *Echinisca triserialis* (Brady, 1886)
25. *Echinisca odiosa* (Gurney, 1907)

Genus (13) *Ilyocryptus* Sars, 1862a

26. *Ilyocryptus spinifer* Herrick, 1882

Family VI CHYDORIDAE Stebbing, 1902

Subfamily (ii) CHYDORINAE Stebbing, 1902

Genus (14) *Pleuroxus* Baird, 1843

27. *Pleuroxus aduncus bhigawanensis* Rane, 2002
28. *Pleuroxus similis* Vavra, 1900

29. *Pleuroxus laevis* Sars, 1862a

30. *Pleuroxus denticulatus* Birge, 1879

Genus (15) *Alonella* Sars, 1862a

31. *Alonella excisa* (Fischer, 1854)

Genus (16) *Chydorus* Leach, 1816

32. *Chydorus sphaericus* (O. F. Muller, 1776)
33. *Chydorus faviformis* Birge, 1893
34. *Chydorus kallipygos* Brehm, 1934
35. *Chydorus ventricosus* Daday, 1898
36. *Chydorus reticulatus* Daday, 1898
37. *Chydorus eurynotus* Sars, 1901
38. *Chydorus eurynotus brehmi* (Biswas, 1965)
39. *Chydorus gibbus* Sars, 1891

Genus (17) *Dunhevedia* King, 1853

40. *Dunhevedia crassa* King, 1853
41. *Dunhevedia crassa ciliocaudata* (Sovinski, 1891)
42. *Dunhevedia serrata* Daday, 1898

Genus (18) *Dadaya* Sar, 1901

43. *Dadaya macrops* (Daday, 1898)

Genus (19) *Pseudochydorus* Fryer, 1968

44. *Pseudochydorus globosus* (Baird, 1843)

Subfamily (iii) ALONINAE Frey, 1967

Genus (20) *Alona* Baird, 1843

45. *Alona rectangula* Sars, 1862a
46. *Alona rectangula richardi* (Stingelin, 1895)
47. *Alona davidi* Richard, 1895a
48. *Alona davidi punctata* (Daday, 1898)
49. *Alona costata* Sars, 1862b
50. *Alona pulchella* King, 1853
51. *Alona guttata* Sars, 1862b
52. *Alona taraporevalae* Shirgur and Naik, 1977
53. *Alona pseudadentata anodonta* Daday, 1905
54. *Alona monocantha tridentata* (Stingelin, 1904)
55. *Alona intermedia* Sars, 1862
56. *Alona archeri* Sars, 1888
57. *Alona capensis* Ruhe, 1921
58. *Alona macronyx* Daday, 1898

- Genus (21) *Camptocercus* Baird, 1843
59. *Camptocercus rectirostris* Schoedler, 1862
- Genus (22) *Graptoleberis* Sars, 1862a
60. *Graptoleberis testudinaria nathsagerensis* Rane, 2005
- Genus (23) *Leydigia* Kurz, 1875
61. *Leydigia acanthocercoides* (Fischer, 1854)
62. *Leydigia ciliate melghatensis* Rane, 2005
- Genus (24) *Biapertura* Smirnov, 1971
63. *Biapertura affinis* (Leydig, 1860)
64. *Biapertura karua* (King, 1853)
65. *Biapertura verrucosa* (Sars, 1901)
- Genus (25) *Oxyurella* Dybowski and Grochowski, 1894
66. *Oxyurella singalensis* (Daday, 1898)
- Genus (26) *Kurzia* Dybowski and Grochowski, 1894
67. *Kurzia longirostris* (Daday, 1898)
- Genus (27) *Euryalona* Sars, 1901
68. *Euryalona orientalis* (Daday, 1898)
- Genus (28) *Indialona* Petkovski, 1966
69. *Indialona ganapati* Petkovski, 1966
- Genus (29) *Natoalona* Rajpaksha and Fernando, 1987
70. *Natoalona globulosa* (Daday, 1898)
- Genus (30) *Ephemeroporus* Frey, 1982
71. *Ephemeroporus barroisi* (Richard, 1894)

Key to the families of Cladocera

- 1a. Six pairs of legs of similar structure
.....SIDIDAE, Baird, 1850
- b. Five pairs of legs of different structure2
- 2a. Dorsal ramus of antennae 4 segmented,
- b. Ventral ramus 3 segmented.....5
- 3a. Antennules not mobile.....
.....DAPHNIIDAE, Straus, 1820
- 3b. Antennules mobile4
- 4a. Antennule situated on anteroventral end of headMACROTHRICIDAE Baird, 1843

- b. Antennules situated on the ventral margin of the head but not at anterior end
MOINIDAE Goulden,
- 5a. Antennules fused with the rostrum, forming proboscis structure
.....BOSMINIDAE Sars, 1895
- b. Antennules are at base, ocellus covered by head, shield of rostrum
.....CHYDORIDAE, Stebbing 1902

Family I. SIDIDAE

Key to the genera and species of family SIDIDAE

(Generic diagnosis of genera with only one species are not given)

- 1a. Postabdomen without anal spines
.....*Diaphanosoma* Fischer, 1850
- b. Postabdomen with anal spines2
- 2a. Rostrum present
Pseudosida bidentata var. *szalay* (Daday, 1898)
- b. Rostrum absent
.....*Latonopsis australis* Sars, 1884

Genus *Pseudosida* Herrick, 1884

1. *Pseudosida bidentata* var. *szalay*

1884. *Pseudopsida bidentata* Herrick, *Geol. And Nat. Hist. Survey Minnesota; Ann. Rep.*, 12 : 1-191, p.20, pl.k, fig. 9.
1898. *Pseudopsida szalay* Daday, *Termes Fuzetek. Budapest*, 21 : 64-66, figs. 33a-d.
1961. *Pseudopsida bidentata* var. *szalay* : Thomas, *Crustaceana*, 3 : 1-8.
1988. *Pseudopsida bidentata* var. *szalay* Michael and Sharma, *Fauna of India, Cladocera*, : 38-39, figs. 6, a-e.

Material examined and locality : Chandrapur Dist. : Tadoba National Park : 1ex., Pamanbadi Talav. 22.1.2001; 1ex., Tadoba lake, 23.3.1999 (Coll. R.M. Sharma), 2exs., Pandharpavani tank, 15.9.1998; 1ex., Ambathira, 21.4.1996 (Coll. P.P. Kulkarni); Kolhapur Dist. : 1 ex., Rankala tank, 06.01.2007 (Coll. P.D. Rane); Nagpur Dist. : Pench National Park : 2exs., Shivkunda, 1.3.99 (Coll.

M.S. Pradhan); 1 ex., Gawalighat, 12.11.1996 (Coll. A.S. Mahabal); 1 ex., Bokhari talao, 5.12.1995 (Coll. R.M. Sharma); 2 exs., Ambakhori, 14.12.1994 (Coll. P.P. Kulkarni).

Diagnostic characters : Body elongated oval; head short, eye relatively small and situated near to the anteroventral corner. Antennules unsegmented, long and attached to the posteroventral part of the head, with olfactory setae on each side and long flexible flagellum. Antenna not extending beyond the posterior margin of valves. Ventral margin with a series of long setae followed by series of spinules on the posteroventral corner. Postabdomen with about 10-11 clusters of spinules. Claw with large basal spines and a very small spine proximal to them. Median projection at the base of claws on the ventral side. Length 1.00mm.

Distribution : India : Rajasthan, Kerala, Andaman and Nicobar, Tripura, Tamil Nadu, Goa, Madhya Pradesh.

Elsewhere : South-East Asia, South Africa, Sri Lanka, Malaysia, South America, Thailand, Sumatra and Australia.

Remarks : Thomas (1961b) stated that there has been a lot of confusion between *P. bidentata* Herrick and *P. szalayi* Daday because the only distinguishing character between two species is the absence of median projection in *bidentata* and its presence in *szalayi*, at the base of claws on ventral aspect. This difference being not sufficient to differentiate the two species. He further mentioned that the specimens with median projection may be treated as *Pseudopsida bidentata* var. *szalayi* Daday.

Genus *Latonopsis* Sars, 1886

2. *Latonopsis australis* Sars, 1888

1888. *Latonopsis australis* Sars, *Forh. Vid. Selsk., Christiania*, No., 7 : 6-15, pl. 1, figs. 1-6.

Material examined and locality : Amaravati Dist. : 5exs., Hatida talao, Semadoh, Chamarkund, Sidukund, Melghat Tiger Reserve, 25.02.1997 (Coll. A.S. Mahabal); Chandrapur Dist. : 3exs.

Hirdi-Nalla, Pangli tank, Tadoba lake, Tadoba National Park, 29.09.1994 (Coll. R.M. Sharma); Dhulia Dist. : 1 ex. Dondaicha Dam, 03.07.2008 (Coll. A. Chaudhari); Nagpur Dist. : Pench National Park : 1ex., Totladoh, 30.11.1995 (Coll. R.M. Sharma); 1ex., Kolutmara, 07.10.1994; 4 exs., Saddle Dam at Sillari, 22.02.1999; Shivkunda near Totladoh, 01.03.1999 (Coll. M.S. Pradhan); 1 ex., Lamandoh, 01.05.1997 (Coll. S.G. Patil); 2exs., Ranidoh of Pench River, 08.10.1996 (Coll. A.S. Mahabal).

Diagnostic characters : Large head, body connected without noticeable fold. Elongated body; ventral margin of valve with numerous long setae; three setae at the posteroventral corner especially long. Head without a distinct rostrum. Eye located in the middle part of head. Ocellus small located immediately in front of the base of the labrum. Antennules long and segmented, attached to the anteroventral corner of head. Antenna on the thick base. Antennal setae 4-7/0-1-4. Two ventral most setae of triarticulate branch especially large with hooked ends. Postabdomen relatively small, conical, slightly dilated in proximal part. Small anal teeth arranged singly, 7-9 and situated closer to distal end of abdomen. Claw much incurved with two basal spines. Length : 1.1 mm.

Distribution : India : Maharashtra, Goa, Rajasthan, Tripura, Tamil Nadu.

Elsewhere : Australia, Oriental region.

Remarks : *Latonopsis australis* is separable from other species *Latonopsis brehmi* by its comparative smaller size, by having fewer setae on the antenna and claw having two basal spines which the later have three.

Genus *Diaphanosoma* Fischer, 1850

Key to the species of *Diaphanosoma*

1. Distal part of ventral shell margin with small denticles, comparatively small head2
- 1a. Shell duplicature rounded at distal end
..... *D. sarsi* Richard, 1894a

- 1b. Shell duplicature joining ventral shell margin at nearly right angle; Antenna not reaching at posterior end of carapace
..... *D. excisum* Sars, 1885
- 1c. Antenna reaching and superpass the posterior shell border
.... *D. excisum* var. *longiremis* Ekman, 1904
2. Large head, thickened head muscles and dorsal part of ventral shell margin with short row of diminishing setae followed by long row of large denticles
..... *D. senegalensis* (Gauthier, 1951)

3. *Diaphanosoma sarsi* Richard

1894a. *Diaphanosoma sarsi* Richard, *Revue boil. Du Nord France*, VI : 365, pl. 15, figs. 1-8.

Material examined and locality : Amaravati Dist. : Melghat Tiger Reserve : 1ex., Chaurakund at Malur vill.; 28.08.1993; 6exs., Gavilghat tank at Chikaldhara, 19.12.1994 (Coll. P. P. Kulkarni). 1ex., Kelpani Koktu, 23.03.1994 (S.G. Patil); Aurangabad Dist. : 9exs., Nathsagar Dam, sagar darshan site, Nathsagar-Jaikawadi wetland, 03.07.1998 (Coll. P.D. Rane); Pune Dist. : 3exs., Rajewadi, Saha, Bhigwan, Ujani wetland, 09.08.1992 (Coll. S.G. Patil).

Diagnostic characters : Carapace oblong in outline, transversely truncate behind, with almost rectangular posterodorsal corner. Posteroventral corner obliquely cut off and armed with a series of small denticles (12-20) followed by small setae. Dorsal margin more arched, ventral margin almost straight or slightly ascending. Shell duplicature broad on distal end. Head rather narrow, slightly tapering distally and almost obliquely truncated at frontal end. Large and small both type of specimens are seen in the collection. Antennae not reaching hind edge of carapace. Postabdomen narrow. Claw with three basal spines rapidly decreasing in size proximally. Length : 1.16 mm.

Distribution : India : New Delhi, Tamil nadu, West Bengal, Rajasthan, Bihar, Meghalaya.

Elsewhere : Pantropical.

Remarks : This species differs from the nearest one, *D. excisum* Sars and its varieties mainly by the greater breadth of the shell duplicator and more spines at its inferoposteal corner.

4. *Diaphanosoma excisum* Sars

1885. *Diaphanosoma excisum* Sars, *Forb. Vid. Selsk. Christiania*, No., 8 : pp. 13-18, pl. 2. Figs. 1-3.

Material examined and locality : Amaravati Dist. : Melghat Tiger Reserve : 1ex., Tallaii Koktu river, 15.02.1993 (Coll. S.G. Patil); Aurangabad Dist. : Nathsagar Wetland : 11 exs., Ramdoh, Lakhephal, Dahigaon, 20.04.1999 (Coll. R.M. Sharma); Chandrapur Dist. : Tadoba-Andhari Tiger Reserve : 15exs. Pandharpavani tank, Pangali tank, Kolsa tank, 19.10.1997 (Coll. A.S. Mahabal); Kolhapur Dist. : 1ex., Nipani tank, 06.01.2007 (Coll. P.D. Rane); Nagpur Dist. : Pench National Park : 4exs., Pench river near Totaladoh dam, 30.11.1995 (Coll. R.M. Sharma), 10exs., Saddle dam at Sillari, 22.02.1999 (Coll. M.S. Pradhan); Pune Dist. : Ujani Wetland : 22exs., Saha, Khanota, Palasdeo, 21.01.1997 (Coll. R.M. Sharma); Sindhudurg Dist. : 2exs., Pat Nala, 13.01.1997 (Coll. P.D. Rane); Satara Dist. : 1ex., Mahabaleshwar tank, 18.01.2007 (Coll. P.D. Rane).

Diagnostic characters : Carapace almost oblong in outline and posterior end abruptly truncate. Posterodorsal corner of valve almost ending in right angle. Posteroventral corner with variable number of denticles followed by delicate cilia; number of denticles sometimes differing even on the two valves. Head large, oblong quadratic and obtusely truncated anteriorly. Eye relatively large, with numerous crystalline lenses; located in the frontal portion of head, close to the ventral margin. Antenna not reaching posterior margin of valves. Postabdomen narrow with fine setules. Claw with three basal spines, decreasing in size proximally. Length : 0.8 mm.

Distribution : India : Kerala, Rajasthan, Assam, West Bengal, Maharashtra, Goa, Andaman & Nicobar and Tripura.

Elsewhere : Common in tropics and subtropics.

5. *Diaphanosoma excisum longiremis*

Ekman, 1904

1904. *Diaphanosoma excisum* var. *longiremis* Ekman, *Jagerskiold Expedi., Uppsala*, 26(i)(8), pp.1-2.

Material examined and locality : Chandrapur Dist. : Tadoba-Andhari Tiger Reserve : 5exs., Katezari, 21.01.2001; 1ex., Tamanbadi Talav, 22.01.2001 (Coll. S.G. Patil); 4 exs., Tamanbadi tank, 15.09. 1998; 1 exs., Pangali tank, 21.04.2000; 2exs., Kolsa tank, 22.04.2000 (Coll. P.P. Kulkarni).

Diagnostic characters : This subspecies differs from typical *Diaphanosoma excisum* by presence of hairs at side of postabdomen, less number of denticles at lower part of posterior margin of valve (5-6) and the greater length of antenna which almost surpass the posterior border of carapace.

Distribution : India : Maharashtra, Rajasthan, West Bengal.

Elsewhere : Sumatra and Africa (Sudan, Egypt).

6. *Diaphanosoma senegalensis* (Gauthier, 1951)

1951. *Diaphanosoma senegalensis* Gauthier, *Alger*, 43-45, pl. IX 1-j.

1952. *Diaphanosoma hydrocephalus* Brehm, *Zool. Anz.*, 149 : 138-140, abb. 1-4.

Material examined and locality : Amaravati Dist. : Melghat Tiger Reserve : 5exs., Hatida talao, 22.03.1993, Coll. S.G. Patil), 4exs., Kalpani, 30.04.1994 (Coll. M.S. Pradhan); Chandrapur Dist : Tadoba-Andhari Tiger Reserve : 10exs., Talaidam, Vasant Bandhara, Tadoba lake, Pandharpavni tank, 25.01.2001 (Coll. S.G. Patil).

Diagnostic characters : Carapace almost oblong in outline; posterodorsal corner with a distinct angle, dorsal margin slightly arched. Ventral margin of valves almost straight; distal part of ventral shell margin with short row of gradually decreasing setae, followed by row of denticles. Shell duplicature narrow. Head markedly large with sloping anterior margin. Eye moderately large, located near the anterior ventral margin of head. Antennae not reaching posterior end of valves. Claws short; with three basal spines

increasing in length distally and with setae on its concave margin. Length : 1.6 mm.

Distribution : India : Maharashtra, Madhya Pradesh, Goa, South India.

Elsewhere : Africa.

Remarks : Venkatraman and Krishnaswamy (1984) amended the original name *D. senegal* to *D. senegalensis* while recording this species from South India. It is rare species which has extremely specific structural features, the structure and armature of margin of valve is especially remarkable: the ventral inflection with numerous identical setae, the presence of large head and anal teeth. This species also has only limited distribution from equatorial zone almost to the boundary between the tropical and subtropical zones (Korovchinsky, 1991).

Family II. DAPHNIIDAE Straus, 1820**Key to the genera of *Daphniidae***

1. Rodrum present 2
- 1a. Rostrum absent *Ceriodaphnia* Dana, 1853
2. Valve with one posterior long spine, ventral margin convex *Daphnia* O. F. Muller, 1785...3
3. Ventral margin straight ending with small spine at posteroventral corner, valve with faint reticulation *Scapholeberis* Schoedler, 1853...4
4. Ventral margin curved ending smoothly at posteroventral corner, postabdomen large, wide, indented on its distal side; valves transversely striated *Simocephalus* Schoedler, 1858

Genus *Ceriodaphnia* Dana, 1852**Key to the species of genus *Ceriodaphnia***

1. Head produced anteriorly into a short conical beak *C. cornuta* Sars, 1885
2. Claw with proximal pecten, head small with small eye *C. reticulata* (Jurine, 1820)

- Claw without pecten.....3
3. Postabdomen dilated in the middle. Eye large nearly filling vertex of head
..... *C. laticaudata* P. E. Muller, 1867

7. *Ceriodaphnia cornuta* Sars

1885. *Ceriodaphnia cornuta* Sars, *Norske. Vidensk. Selsk. Forhandl. Christiania*, 8 : 26-28, pl. 5, figs. 1-3.
- 1894a. *Ceriodaphnia rigardi* Richard, *Revue Biol. Nord. France*, 6 : 367.

Material examined and locality : Amaravati Dist. : Melghat Tiger Reserve : 7 exs., Gavighat tank at Chikhaldara, Chipidoh, 18.03.1993 (Coll. S.G. Patil); Aurangabad Dist. : Nathsagar Wetland : 12exs., Kayagaon, Sagardarshan, Lakhephal, Saukheds, 12.09.1999 (Coll. P.P. Kulkarni); Chandrapur Dist. : Tadoba-Andhari Tiger Reserve : 17exs., Tadoba lake, Katezari, Pandharpavani tank, Jamunwadi, 28.03.1999, (Coll. R.M. Sharma); Nagpur Dist. : Pench National Park : 10exs., Piparia tank, 04.12.1995, several females from Totaldoh, 30.11. 1995 (Coll. R.M. Sharma); Pune Dist. : Ujani Wetland : 57exs., Palasdeo, Khed, Khandar, 09.02.1992 (Coll. S.G. Patil).

Diagnostic characters : Carapace of female broadly oval in outline, produced posteriorly into short projection, lying slightly above the longitudinal axis. Valve distinctly reticulate with large polygonal or hexagonal cells, free edges of valve smooth. Head small, depressed and separated from body by distinct ocular depression, with rounded frontal part and produced in front of antennules into a very acute, short and deflexed rostrum. Head also with short spine or horn over eye on anterior margin in some specimens. Eye large, ocellus small. Antennule small, fusiform not extending to the tip of rostrum; lateral sensory seta somewhat distal in middle. Postabdomen moderately broad, with 5-6 anal spines. Claw short, stout, and finely setulate. Length : 0.6 mm.

Distribution : India : Tamil Nadu, Kerala, Maharashtra, Goa, West Bengal, Rajasthan, Madhya Pradesh, Karnataka, Punjab, Haryana, Himachal Pradesh, Bihar, Meghalaya, Tripura, Andaman and Nicobar Islands.

Elsewhere : Cosmotropical, China, Japan, Australia, South East Asia.

8. *Ceriodaphnia reticulata* (Jurine, 1820)

1820. *Monoculus reticulatus* Jurine, *Historie des Monocles, qui se trouvent aux environs de Geneve*. Paris. P. 139, pl.14.
1901. *Ceriodaphnia reticulata* Sars, *Arch. Math. Nat.*, 23 : 21.

Material examined and locality : Pune Dist. : Ujani Wetland : 7exs., Khanota, Khed, 13.08.1992, (Coll. S.G. Patil).

Diagnostic characters : Female carapace almost rounded oval in outline; produced posteriorly into a rather small protuberance above the longitudinal axis of body. Valves reticulated. Head rounded or angulated in front of antennules. Antennules small with sensory seta near the apex of antennules. Eye large, nearly filling frontal region of head; ocellus small and rounded. Postabdomen with 7 marginal anal spines. Claw with distinct pecten of 6 teeth. Length 0.87 mm.

Distribution : India : Rajasthan, Bihar, Maharashtra, Goa.

Elsewhere : Holarctic, Neotropical and Ethiopian regions.

9. *Ceriodaphnia laticaudata* P.E. Muller, 1867

1867. *Ceriodaphnia laticaudata* P. E. Muller, *Nat. Tidskr.*, (3), 5 : 130, pl. 1, fig. 19.
1959. *Ceriodaphnia laticaudata* Brooks, *Freshwater Biology*, New York, : 620, fig. 27-92.
1962. *Ceriodaphnia laticaudata*, Husek, *Fauna of C.S.S.R.*, Prague, 16 : 241-242, figs. 87 A-K.

Material examined and locality : Chandrapur Dist. : Tadoba-Andhari Tiger Reserve : 1ex., Pangadi Talav, 25.01.2001; 4exs., Telea dam, 22.01.2001 (Coll. S.G. Patil); 1ex., Kolsa lake, 21.09.1990 (Coll. P.P. Kulkarni).

Diagnostic characters : Carapace rounded quadrangular in shape with posterior protuberance. Valve reticulated, edges of valve smooth. Head comparatively small, vertex evenly rounded, eye and ocellus present. Antennules somewhat

produced. Postabdomen large, dilated near the middle, obliquely truncate and with 8-10 anal spines and group of lateral setae present. Claw long, ciliated and denticulate.

Distribution : India : Maharashtra, Himachal Pradesh.

Elsewhere : Turkistan, Europe, Africa, Madagascar and Australia.

Genus *Daphnia* O. F. Muller, 1785

Key to the genus *Daphnia* O.F. Muller, 1785

1. Head usually without any crest (helmet), Rostrum recurved, generally close to or contact with ventrolateral carapace margin; Antennular mounds set close to rostrum
..... *D. carinata* King, 1853...2
2. Head with large crest (helmet) above the heart. Rostrum acute well away from ventrolateral carapace margin. Antennular mounds at some distance from the rostrum. Helmet has anteriorly directed large bulge
..... *D. longicephala* Herbert, 1977...3
3. Head triangular with small helmet, thick shell spine with may have different shapes
D. katrajensis Rane, Jafri and Rafiq, 1998...4
4. Head rounded, anterior end of head produced into head spine vertically directed, fornices well developed, expanded laterally
..... *D. lumholtzi* Sars, 1885

10. *Daphnia carinata* King, 1853

1853. *Daphnia carinata* King, *Pap. And Proc. Roy. Soc. Van Diemen Land, Hobartown*, 2(2) : 246, pl. I, and VI A.

Material examined and locality : Nagpur Dist. : Pench National Park : 7exs., Gawalighat, 11.10.1996; 5exs., Piparia tank, 29.09.1996 (Coll. A.S. mahabal); Sindhudurg Dist. : 2exs., Savantwadi tank, 13.01.2007 (Coll. P.D. Rane).

Diagnostic characters : Carapace oblong, dorsal margin evenly arched and forming a slight concavity in anterior region; posterior spine rather elongated and slightly upturned. Posterior spines

with small spines which extend to the middle region of ventral margin of valves, those on dorsal margin extend to vertical region. Head large, with semicircular anterior margin. Rostrum recurved and generally in contact with ventrolateral carapace margin. Antennular mounds very small set close to rostrum; ocellus small. Abdominal processes three. Postabdomen conically tapering distally with 10-13 anal spines. Claws short, stout, and curved, three combs with 12, 17 and 30 teeth. Ehippium with two eggs; egg locates obliquely disposed, separated by unmelanised ehippial matrix. Length : upto 2 mm.

Distribution : India : Tamil Nadu, Uttar Pradesh, Karnataka, Manipur, Andhra Pradesh, Himachal Pradesh, Rajasthan, West Bengal, Punjab, Haryana, Bihar, Goa.

Elsewhere : Australia, Africa, Indonesia, Sri Lanka.

11. *Daphnia longicephala* Herbert, 1977

1977. *Daphnia longicephala* Herbert, *Australian journal of Zoology*, 25 : 388-391, figs. 63-75.

1983. *Daphnia longicephala*, Smirnov and Timmes, *Records of Australian Museum*, 1 : 96, fig. 115.

Material examined and locality : Chandrapur Dist. : Tadoba-Andhari Tiger Reserve : 1ex., Pandharpani tank, 15.09.1998, 1ex., Ambat hira, 21.04.1996 (Coll. P.P. Kulkarni); 1ex., Shivanzari tank, 23.01.1991 (Coll. S.G. Patil).

Diagnostic characters : Large species upto 4 mm. Carapace oval and narrow. Tail long about half the length of carapace. Dorsal carapace margin slightly sinuate due to presence of cephalic crest. Helmet generally have large anterior bulge which is anteriorly directed. Rostrum acute, extending along the ventral carapace margin due to large elongated head. Distance from antennular mound to rostrum much greater than diameter of eye. Antennule mound small distant from rostrum. Eye small, ocellus absent. Intestine caecae thin. First abdominal process slightly smaller than second, sparsely covered with hairs. Other process more pubescent. Dorsal surface of postabdomen

straight with 10-13 spines. Three combs on postabdominal claw with 10-16-30 teeth respectively.

Distribution : India : Tamil Nadu, and this is second record of this species from India.

Elsewhere : Australia.

**12. *Daphnia katrajensis* Rane,
Jafri and Rafiq, 1998**

1998. *Daphnia katrajensis* Rane, Jafri and Rafiq, *Marathwada University J. lifesciences, Aurangabad*, pp. 73-75, figs. 1-14.

Material examined and locality : Pune Dist. : 11exs., Katraj tank, Pune, Maharashtra State, 12.02.1987 (Coll. D. F. Singh).

Diagnostic characters : **Female** : Head large, triangular. Anteriorly produced in to pointed tips and convexities in front above the eye. Large eye situated near the frontal edge of head with 7-8 small lenses. Ocellus small, posterior end of fornix produced into long points. Lateral shell keel well developed, shell spines thin and large about 90% of body length; with 28-29 strong lateral spines on dorsal and ventral margin. Tail spine straight sometimes bend dorsally or sometimes turned and bend towards the head. Rostrum pointed not in contact with ventral margin of head. Antennules mound situated near the rostrum with 8-9 olfactory setae at the anterior tips. Antenna well developed with cilia like setae all over its segments. Carapace oval with strong spines at dorsal and ventral margin. Dorsal margin of postabdomen sinuate, with 9-11 marginal spines. First anal spine large, thin and hook shaped. Four abdominal process. Claw well developed broad with 3 sets of pectens. Parthenogenetic female with maximum of 18 eggs in the brood pouch. No reproductive female found. Length 1.95 mm-2.00 mm.

Male : Carapace obliquely round and thin tail spine about half the length of carapace. Small rostrum. Antennules large with well developed flagellum which slightly bend near the tip. Large eye and distinct ocellus present. Abdominal processes reduced in the form of small bulge. Dorsal margin of postabdomen strongly sinuate

with indentation anteriorly with 8 anal spines. Claw with 3 pectens. Tail spines situated dorsally slightly to the midline of body with 16-17 spines on dorsal and ventral margin.

Distribution : India : Maharashtra State : Only found at type locality of the species (Endemic).

13. *Daphnia lumholtzi* Sars, 1885

1885. *Daphnia lumholtzi* Sars, *Selsk. Forh., Christiania*, No., 8 : 19-26, pl. 1, figs. 1-10, pls. 3 and 4.

1950. *Daphnia lumholtzi* : Brehm, *Res. Judian Mus., Delhi*, 48 : 19-21, figs. A-E.

Material examined and locality : Amaravati Dist. : Melghat Tiger Reserve : 15exs., Gobayana, Sipna river, Semadoh, 20.2.1993 (Coll. S.G. Patil); Chandrapur Dist. : Tadoba-Andhari Tiger Reserve : 1ex., Jamunbodi tank, 15.09.1998 (Coll. P.P. Kulkarni); 2exs., Tadoba lake, 28.03.1999, (Coll. R.M. Sharma); Pune Dist. : Ujani Wetland : 20exs., Khed Bridge, 20.01.1991 (Coll. R.M. Sharma).

Diagnostic characters : Female carapace broadly oval, narrow posteriorly and continued into a long posterior spine. Dorsal surface of valve moderately arched and armed with elongated and distinct spinules, which continued to posterior spine. This spinules extending till behind middle region of ventral surface of valve. Head produced anteriorly into helmet of variable length. Antennule well developed, situated close to rostrum. Eye large, ocellus small. Fornices extremely well developed, produced into lateral spine. Postabdomen distinctly with 10-13 anal spines and groups of lateral setae. Claws stout, curved with 3 groups of setae. Ephippium relatively broad and egg chamber obliquely placed.

Distribution : India : Rajasthan, Chandigarh, Punjab, North-East India, Uttar Pradesh, Bihar, Madhya Pradesh, Kashmir, Tamil Nadu, Andhra Pradesh, Gujrat, Orissa, Himachal Pradesh, Maharashtra, Goa.

Elsewhere : West Pakistan, Sri Lanka, Syria, Egypt, Australia and throughout Asia.

Subfamily SCAPHOLEBERINAE Dumont and
Pensaert, 1983

14. *Scapholeberis kingi* Sars, 1903b

1903. *Scapholeberis kingi* Sars, *Archiv. Math. Natur. Christiania*, **25** : 8-10, pl. 1, figs. 2a-c.

Material examined and locality : Amaravati Dist. : Melghat Tiger Reserve : 3exs., Hatida talao, 23.03.1993 (Coll. S.G. Patil); Aurangabad Dist. : Nathsagar Wetland : 33exs., Sagardarshan, Gangapur, nathsagar Dam, Dhakephal, 07.07.1999 (Coll. S.G. Patil); Nagpur Dist. : Pench National Park : 2exs., Pench river ditch, 07.10.1994; 5exs., Kolitmara, 07.10.1994; 4exs., Saddle Dam at Sillari, 22.02.1999 (Coll. M.S. Pradhan); 1ex., Gawalighat, 01.05.1997; 1ex., Ranidoh, 29.04.1997; 3exs., Lamandoh, 01.05.1997 (Coll. S.G. Patil); Pune Dist. : Bhimashankar Wildlife Sanctuary : 20exs., Bhimashankar dam, 10.10.1995 (Coll. P.D. Rane); Ujani Wetland : 6exs., Khed, Bhigwan, 04.10.1990 (Coll. S.G. Patil); Satara Dist. : 1ex., Mahabaleshwar tank, 18.01.2007 (Coll. P.D. Rane); Sindhudurg Dist. : 10exs., Pattalav, 12.1.2007 (Coll. P.D. Rane).

Diagnostic characters : Carapace oval quadrangular in outline; transversely truncated at posterior margin. Head moderate in size with large eye and small ocellus. Rostrum well developed, trilobite; middle lobe evenly rounded, with narrow hyaline membrane in front. Head never with a dorsal spine. Antennule short located behind the rostrum. Posteroventral corner of each valve produced into a short spine pointing backward. Ventral margin of valve almost straight and densely ciliated. Valve with distinct transverse striae. Postabdomen short and broad, rounded at posterior and with 4-5 anal spines. Claw moderately long, stout, and setae on its concave margin. Ehippium with one egg. Length 0.6 mm.

Distribution : India : Tamil Nadu, West Bengal, Rajasthan, Meghalaya, Assam, Kashmir, Andaman and Nicobar, Tripura, Maharashtra and Goa.

Elsewhere : Africa, Australia, North America, Sri Lanka, Germany, China, Thailand, Indonesia.

Remarks : Occurs near the surface of water body.

Genus *Simocephalus* Schoedler, 1858

Key to the species of genus *Simocephalus*

1. Claw without pecten, ocellus elongated or rhomboidal.....2
2. Vertex rounded without spinules. Posterior body without any spine or protuberance. Ocellus elongated*S. vetulus* (O.F. Muller, 1776)...3
3. Posterior emargination of body with short spine. Vertex not spinous*S. latirostris* Stingelin, 1906...4
4. Vertex angulate, spinous, ocellus usually rhomboidal..... *S. serrulatus* (Koch, 1841)

15. *Simocephalus vetulus* (O.F. Muller, 1776)

1776. *Daphne vetula* O.F. Muller, *Zool. Dania Prodrum seu Animalium Norvegia, etc., Havnia*, P. 199, No. 2399.

1900. *Simocephalus vetulus* : Lilljeborg, *Nova Acta Regiae Societatis Scientiarum Upsaliensis, ser. 3*, **19** : 166-173, tab xxiv, figs. 8-18.

Material examined and locality : Ahmednagar Dist. : Nathsagar Wetland : 13exs., Sagardarshan, Saukheda, Bramhagavan, Lakhephal, Shevta, 03.07.1998 (Coll. P.D. Rane); Amaravati Dist. : melghat Tiger Reserve : 5exs., Gurgipati, Rangubelli, Tapi River, 13.02.1991, (Coll. D.F. Singh); Chandrapur Dist. : Tadoba-Andhari Tiger Reserve : 6exs., Pandharpani, Pangali tank, Shivanzari Nala, Botezari tank, 22.04.2000 (Coll. P.P. Kulkarni); Nagpur Dist. : Pench National Park : 4exs., Phepharikund, 05.09.1994; 1ex., Bhukheri Tank, 29.09.1994; 1ex., Totaladoh, 26.12.1999 (Coll. M.S. Pradhan); 2exs., Piparia Tank, 04.12.1995 (Coll. R.M. Sharma); Pune Dist. : Ujani Wetland : 26exs., Khanota, Bhigwan, Palasdeo, Kandar, 22.01.1991 (Coll. R.M. Sharma).

Diagnostic characters : Carapace rounded, trigonal in outline, considerably extended posteriorly; no posterior spine present; posterodorsal corner with blunt angle. Dorsal margin arched; posterior part of dorsal margin with distinct denticles. Head small, prominent,

rounded in front. Eye moderately large, ocellus large and elongated. Postabdomen very broad, deeply emarginated with about 10 anal spines, curved and denticulate. Length upto 2 mm.

Distribution : India : West Bengal, Tamil nadu, Rajasthan, Punjab, Kashmir, Karnataka, Kumaon-Western Himalaya, Bihar, Northern Uttar Pradesh, Andaman and Nicobar islands, Tripura, Maharashtra and Goa.

Elsewhere : Tibet, England, Australia, Switzerland, Turkey, Russia and N.S. America.

16. *Simocephalus latirostris* Stingelin, 1906

1906. *Simocephalus latirostris* Stingelin, *Ann. Biol. Lacustre, Brasells*, 14 : p. 187-189, figs. 5-7.

1971. *Simocephalus latirostris* (Stingelin) : Biswas, *Rec. zool. Surv. India*, 63 : p. 115, figs. 6 B-D.

Material examined and locality : Ahmednagar and Aurangabad Dist. : Nathsagar Wetland : 4exs., Sagardarshan, Ramdoh, Gangapur, 03.07.1998 (Coll. P.D. Rane).

Diagnostic characters : Length of female -1.2 mm. Carapace almost oval, produced posteriorly into distinct conical spine bearing spinules near tip. Posterior region of dorsal margin of valve with spinules. Inner ventral margin with setae. Carapace markings reticulate with hexagon. Head with long beak like broadened rostrum. Frons are evenly rounded. Eye and ocellus present. Ocellus triangular or rhomboidal. Antennules slightly longer than rostrum with lateral seta near the base. Postabdomen less broad with 5 anal spines, proximal most anal spine very small. Claw long slender and with ciliated concave margin.

Distribution : India : Rajasthan, Tamil Nadu. This is first record from Maharashtra.

Elsewhere : Pantropical.

17. *Simocephalus serrulatus* (Koch)

1841. *Daphnia serrulata* Koch, *Friedrich, Pustel. Rosemberg. Hefts.*, 8 : 35-37, pl. 17.

1900. *Simocephalus serrulatus* Lilljeborg, *Nova Acta Regiae Societatis Scientiarum Upsalienis*, 3(19) : 179, pl. 20 figs. 9-16.

Material examined and locality : Amaravati Dist. : Melghat Tiger Reserve : 3exs., Gadga River near Dhakna, 15.02.1993 (Coll. S.G. Patil); Chandrapur Dist : Tadoba-Andhari Tiger Reserve : 6exs., Hirdi Nala, Talaidam, 16.09.1998 (Coll. P.P. Kulkarni); Nagpur Dist. : Pench National Park : 8exs., Ranidoh, Shivkunda near Totladoh, 01.03.1999 (Coll. M.S. Pradhan).

Diagnostic characters : Carapace broadly oval or rhomboidal outline, strongly widened behind. Dorsal margin evenly arched, ventral margin bulging in middle and posterior protuberance slightly above the median axis of body. Posterior part of dorsal margin and terminal protuberance denticulated. Head comparatively small, with dorsal margin evenly curved and front forming below an acute angle armed with a number of minute denticles; rostral projection small. Eye comparatively large; ocellus small, almost rhomboidal in form. Postabdomen with about 8 denticles. Claw long, slender with fine situles on the concave margin. Length : 1.00 mm.

Distribution : India : Tamil Nadu, Garo Hills, Meghalaya, Rajasthan, Tripura Maharashtra and Goa.

Elsewhere : North and South America, Africa, Java, Europe, Australia, New Zealand, South and East Asia, China.

Family MOINIDAE Goulden, 1968

Genus *Moina* Baird, 1850

Key to the species/subspecies of *Moina*

1. Small species, claw lacking a strong pecten, with setae increasing in size distally. Two sensory setae at base of second antenna small *M. micrura* Kurz, 1874...2
2. Small pecten with small spines about 15; two sensory setae at base of antenna are large *M. m. dubia* Guerne and Richard, 1862...3
3. Large species. Claw with large distinct pecten, having 11-14 teeth *M. brachiata* (Jurine, 1820)

18. *Moina micrura* Kurz, 1824

1874. *Moina micrura* Kurz, Sitzber. K. Acad. Wiss. Wein. Math. Nath., 70 : p. 13-15, pl. 1, fig. 1.

Material examined and locality : Amaravati Dist. : Melghat Tiger Reserve : 8exs., Chaurakunda, Dharni, Chadupati, Choppan, 26.08.1993 (Coll. P.P. Kulkarni); Aurangabad Dist. : Nathsagar Wetland : 19exs., Ramdoh, Bramhagavan, Sagardarshan, Saukheda, Kaigaon, 13.10.1999 (Coll. P.P. Kulkarni). Chandrapur Dist. : Tadoba-Andhari Tiger Reserve : 14exs., Katezari, Pandharpavni, Kolsa lake, Pangli tank, Talai dam, Tamanibadi Talav, 22.01.2001 (Coll. S.G. Patil); Pune Dist. : Ujani Wetland : 18exs., Bhigwan, Rajewadi, Khanota, Saha, 13.04.1992 (P.D. Rane); Sindhudurg Dist. : 2exs., Pat talav, 13.01.2007 (Coll. P.D. Rane).

Diagnostic characters : Length of female- 1.1 mm. Head large with well developed supraocular depression. Anterior and ventral margin of head evenly rounded. Eye large. Valve reticulated; ventral margin of valve with 11-25 long setae followed by groups of short setae. Antennules large, thin, originate well behind the eye with basal seta. Postabdomen short, slender and with distal conical part; distal margin with bident tooth and 5-9 feathered lateral setae. Claw long, curved, ventral base of claw with 3-7 teeth; concave margin with fine setae, proximal setae comparatively larger and forming a distinct pecten.

Distribution : India : West Bengal, Nilgiri Hills, Bihar, Rajasthan, Maharashtra, Goa.

Elsewhere : Africa, Syria, USSR, France, Philippines.

19. *Moina micrura dubia* Guerne and Richard, 1862

1892. *Moina dubia* Guerne and Richard, Mem. Soc. Zool. France, Paris, 5 : p. 527-530, figs. 1 & 2.

1953. *Moina dubia* : Brehm, Osterr. Zool. Z., Vienna, 4(3) : p. 334-336.

1969. *Moina micrura dubia* : Goulden, Trans. Amer. Phil. Soc., N.S., 58(6) : p. 32, figs. 10E & 11F.

Material examined and locality : Aurangabad Dist. : Nathsagar Wetland : 8exs., Teloegaon, Ramdoh, 14.10.1997 (Coll. P.P. Kulkarni).

Diagnostic characters : Length of female-0.6 mm. Proximal part of ventral margin of valve with strong spines, distal part with groups of spinules. Absence of across any ridge on end claw and head depression at an angle of 70°. Postabdomen has distinct pecten of about 15 teeth and the two sensory setae at the base of second antenna are long. Absence of hairs on the head. Other characters are similar with the typical *Moina micrura*.

Distribution : India : Rajasthan, West Bengal, Bihar, South India. Recorded first time in Maharashtra.

Elsewhere : Java, Australia, Africa (Sahara, Uganda, Congo, Transuaal and Kenya) and Europe.

20. *Moina brachiata* (Jurine, 1820)

1820. *Monocles brachiatus* Jurine, *Historie Monocles Geneve*, Geneva and Paris, p. 131, pl. 12, figs. 1,2.

1850. *Moina brachiata* Baird, *Natural History, Brit. Entom., Ray, Soc.*, London, 102 : pl. IX, figs. 1,2.

Material examined and locality : Aurangabad Dist. : Nathsagar Wetland : 5exs., Sagardarshan, Saukheda, Nathsagar Dam, 03.07.1998, (Coll. P.D. Rane).

Diagnostic characters : Length of female-1.1 mm. Head broad; supraocular depression located above eye. Eye situated near the dorsal margin of head. Antennules long and thin with sensory seta located laterally. Ventral margin of valve with 35-41 long setae at anterior two thirds of valve margin followed by groups of shorter setae. Postabdomen large and rather long, its dorsal margin with long bident tooth and 9-14 feathered teeth. Claw with large pecten of 11-14 teeth followed by short setae; ventrally claw with 5-8 thin teeth.

Distribution : India : Kashmir, Rajasthan, Meghalaya, Maharashtra, Goa.

Elsewhere : Europe, England, Russia, Mongolia, Italy, Greece, Africa, Philippines. Throughout the old World.

Family **BOSMINIDAE** Sars, 1865**Key to the genera and species of family BOSMINIDAE**

- 1a. Antennules of female not united at base, almost parallel to each other
Bosmina longirostris (O. F. Muller, 1776)
- 1b. Antennules united at base and diverging at apex *Bosminopsis deitersi* Richard, 1895

21. *Bosmina longirostris* (O.F. Muller, 1776)

1776. *Lynceus longirostris* O. F. Muller, *Zoologiae Danicae prodromus*, Havniae, : 76, tab. 10. Figs. 7-8.

1862. *Bosmina longirostris* Sars. *Forhandl. Vidensk. Selsk. Christiania*, p. 162.

Material examined and locality : Chandrapur Dist. : Tadoba-Andhari Tiger Reserve : 14exs., Tadoba lake, 28.03.1999 (Coll. R.M. Sharma); 2exs., Pangadi Talav, 25.01.2001 (Coll. S.G. Patil).

Diagnostic characters : Body oval usually transparent; Valve thin and posteroventral margin of each valve with spine (Micro). Antennules of female almost parallel to each other, curving backward and fixed to head, olfactory setae lateral and usually near base of each antennules. Head large, more or less arched in front of the eye. Eye usually large. Antenna small with 3 and 4 segmented rami. Postabdomen almost quadrate. Claw with proximal pecten of 3-4 spinules and distal pecten with 7-10 spines.

Distribution : India : Kashmir, Meghalaya, West Bengal, Maharashtra, Goa.

Elsewhere : Cosmopolitan.

22. *Bosminopsis deitersi* Richard, 1895

1895c. *Bosminopsis deitersi* Richard, *Bull. Soc. De France*, 20 : 96-98, figs. 1-4.

Material examined and locality : Chandrapur Dist. : Tadoba-Andhari Tiger Reserve : 3exs., Talai dam, 18.09.1998 (Coll. P.P. Kulkarni); 10 exs., Andhari River pool, 27.01.2001 (Coll. S.G. Patil); Pune Dist : Ujani Wetland : 40exs., Khed bridge, 12.11.1992 (Coll. P.D. Rane); Dhulia Dist. : 2exs., Dondaicha dam, 06.06.2008 (Coll. P.D. Rane).

Diagnostic characters : Body almost oval or oblong. The general form much like *Bosmina*. Posterodorsal corner of valves distinct, posteroventral corner with small micro like process and with 1 or 2 spinules before it. Head large, with a long rostrum. Antennules long, united with each other at the basal part and with 5-6 sensory setae on the ventral side near apex. Postabdomen broad and tapering distally; with about 7 small spines at last anal edge followed by a row of setae proximally. Claw large with one large basal spine near base.

Distribution : India : Delhi, Kerala, Maharashtra, Goa.

Elsewhere : Asia, Africa, North and South America.

Family **MICROTHRICIDAE** Baird, 1843**Key to the genera of family Microthricidae**

- 1a. Postabdomen with small spine. Exopodite of leg IV with 3 bristales
 *Macrothrix* Baird, 1843...2
- b. Exopodite of leg IV with two bristles
 *Echinisca* Lieven, 1848
2. Body triangular, large postabdomen with long spines *Ilyocryptus* Sars, 1862

23. *Macrothrix spinosa* King, 1843

1853. *Macrothrix spinosa* King, *Pap. Proc. R. Soc. Van Diemens Land.*, 2 : 256, pl. vif.

Material examined and locality : Aurangabad Dist. : Nathsagar Wetland : 13exs., Ramdoh, Sagardarshan, Nathsagar Dam, 03.07.1998 (Coll. P.D. Rane); Chandrapur Dist. : Tadoba-Andhari Tiger Reserve : 7exs., Hirdi Nala, Pandharpavani tank, Talai dam, Tadoba lake, 16.09.1998 (Coll. P.P. Kulkarni); Nagpur Dist. : Pench National Park : 2exs. Bukheri talao, 05. 12.1995 (Coll. R.M. Sharma); 4exs., Totladoh, 30.11.1994; 1exs., Ranidoh, 10.12.1994 (Coll. P.P. Kulkarni); 2exs., Totladoh, 26.02.1999; 7 exs., Shivkheda, 01.3.1999 (Coll. M.S. Pradhan).

Diagnostic characters : Carapace broadly rounded-oval. Dorsal margin almost evenly arched.

ventral margin subangulated in middle and obliquely ascending posteriorly; posterior end with short protuberance occurring above in line of axis of body. Head subtriangular and with slightly prominent rostral projection. A lateral view, a ridge departing from compound eye arched at level at the base of antenna and running downwards towards the central edge of head shield. Antennules enlarge at apex; anterior margin with several fine incisions and clusters or rows of setule and with ventral angulation. The shell is reticulated and dorsal surface with more or less distinct squamous sculpture, giving dorsal edge a minute serrulate appearance. Ventral edge of valves serrate and armed with slender spines. Eye large, ocellus small and located near tip of rostrum. Postabdomen short, bilobed, and with a row of small but strong anal denticles along the dorsal edge and row of minute lateral spines. Claw very short and with setae on the concave margin. Length : 0.4 mm.

Distribution : India : Tamil Nadu, Rajasthan, Manipur, Andaman and Nicobar Islands, Tripura, Maharashtra and Goa.

Elsewhere : Thailand, Sri Lanka, Sumatra, Java, Australia, Africa, Malaysia, S. America.

Remarks : Commonly found in all type of habitats.

Genus *Echinisca* Lievin, 1848

Key to the species of *Echinisca*

- 1a. Small species, posteroventral margin of valve fringed with short setae, antennules slender with out lateral spines
..... *E. triserialis* (Brady, 1886)
- b. Large species, posteroventral margin of valve fringed with long setae. Anus at postabdomen guarded with pair of flaps
..... *E. odiosa* (Gurney, 1907)

24. *Echinisca triserialis* (Brady, 1886)

1885. *Macrothrix triserialis* Brady, J. Linn. Soc. lond. (Zool.), London, 19 : 295, pl. 47, figs. 16-20.
1976. *Echinisca triserialis* Smirnov, Zool. Inst. Acad. Nauk., Osr, New Ser., 112 : 109-110, figs., 81-83.

Material examined and locality : Ahmednagar Dist. : Nathsagar Wetland : 12exs., Ramdoh, Dhakephal, Kayagaon, 14.10.1999 (Coll. P.P. Kulkarni); Amravati Dist. : Melghat Tiger Reserve : 10exs., Gurgipati, 27.03.1994 (Coll. S.G. Patil); Chandrapur Dist. : Tadoba-Andhari Tiger Reserve : 2exs., Pangadi talav, 25.01.2001 (Coll. S.G. Patil); 1exs., Tadoba lake, 15.09.1998 (coll. P.P. Kulkarni); 2exs., Tadoba lake, 28.03.1999 (Coll. R.M. Sharma); Pune Dist. : Ujani Wetland : 22exs., Palasdeo, Bhigwan, Khanota, Rajewadi, Saha, 07.03.1991 (Coll. S.G. Patil); Sindhudurg Dist. : 2exs., Pat lake, 13.01.2007 (Coll. P. D. Rane).

Diagnostic characters : Body almost oval in outline, dorsal margin slightly arched, ventral more strongly arched and produced point posteriorly. Valve reticulate, dorsal margin with serrations, particularly in the posterior region, ventral margin with serrations and bristles and serrations on the posteroventral margin arranged in group of three. Head large, moderately arched with ridge over its edges. Small rostrum. Eye large, ocellus small and located near the tip of rostrum. Antennule slender, cylindrical and olfactory setae unequal in length, antennules with notches on anterior margin and sensory seta situated near the base. Postabdomen large, broad, bilobed, with anal spines on the both lobes. Claw short and curved. Length : 0.52 mm.

Distribution : India : Kerala, Rajasthan, West Bengal, Andaman and Nicobar Islands, Tamil Nadu, Tripura, Maharashtra (Ujani, Melghat, Pench, Tadoba), Goa.

Elsewhere : Cosmotropical.

25. *Echinisca odiosa* (Gurney, 1907)

1907. *Macrothrix tenuicornis* Gurney, Rec. Indian Mus., Calcutta 1(2), p.25, figs. 1,2, figs. 22.
1907. *Macrothrix odiosa* Gurney, Rec. Indian Mus., Calcutta 1(2) : 175
1976. *Echinisca odiosa* Smirnov, Fauna of USSR, Rakoobrazn ye, Zool. Inst. Acad. Nauk. 1(3), 112 : 118-119, figs. 94-95.

Material examined and locality : Chandrapur Dist.: Tadoba-Andhari Tiger Reserve : 1ex.,

Vasant Bandhara, 12.09.1998; 1ex., Kolsa lake, 22.04.2002 (Coll. P.P. Kulkarni); 1ex., Pandharpavni tank, 20.01.2001; 1ex., Katezari, 21.01.2001 (Coll. S.G. Patil); Pune Dist. : Ujani Wetland : 2exs., Bhigwan, 14.03.1992 (Coll. S.G. Patil).

Diagnostic characters : Body rounded oval, dorsal and ventral margin evenly arched. Posterior end with very small protuberance above the axis of body. Shell with faint hexagonal or pentagonal reticulations, dorsal margin of body smooth, ventral margin slightly serrated anteriorly with minute, blunt teeth posteriorly, fringed with large setae. Head almost evenly rounded, with a conspicuous ridge over the eye; produced into small rostrum. Plate of labrum marked with transverse ridge. Eye moderately large, ocellus small, located near tip of rostrum. Antennule long and straight, with 3 spines at tip. Sensory seta located near the base of antennules. Postabdomen bilobed, preanal part densely setiferous, postanal part with row of anal spines. Claw short and curved. Length : 0.44 mm.

Distribution : India : Rajasthan, Bihar, Maharashtra (Pench National Park, Ujani Wetland).

Elsewhere : Russia, Madagascar.

Genus *Ilyocryptus* Sars, 1862

26. *Ilyocryptus spinifer* Herrick, 1882

1882. *Ilyocryptus spinifer* Herrick, 10th Annual Rep. Geol. and Nat. Hist. Survey, Minn., p. 246, pl. 8, figs-1-5.

Material examined and locality : Amravati Dist. : Melghat Tiger Reserve : 3exs., Kolkaz, Chipidoh, churni tank, 08.04.1994 (Coll. M.S. Pradhan); Chandrapur Dist. : Tadoba-Andhari Tiger Reserve : 1ex., Kolsa lake, 22.04.2002; 1ex., Tadoba lake, 15.09.1998 (Coll. P.P. Kulkarni); Pune Dist. : Ujani Wetland : 4exs., Khanota, Bhigwan, 19.01.1991 (Coll. R.M. Sharma); Sindhudurg Dist. : 1ex., Savantwadi tank, 14.11.2007 (Coll. P.D. Rane).

Diagnostic characters : Body oval-triangular. Posterior and ventral edge of valves rounded and

usually bearing long branched setae. Head keeled, antennules long, biarticulate (two segmented) and attached to ventral side of head. Antennary setae usually long. Postabdomen large, broad and anus opening in the depression on the dorsal margin of postabdomen; with 5-7 preanal spines and 4-8 post anal spines. Claw long, slightly curved with dorsal spines of unequal length. Length : 0.75 mm.

Distribution : India : Kerala, Rajasthan, West Bengal, Meghalaya, Adaman and Nicobar Islands, Tripura, Tamil Nadu, Maharashtra and Goa.

Elsewhere : Pantropical, North America, China, Australia, Cuba, South East Asia.

Family CHYDORIDAE Stabbing, 1902

Keys to the subfamilies of CHYDORIDAE

- 1.a. Two separate main pores and two small pores situated between main pores
..... CHYDORINAE Stabbing, 1902
- b. Two or three main pores and two small pores situated lateral to main pores at distance
..... ALONINAE, Frey, 1967

Key to the genera of subfamily CHYDORINAE

1. Valve with setae on the entire posteroventral margin 2
Valve with setae situated on the ventral margin in anterior half and on inner side of ventral margin of posterior half 3
2. Rostrum long *Pleuroxus* Baird, 1843
Rostrum short and blunt
..... *Alonella* Sars, 1862
- 3a. Labrum with plate-shaped process 4
- b. Labrum without plate shaped process
..... *Pseudochydorus* Frger, 1968
- 4a. Body spherical. Postabdomen long, anus situated on its functionally ventral side
..... *Chydorus* Leach, 1816
- b. Body oval. Postabdomen rounded, anus situated on its functional posterior side
..... *Dunhevedia* King, 1853

Key to the Genera and species of subfamily CHYDORINAE

1. Postabdomen with rounded distal end2
2. Anal denticles irregularly distributed, valve with setae on the entire posteroventral margin, ventral margin of valve with knob like structure at the base of setae
Pleuroxus aduncus bhigwanensis Rane, 2002
3. Valve without striae
.....*Pleuroxus similis* Vavra, 1900
4. Maximum height of valves about 3-5 times that of posterior margin, rostrum short
.....*Pleuroxus denticulatus* Binge, 1879
Maximum height of valve about 2-3 times that of posterior margin
.....*Pleuroxus laevis* Sars, 1862a
5. Rostrum short and blunt
.....*Alonella excisa* (Fischer, 1854)

Genus *Pleuroxus* Baird, 1843

27. *Pleuroxus aduncus bhigawanensis* Rane, 2002

2002. *Pleuroxus aduncus bhigawanensis* Rane, *Zool. Surv., India, Fauna of Ujani Wetland*, 1-4 : 77-78, figs. 1-5.

Material examined and locality : Chandrapur Dist. : Tadoba-Andhari Tiger Reserve : 2exs., Katezari, 10.09.1997 (Coll. A.S. Mahabal); 2exs., Pangadi talav, 25.01.2001 (Coll. S.G. Patil).

Diagnostic characters : Female height about two and half times longer than posterior part of valve. Posteroventral corner of valve with 1-2 denticles directed posteriorly. The anterior marginal setae arise from rounded denticles at the bases. Posterior setae large, thick, and feathered. Valves with lines. Rostrum long, pointed and directed downwards. Antennule reaching one third part of rostrum with sensory setae in the middle. Antenna small. Plate of labrum convex anteriorly with slightly pointed apex. Postabdomen short, tapering distally. Preanal part projecting with 10-12 small anal denticles which decreasing in size proximally and few last ones appears in groups. Ocellus smaller than eye. Posteroventral corner

of valve may have different number of denticles which decreasing in size proximally and few last ones appears in groups. Ocellus smaller than eye. Posteroventral corner of valve may have different number of denticles at right or left valve.

Distribution : India : Maharashtra (Ujani wetland and Tadoba National Park), Goa.

Elsewhere : Not recorded.

28. *Pleuroxus similis* Vavra, 1900

1900. *Pleuroxus similis* Vavra, *Hamburger Magalhaensische Sammelreise*, 2, Hamburg, : 23-24, fig. 6.

Material examined and locality : Chandrapur Dist. : Tadoba-Andhari Tiger Reserve : 1ex., Pangadi talav, 25.01.2001 (Coll. S.G. Patil); 1ex., Hirdi Nala, 25.01.2001 (Coll. S.G. Patil).

Diagnostic characters : Body uniformly curved dorsal margin. Posteroventral corner of valve with 1-3 denticles. Valve without pattern, ventral margin with featured setae, rostrum long and pointed downwards, reaching level of ventral margin of valve. Antennules terminating from apex of rostrum. Plate of labrum with convex anterior margin. Postabdomen elongated, tapering slightly to distal end; dorsal distal corner of postabdomen situated slightly behind base of claw. Anal spines 10-13 and increase gradually in size distally. Claw with two basal spines.

Distribution : India : Kashmir, West Bengal, Madhya Pradesh, Maharashtra.

Elsewhere : Australia, Sri Lanka, Chile, Northern Caucasus.

29. *Pleuroxus laevis* Sars, 1862a

1862. *Pleuroxus laevis* Sars, *Forhandl. Vidensk. Selsk. Christiania*, p. 164-165.

Material examined and locality : Aurangabad Dist. : Nathsagar wetland : 1 ex., Sagardarshan, 3.7.88 (Coll. P.D. Rane); 2 exs Brahadgavan, 10.10.99 (Coll. P.P. Kulkarni).

Diagnostic characters : Length of female 0.42 mm. Dorsal margin of body uniformly convex, ventral margin only slightly convex. Posterodorsal

corner distinct and slightly projecting. Posteroventral corner with a denticle; small setae all along the inner side of the posterior margin. Rostrum long, directed posteroventrally. Antennules ending before middle of rostrum; anterior margin of antennule with sensory seta on the distal end. Plate of labrum with convex anterior margin and broad apex. Ocellus small than eye situated near to eye than apex of rostrum. Postabdomen taper distally; anal spines irregularly distributed. Claw with two basal spines and setae on concave margin. Maximum height of valves about 2-3 times that of posterior margin.

Distribution : India : Kashmir. This is only second record of species in India and first record from Maharashtra.

Elsewhere : Holarctic region, Africa, Sri Lanka, European USSR.

30. *Pleuroxus denticulatus* Birge, 1879

1879. *Pleuroxus denticulatus* Birge, *Trans. Wis. Acad. Arts. and Letts.*, 4, p.20-21, pl. 1, fig. 21.

Material examined and locality : Ahmednagar Dist. : Nathsagar wetland : 1 ex., Ramdoh, 25.11.99 (Coll. S.G. Patil).

Diagnostic characters : Length of female - 0.35 mm. Body broadly oval, dorsal margin arched, ventral posterior margin straight with 2 denticles. Maximum height of valves about 3-5 times that of posterior margin. Valve striated. Rostrum long, pointed. Antennules ending far from apex of rostrum. Eye and ocellus present. Postabdomen tapering distally, with 3-4 large distal anal spines and about 10 anterior to them. Group of lateral setae present. Claw with two basal spines, distal is much longer than proximal.

Distribution : India : West Bengal. First record from Maharashtra State.

Elsewhere : North and South America, Africa, United Kingdom. Easter China and France.

Genus *Alonella* Sars, 1862

31. *Alonella excisa* (Fischer, 1854)

1854. *Lynceus excisus* Fischer, *Bull. Soc. Imp. nat. Mosc.* 27 : 428-429; pl.3 figs 11-13.

1988. *Alonella excisa* (Fischer) : Michael and Sharma, *Fauna of India, Cladocera*, pp. 135-136, figs. 43a-d.

Material examined and locality : Chandrapur Dist. : Tadoba-Andhari Tiger Reserve : 2 exs., Hirdi Nala, 25.01.2001 (Coll. S.G. Patil); 1 ex., Tadoba lake, 28.03.1999 (Coll. R.M. Sharma).

Diagnostic characters : Body oval in outline, posterior margin of valve straight. Posteroventral corner with blunt denticle. Reticulation on valve in the form of parallel lines. The lines being fused in some places to form a honeycomb pattern and fine longitudinal lines and dots inside the each polygon. Rostrum blunt and directed downwards. Antennule with sensory seta distal to middle of margin. Plate of labrum with convex anterior margin and blunt apex. Eye and ocellus present. Postabdomen short. Preanal corner blunt with 10 anal spines. Anal margin with setules. Claw with two basal spines.

Distribution : India : Madhya Pradesh, Kashmir, Maharashtra, Goa.

Elsewhere : Cosmopolitan.

Genus *Chydorus* Leach, 1816

Key to the species of genus *Chydorus*

- 1a. Valve superficial but without deep polygonal reticulation; Labrum with pointed apex
Chydorus spaericas (O.F. Muller, 1776)...2
Valve with deep polygonal cells, labrum with rounded apex
..... *Chydorus faviformis* Birge, 1893
- 2a. Labrum with rounded and slightly produced apex. Postabdomen not tapering
..... *Chydorus eurynotus* Sars, 1901
- b. Labrum with papilliform shaped apical process
Chydorus eurynotus brehmi Biswas, 1966
- c. Labrum broadly rounded, postabdomen slightly tapering distally ventral margin in of valve rounded
..... *Chydorus kallipigos* Brehm, 1934...3
3. Large species valve without reticulation, ventral margin of valve with a convexity in

the middle valve with out pits
 *Chydorus ventricosus* Daday, 1898

4. Valve with strong reticulations and concentration of dots with in the each cell, dorsal margin evenly convex
 *Chydorus reticulatus* Daday, 1898...5
5. Carapace with humped dorsal margin, anal denticles small and numerous
 *Chydorus gibbus* Sars, 1891

32. *Chydorus sphaericus* (O.F. Muller, 1776)

1776. *Lynceus sphaericus* O.F. Muller, *Havnae*, : 119.

1900. *Chydorus sphaericus* Lilljeborg, *Nova Acta Regiae Societatis Scientiarum Upsaliensis*, 3(19) : 567, pl. 77. Figs. 8-25.

Material examined and locality : Chandrapur Dist. : Tadoba-Andhari Tiger Reserve : 2exs., Talaidam, 16.09.1998 (Coll. P.P. Kulkarni); 1ex., Shivanzari Nala, 23.01.2001 (Coll. S.G. Patil); 2exs., Kolsa lake, 22.04.2000 (Coll. P.P. Kulkarni); 2exs., Talaidam, 22.01.2001 (Coll. S.G. Patil).

Diagnostic characters : Body almost spherical in outline. Length slightly more than height. Posterodorsal corner distinct. Posteroventral corner rounded without denticles. Valve usually reticulated but without dots or pits. Rostrum pointed and emarginated. Antennule with sensory setae near middle of anterior margin; all aesthetascs situated on the apex of antennules. Plate of labrum with smooth, convex anterior margin and with produced, pointed apex. Ocellus near to eye than apex of rostrum. Postabdomen short with 7-10 Anal denticles. Preanal corner projecting. Lateral setae in several groups. Claw with two basal spines and setae with concave margin. Length : 0.5 mm.

Distribution : India : West Bengal, Bihar, Kashmir, Ladakh and Nilgiri Hills, Meghalaya.

Elsewhere : Cosmopolitan.

33. *Chydorus faviformis* Birge, 1893

1893. *Chydorus faviformis* Birge, *Trans. Wis. Acad. Sci. Arts and letts.*, 9 : 307-308. Pl. XIII, figs. 7-8.

Material examined and locality : Chandrapur Dist. : Tadoba-Andhari Tiger Reserve : 2exs., Pangadi Talav, 25.01.2001 (Coll. S.G. Patil); 1ex., Pandharpavni tank, 15.09.1998 (Coll. P.P. Kulkarni); Pune Dist : Ujani Wetland : 3exs., Palasdeo, 05.01.1990 (Coll. S.G. Patil).

Diagnostic characters : Body rounded, posterodorsal and posteroventral corner of valves not distinct. Valve and shield with deep polygonal cells. Rostrum pointed. Antennules not reaching apex of rostrum. Plate of labrum with convex anterior margin and with slightly pointed apex. Ocellus situated almost midway between eye and apex of rostrum. Postabdomen wide with rounded apex, preanal corner distinctly projecting. 9-10 anal spines and groups of lateral setae present. Claw with setae on its concave margin and two basal spines. Length : 0.4 mm.

Distribution : India : Kashmir, Assam, Tripura, Maharashtra, Goa.

Elsewhere : Northeast of North America, Sri Lanka, China, Malaysia, Australia, S.E. Asia.

34. *Chydorus kallipygos* Brehm, 1934

1934. *Chydorus kallipygos* Brehm, *Arch. Hydrobiol.*, 26, p.74-75, figs. 27-29.

Material examined and locality : Aurangabad Dist. : Nathsagar wetland : 2 exs., Shevta, 17.4.99 (Coll. R.M. Sharma); 1 ex., Dahigaon, 8.12.97, (Coll. S.G. Patil); 1 ex., Dhakephal, 9.10.99 (Coll. P.P. Kulkarni).

Diagnostic characters : Length of female - 0.55 mm. Body almost oval, maximum height around middle posterodorsal corner of valves distinct and projecting; posteroventral corner rounded without spine. Valve with pattern of polygons. Rostrum short and pointed. Antennules ending far before apex of rostrum. Plate of labrum rounded, with anterior depression. Ocellus situated almost midway between eye and apex of rostrum. Postabdomen with 10 anal spines. Preanal corner strongly projecting. Margin of anus with setae. Length : 0.55 mm.

Distribution : India : Tamil Nadu, Madhya Pradesh, Maharashtra.

Elsewhere : Ethiopian region.

35. *Chydorus ventricosus* Daday, 1898

1898. *Chydorus ventricosus* Daday, *Termis Furetk*, 21, p. 28-29, figs. 10, a-b.

Material examined and locality : Amaravati Dist. : Melghat Tiger Reserve : 4 exs., Kolkaj, Hatida Talav, 23.03.1993 (Coll. S.Patil); Aurangabad Dist. : Nathsagar wetland : 10 exs., Sagardarshan, 3.7.98 (Coll. P.D. Rane); 4 exs., Lakhephal, 18.4.99 (Coll. R.M. Sharma); Chandrapur Dist. : Tadoba-Andhari Tiger Reserve : 2 exs., Tadoba lake, 15.09.1998 (Coll. P.P. Kulkarni); Pune Dist. : Ujani Wetland : 3 exs., Palasdeo, Saha, Khandor, 05.01.1990 (Coll. S.G. Patil).

Diagnostic characters : Length of female 0.5 mm. Body oval, posteroventral and posterodorsal corners rounded without denticles. Ventral margin strongly bulged in middle with long setae and submarginal setae posterior to bulge. Posterior margin double lined with transverse setae. Valve with faint polygons under wavy margin enclosing dots. Rostrum long, pointed and slightly indented on the anterior marginal tip. Ocellus about half of eye. Postabdomen elongated with distinct preanal corner with 10 marginal spines and lateral groups of setules. Claw with setae on concave margin and slender basal spine.

Distribution : India : Gujarat, Rajasthan, Maharashtra, Tamil Nadu, Maharashtra, Goa.

Elsewhere : Sri Lanka, China, Java, East Africa.

36. *Chydorus reticulatus* Daday, 1898

1898. *Chydorus reticulatus* Daday, *Termes. Fuzetek*, 21, p.27, figs. 9 a-d.

1971. *Chydorus reticulatus* : Smirnov, *Acad. Sci. Zool. Institute Nova Ser.* No. 101, p. 308, fig. 341.

Material examined and locality : Aurangabad Dist. : Nathsagar wetland : 2 exs., Sagardarshan, 3.7.98 (Coll. P.D. Rane).

Diagnostic characters : Length of female 0.3 mm. Posteroventral corner rounded, without

denticles. Posterodorsal corner of valve well marked. Valve strongly reticulated with dots inside. Rostrum long, pointed, curved posteriorly. Rostrum long, pointed. Antennule reaching middle of rostrum. Plate of labrum elongated, differentiated with rounded apex. Postabdomen tapering distally. Anal denticles 8-10. Claws with 2 basal spines with setules on the concave margin. Ocellus half as large as eye. Body somewhat spherical in outline.

Distribution : India : Rajasthan, Kerala, Maharashtra.

Elsewhere : Sri Lanka, Java, Thailand.

37. *Chydorus eurynotus* Sars, 1901

1901. *Chydorus eurynotus* Sars, *Arch. Math. Nat.*, 23, p. 70, p. 11, figs. 3, 3a-c.

Material examined and locality : Aurangabad Dist. : Nathsagar wetland : 3 exs., Ramdoh, 23.11.98 (Coll. S.G. Patil); 1 ex., Dahigaon, 27.9.97 (Coll. R.M. Sharma).

Diagnostic characters : Length of female 0.3 mm. Posteroventral corner of valve rounded without denticles. Rostrum pointed. Antennules not reaching apex of rostrum. Plate of labrum broadly rounded, slightly depression at anteroventral region. About 10-12 anal denticles and lateral setae present on the postabdomen. Intestine forming loops. Claw with two basal spines. Valve faintly reticulated (honey comb type) with pits inside. Length : 0.32 mm.

Distribution : India : Rajasthan. First record from Maharashtra.

Elsewhere : Ethiopian, Indo-Malayan, Australian and Neotropical regions, Sri Lanka.

38. *Chydorus eurynotus brehmi* (Biswas, 1965)

1965. *Chydorus brehmi* Biswas, *Crustaceana, Leiden*, 11 (2) : 113-114, fig. 1.

1971. *Chydorus eurynotus brehmi* Comb. N. Smirnov, *USSR. Sci. Zool. Inst. Nova. Ser. No.* 101, 12 : 378 p. (Translated from Russian).

Material examined and locality : Amaravati Dist. : Melghat Tiger Reserve : 5 exs., Gavighat

tank at Chikaldhara, 19.12.1997 (Coll. P.P. Kulkarni).

Diagnostic characters : Valve without sculpture. Plate of labrum with round anterior margin but ending with a papilliform process. Antennule ending far before apex of rostrum. Postabdomen preanal corner with 12 anal denticles. Ocellus about half as long as eye. Length: 0.57 mm.

Distribution : India : Rajasthan, Maharashtra (only second time recorded from India after original description).

Remarks : Behm (1936) doubtfully mentioned similar specimen from Nilgiri Hills. Later on Biswas 1965 recorded a new species *C. brehmi* from Jaipur dist., Rajasthan on the basis of peculiar papilliform process on the tip of the plate of labrum. Smirnov (1971) shifted this species to *C. eurynotus brehmi* com. n. as showing the same character of labrum with slightly produced apex similarly which was always found in *C. eurynotus* species.

39. *Chydorus gibbus* Sars, 1891

1891. *Chydorus gibbus* Sars, *Forhandlenger I Videnskabs-selskabet i Christiania*, : 50.

Material examined and locality : Chandrapur Dist. : Tadoba-Andhari Tiger Reserve : 2exs., Pangli tank, 21.04.2000 (Coll. P.P. Kulkarni); 1ex., Shivanzari Nala, 23.01.2001 (Coll. S.G. Patil).

Diagnostic characters : Valve with humped dorsal margin. Body triangular in anterior view. Hexagonal cells reticulation on the valve. Rostrum pointed. Antennules with sensory seta in the middle of anterior margin. Antenna with 7 setae. Plate of labrum with convex anterior margin and pointed posterior end. Postabdomen short. Preanal corner projecting, pubescent. Dorsal margin with 2 rows of 8-10 anal denticles. Claw with basal spines with setae on concave margin. Ocellus near to eye than apex of rostrum. Length : 0.56 mm.

Distribution : India : First time recorded from India.

Elsewhere : Holarctic, European USSR, Kurile Islands.

Genus *Dunhevedia* King, 1853

Key to the species of genus *Dunhevedia*

- 1a. Plate of labrum without denticles
..... *Dunhevedia crassa* King, 1853.
- b. Plate of anterior margin of labrum with tubercle-shaped convexity
Dunhevedia crassa cilio-caudata (Sovinsky, 1891)
- b. Plate of labrum with numerous denticles
..... *Dunhevedia serrata* Daday; 1898

40. *Dunhevedia crassa* King, 1853

1853. *Dunhevedia crassa* King, *Pap. and proc. Roy. Soc. Van Diemens Lond., Hobart Town*, 2 : 261, pl. VII F.

Material examined and locality : Amaravati Dist. : Melghat Tiger Reserve : 3exs., Water pool near Dhakna, Chaurakunda, 17.02.1991 (Coll. D.F. Singh); Aurangabad Dist. : Nathsagar wetland : 8exs., Lakhephal, Dhakephal, Sagardarshan, 03.07.1998 (Coll. P.D. Rane); Pune Dist. : Ujani Wetland : 14exs., Khanota, Khed, Palasdeo, 12.02.1992 (Coll. S.G. Patil); Nagpur Dist. : Pench National Park : 1 ex., Salama area of Saddle dam, 10.10.96 (Coll. A. Mahabal); 1 ex., Fefrikunda, 30.4.97 (Coll. S.G. Patil).

Diagnostic characters : Body almost oval in outline, maximum height slightly before the middle. Posteroventral corner of valve with one denticle. Ventral margin of valve with feathered setae, which are longest in the middle. Antennules ending slightly before apex of the rostrum; thick and tapering distally; lateral sensory seta situated on a tubercle and sensory papillae at most half as long as antennules. Plate of labrum without denticles with produced apex. Ocellus situated nearer to eye than to apex of rostrum. Postabdomen oval with 15-18 anal spines and numerous lateral groups of setae. Length : 0.35 mm.

Distribution : India : West Bengal, Maharashtra, Gujarat, Rajasthan, Andaman and Nicobar, Tripura, Tamil Nadu, Kerala, Goa.

Elsewhere : Holarctic region, Ethiopian region, Indo-Malayan, Australia, Southern part of Europe, USSR, S.E. Asia.

41. *Dunhevedia crassa ciliocaudata* (Sovinski 1891)

1891. *Alona ciliocaudata* Soviski, *Zapiski, Kievskogo Obschesiva Estestvaispytatelei*, II, p. 159-160, pl. 111, figs. 33-34.

1971. *Dunhevedia crassa ciliocaudata* Smirnov, *USSR Acad. Sci. Zool. Institute, Nova Ser. No.*, 101, Leningrad, p. 322. Figs. 363.

Material examined and locality : Aurangabad Dist. : Nathsagar Wetland : 5exs., Sagardarshan, 23.02.1999 (Coll. A.S. Mahabal); Chandrapur Dist. : Tadoba-Andhari Tiger Reserve : 1ex., Pangli tank, 21.04.2000; 1ex., Talai dam, 16.09.1998 (Coll. P.P. Kulkarni); 1ex., Tadoba lake, 27.09.1994 (Coll. R.M. Sharma); Pune Dist. : Ujani Wetland : 2exs., Khed, 20.01.1991 (Coll. R.M. Sharma).

Diagnostic characters : Female posteroventral corner of valve with a denticles, sometimes with accessory denticle above it. Anterior margin of plate of labrum with tubercle shape convexity and blunt apex. Two sensory papillae of antennules longer than other. Postabdomen with 10-12 anal denticles and with transverse row of setae almost all the surface. Ocellus about a quarter as large of the eye, situated half way between eye and apex of rostrum. Length : 0.5 mm.

Distribution : India : First Record.

Elsewhere : Poland, USSR, Kiev region.

42. *Dunhevedia serrata* Daday, 1898

1898. *Dunhevedia serrata* Daday, *Termes. Fuzetek.*, 21 : 32-33, figs. 13.

Material examined and locality : Chandrapur Dist. : Tadoba-Andhari Tiger Reserve : 2exs., Ambathira, 02.04.1996 (Coll. P.P. Kulkarni); 1ex., Andhari River, 27.01.2001 (Coll. S.G. Patil).

Diagnostic characters : Body almost oval in outline, maximum height just before middle. Postsodorsal corner valve not very distinct. Postsoventral corner with two denticles. Dorsal denticle smaller than ventral. Valve with longitudinal lines and dots. Rostrum blunt. Plate of labrum with serrated anterior margin with 10-15 denticles, apical denticles directed downward.

Ocellus small than eye. Postabdomen oval, with 3-15 anal denticles and numerous lateral groups of setae. Claw with basal spine and with setae on concave margin. Length : 0.43 mm.

Distribution : India : Tamil Nadu, Maharashtra, Goa.

Elsewhere : Africa, Sri Lanka, New Guinea and North America.

**Key to the species of subfamily
CHYDORINAE Frey, 1967**

- 1a. Labrum without plate shaped process, Ocellus is smaller than eye, antennules not projecting beyond the rostrum
..... *Pseudochydorus globosus* (Baird, 1843)
- b. Labrum with plate-shaped process, ocellus and eye large. Antennule distinctly projecting beyond the rostrum
..... *Dadaya macrops* (Daday, 1898)

Genus *Dadaya* Sars, 1901

43. *Dadaya macrops* (Daday, 1898)

1898. *Alona macrops* Daday, *Termis Fuzetek.*, 21 : 38-39, fig. 17.

1901. *Dadaya macrops* Sars, *Arch. Math. Nat.*, 23 : 73-74, pl. XI, figs. 5, a-b.

Material examined and locality : Chandrapur Dist. : Tadoba-Andhari Tiger Reserve : 2exs., Tadoba lake, 15.09.1998 (Coll. P.P. Kulkarni).

Diagnostic characters : Body oval, dorsal and ventral margin of valve convex. Posteroventral corner of valve rounded, with a denticle. Valve with a pattern of hexagons. Ventral margin of valve with setae on inner side in posterior half. Rostrum long. Antennuls distinctly projecting beyond apex of rostrum. Distal segments of antennae not reaching apex of rostrum. Labrum with a long beak like projection. Ocellus and eye usually large. Postabdomen with about 15 anal spines, proximal ones are smaller. Postabdomen with a projecting preanal corner. Claw with a basal spine. Length : 0.38 mm.

Distribution : India : Southern Region. First

time recorded in middle region like Madhya Pradesh and Maharashtra.

Elsewhere : Ethiopian, Indo-Malaysia, Australia and Neotropical regions.

Genus *Pseudochydorus* Fryer, 1968

44. *Pseudochydorus globosus* (Baird, 1854)

1843. *Chydorus globosus* Baird, *Ann. Mag. Nat. Hist.*, 68 : 90, pl. III, Figs 1-6.

1968. *Pseudochydorus globosus* Fryer, *Phil. Trans. Roy. Soc.*, 254 : 324-328, figs. 92-111.

Material examined and locality : Amaravati Dist. : Melghat Tiger Reserve : 2exs., Chaurakunda, Rangubeli, 10.02.1991 (Coll. D.F. Singh); Aurangabad Dist. : Nathsagar Wetland : 1ex., Sagardarshan, 23.02.1999 (Coll. A.S. Mahabal); Chandrapur Dist. : Tadoba-Andhari Tiger Reserve : 2exs., Tadoba lake, 15.09.1998 (Coll. P.P. Kulkarni).

Diagnostic characters : Body almost spherical, slightly longer than high; posteroventral corner of valve rounded without denticle. Valve with pattern of polygons. Rostrum pointed and ventrally directed. Antennules not reaching apex of rostrum. Postabdomen narrow, almost uniformly wide; Anal spines about 20, decreasing in size proximally. Group of lateral setae present. Anal margin with setae. Claw with two basal spines and row of setae on concave margin. Length : 0.8 mm.

Distribution : India : Tamil Nadu, West Bengal, Meghalaya, Maharashtra (Ujani wetland and Melghat Tiger Reserve).

Elsewhere : Holartic, Indo-Malayan, Australia, USSR.

Subfamily ALONINAE Frey, 1967

Key to the genera of subfamily ALONINAE

1. Three main head pores2
 - One or two main head pores7
2. Lateral setae of postabdomen large
 -*Leydigia* Kurz, 1875
 - Lateral setae of postabdomen not large3
3. Postabdomen of varying form but not narrow or very long4
 - Postabdomen long and narrow5
4. Head shield with broadly rounded anterior margin; projecting in anteriorly lateral view *Graptoleberis* Sars, 1862b
 - Anterior margin of head shield not broadly rounded, not projecting the lateral view
 -*Alona* Baird, 1843
5. Rostrum projecting
 -*Kurzia* Dybowski & Grochowski, 1894
 - Rostrum not projecting
 -*Camptocercus* Baird, 1843
6. Body large*Euryalona* Sars, 1901
 - Body comparatively small
 -*Indialona* Petkovski, 1966
7. Head with one pore, only seen in early developmental stages, broad postabdomen..
 -*Natoalona* Rajapaksha and Fernando, 1987

Genus *Alona* Baird, 1843

Key to the species of genus *Alona*

1. Plate of labrum with rounded apex. Main head pores connected2
 - Plate of labrum with pointed apex. Main head pores not connected
 -*Alona pulchella* King, 1853
2. Postabdomen tapering distally3
 - Postabdomen not tapering distally5
3. Dorsal margin of postabdomen broadly convex
 -*Alona taraporevalae* Shirgur and Naik, 1977
 - Dorsal margin of postabdomen not broadly convex4
4. Valves with pattern of polygons. Anal spines in 10-11 groups
 -*Alona davidi* Richard, 1895a...9
 - Valves with dots. Anal spines in about 16 groups
 -*Alona davidi punctata* (Daday, 1898)

5. Distal end of postabdomen not projecting; Plate of labrum with denticles on anterior margin
.... *Alona monocantha tridentata* (Stingelin, 1904)...8
- Distal end of postabdomen projecting7
6. Postabdomen with 7 anal and 5 groups of lateral setae. Body rectangular
..... *Alona rectangula* Sars, 1862a
- Postabdomen with 6-9 groups of lateral setae, 2-3 spines and setae in each group
Alona rectangula richardi (Stingelin, 1894)
7. Distal end of postabdomen distinctly projecting beyond base of claws. Lateral pores without chitinous thickening
..... *Alona guttata* Sars, 1862b
- Distal end of postabdomen slightly projecting beyond the base of claws. Lateral pores with chitinous thickenings
..... *Alona costata* Sars, 1862b
8. Postabdomen with rounded distal end not widening distally. Valve with row of tubercles and granules
...*Alona pseudanodentata anodonta* Daday, 1905
- Postabdomen strongly widening distally
..... *Alona intermedia* Sars, 1862
9. Lateral setae at postabdomen isolated and long
..... *Alona archeri* Sars, 1889
- Lateral setae at postabdomen with 9-12 groups of setules with large basal spines with 2-6 denticles at posteroventral corner
..... *Alona macronyx* Daday, 1898...10
10. Valves with rounded posterodorsal and posteroventral corner without any denticle
..... *Alona capensis* Ruhe, 1921

45. *Alona rectangula* Sars

1862a. *Alona rectangula* Sars, *Forhandl. Vidensk. Selsk. Christiania*, : 160 p.

Material examined and locality : Amaravati Dist. : Melghat Tiger Reserve : 2exs., Gavalighat,

Chikaldhara, 05.09.1993 (Coll. P.P. Kulkarni); Chandrapur Dist. : Tadoba-Andhari Tiger Reserve : 5exs., Pangli tank, 21.04.2000 (Coll. P.P. Kulkarni); Sindhudurg Dist. : 1ex., Savantwadi tank, 13.01.2007 (Coll. P.D. Rane).

Diagnostic characters : Body almost rectangular, posteroventral corner rounded without denticle. Antennule slightly smaller than rostrum. Ocellus slightly smaller than eye. Postabdomen with 6-7 anal denticles accompanied by setae. Distal end of postabdomen rounded with grouped setae projecting margin of postabdomen. Setae on the ventral side small and almost uniform in size. No longitudinal lines or dots on the valve. Plate of labrum broad and rounded with slight notch at anterior side. Vas differans opening near the base of claw. Length : 0.5 mm.

... *Distribution* : Ladakh, Gujarat, Rajasthan, Meghalaya, Kashmir, West Bengal, Maharashtra, Goa.

Elsewhere : Africa, USSR.

46. *Alona rectangula richardi* (Stingelin)

1895. *Alona richardi* Stingelin, *Rec. Suisse Zool.*, 3, p. 250, pl. 7, fig. 37.

1962. *Alona retangula* var. *richardi* Sramck-Husek *et al.*, *Fauna of USSR, Praba.*, 16, p.347, figs. 1-8F.

Material examined and locality : Aurangabad Dist. : Nathsagar Wetland : 5 exs., Nathsagar dam, 7.7.99; (Coll. S.G. Patil); 1 ex., Dahigaon, 8.12.97 (Coll. S.G. Patil); 1 ex., Kaigaon, 13.10.99 (Coll. P.P. Kulkarni).

Diagnostic characters : Length of female : 0.35 mm. Posteroventral corner of valve rounded without denticle. Valve with about 12 longitudinal lines. Antennule reaching almost apex of rostrum. Plate of laborum rounded. Ocellus slightly smaller than eye. Postabdomen slightly widening distally with 6-9 lateral groups of setae and 2-3 spines and setae in each group. Claw with basal spine.

Distribution : West Bengal. First record from Maharashtra.

Elsewhere : New Zealand, USSR.

47. *Alona davidi* Richard, 1895a

1895a. *Alona davidi* Richard, *Me. Soc. Zool. France.*, 7, p. 192-195.

Material examined and locality : Aurangabad Dist. : Nathsagar Wetland : 5 exs., Ramdoh, 23.11.98 (Coll. S.G. Patil); 2 exs., Sagardarshan, 3.7.98 (Coll. P.D. Rane).

Diagnostic characters : Length of female - 0.35 mm. Maximum height slightly before middle. Dorsal margin of head forming a smooth curve with dorsal margin of valve. Posterodorsal and posteroventral corner rounded. Valve with indistinct pattern of polygons. Inner side of posterior margin of valve with row of setae. Rostrum blunt. Antennules ending a short distance before apex of rostrum. Plate of labrum rounded. Postabdomen widest in the middle, tapering distally; preanal corner projecting. Anal denticles thin in 10-11 groups of 2-4 teeth. Postabdomen with groups of setae laterally, distal seta the longest in each group. Claw with one basal spine and setae at proximal concave margin.

Distribution : India : West Bengal, Andaman & Nicobar Islands, Tripura. First recorded from Maharashtra.

Elsewhere : Ethiopian region, Haithi.

48. *Alona davidi punctata* (Daday, 1898)

1898. *Alona punctata* Daday, *Termes, Fuzetck.*, 21 : 39-40, figs. 18 a-c.

1939. *Alona davidi* var *punctata* Gauthier, *Bull. Inst. fr. Afr. noire*, 1 : 176-182, figs. 10.

Material examined and locality : Amaravati Dist. : Melghat Tiger Reserve : 4 exs., Chaurakunda, Karpa river, 10.02.1991 (Coll. D.F. Singh); Ahmednagar and Aurangabad Dists. : Nathsagar Wetland : 6 exs., Sagardarshan, Nathsagar Dam, Randoh, 03.07.1998 (Coll. P.D. Rane); Nagpur Dist. : Pench National Park : 2 exs., Totladoh, 30.11.1994 (Coll. P.P. Kulkarni); 1 ex., Phephari Kunda, 05.09.1994 (Coll. M.S. Pradhan); Pune Dist. : Ujani Wetland : 5 exs., Saha, Bhigwan, 13.04.1992 (Coll. S.G. Patil).

Diagnostic characters : Body almost oval in

outline, maximum height slightly before the middle region. Valves punctate. Rostrum blunt. Postabdomen widest in middle with 10-12 groups of lateral anal spines and groups of fine setae. Claw with one basal spine and groups of fine setae. Claw with one basal spine and with setae on the concave margin. Ventral margin of valve projecting in the middle. Rostrum blunt. Plate of labrum rounded. Ocellus smaller than eye, slightly near to eye than to apex of rostrum. Claw with one rather large basal spine; setae on the concave margin. Length : 0.6 mm.

Distribution : India : West Bengal, Tamil Nadu, Maharashtra, Goa, Madhya Pradesh.

Elsewhere : Ethiopian, Australian region, Argentina.

49. *Alona costata* Sars, 1862b

1862b. *Alona costata* Sars, *Forhandl. Vidensk. Selsk. Christiania*, 286 p.

Material examined and locality : Amaravati Dist. : Melghat Tiger Reserve : 2 exs., Gavilghat-Chikaldhara, 23.03.1993 (Coll. S.G. Patil); Chandrapur Dist. : Tadoba-Andhari Tiger Reserve : 1 exs., Tadoba lake, 28.09.1999 (Coll. R.M. Sharma); 2 exs., Pangadi talav, 25.01.2001 (Coll. S.G. Patil).

Diagnostic characters : Valve with rounded posterodorsal and posteroventral corner. Valve reticulated with longitudinal and interconnections. Posterior margin of valves with a row of spinnules on its inner margin. Antennule not reaching apex of rostrum. Plate of labrum rounded. Ocellus much smaller than eye and situated half way between eye and apex of rostrum. Postabdomen short and tapering distally, dorsal margin almost straight and preanal corner only slightly projecting beyond the base of claws. Anal spines 11-12, decreasing in size proximally. Group of lateral setae present in a row, the distal setae being longest in each groups. Anal margin almost straight. Claw with basal spine. Length : 0.6 mm.

Distribution : India : Himachal Pradesh, Manipur, Maharashtra (Melghat, Tadoba-Andhari Tiger Reserve).

Elsewhere : Holarctic, Ethiopian, Indo-Malayan, Neotropical and European USSR.

50. *Alona pulchella* King, 1853

1853. *Alona pulchella* King, *Pap. Proc. R. Soc. Van Diemens Land*, 2 : 260, pl. VIII B.

Material examined and locality : Amaravati Dist. : Melghat Tiger Reserve : 2exs., Chamhar height, 20.02.1997 (Coll. A.S. Mahabal); Aurangabad Dist. : Nathsagar Wetland : 14exs., Dahigaon, sagardarshan, Ramdoh, 03.07.1998 (Coll. P.D. Rane); Chandrapur Dist. : Tadoba-Andhari Tiger Reserve: 3exs., Pangadi talav, 25.01.2001 (Coll. S.G. Patil); 1ex., Talai dam, 16.09.1998 (Coll. P.P. Kulkarni); 1ex., Hirdi Nala, 25.01.2001 (Coll. S.G. Patil); Pune Dist. : Ujani Wetland : 2exs., Khandasa, Saha, 06.01.1990 (Coll. S.G. Patil).

Diagnostic characters : Valve generally punctate or reticulated. Rostrum blunt. Antennules not reaching apex of rostrum. Plate of labrum with convex anterior margin and slightly pointed apex. Ocellus situated half way between eye and apex of rostrum. Postabdomen almost straight dorsal and ventral margin, about 16 anal denticles. Groups of lateral setae present; Dorsal setae the longest in each group. Claw with one basal spine. 0.5 mm.

Distribution : India : Gujarat, West Bengal, Maharashtra (Melghat Tiger Reserve, Tadoba-Andhari Tiger Reserve, Ujani Wetland, Nathsagar Wetland), Goa and Madhya Pradesh.

Elsewhere : cosmopolitan.

51. *Alona guttata* Sars, 1862b

1862b. *Alona guttata* Sars, *Forhandl. Vidensk. Selsk. Christiania*, : 287-189.

Material examined and locality : Chandrapur Dist. : Tadoba-Andhari Tiger Reserve: 1ex., Pandharpavani talav, 26.03.1999 (Coll. P.P. Kulkarni), 1ex., Tadoba lake, 28.03.1999 (Coll. R.M. Sharma); 2exs., Pangadi Talav, 25.01.2001 (Coll. S.G. Patil); Pune Dist. : Ujani Wetland : 7exs., Khanota, Palasdeo, Bhigwan, 18.01.1991 (Coll. R.M. Sharma).

Diagnostic characters : Body oval in shape with rounded posterodorsal and postsoventral corners of valve. In some cases valves with tubercles. Antennules not reaching apex of rostrum. Plate of labrum rounded. Ocellus smaller than eye situated half way between eye and apex of rostrum. Postabdomen wide with about 9 anal spines and lateral groups of setae. Distal end of postabdomen pointed and projecting beyond the base of claw. Preanal corner projecting, anal margin or anal groove of postabdomen bordered by groups of spines or setae. Length : 0.47 mm.

Distribution : India : Himachal Pradesh, Rajasthan, Tamil Nadu, Ladakh, Kerala, Kashmir, Maharashtra (Ujani Wetland; Tadoba-Andhari Tiger Reserve), Madhya Pradesh.

Elsewhere : Cosmopolitan.

52. *Alona taraporevalae* Shirgur and Naik, 1977

1977. *Alona taraporevalae* Shirgur and Naik, *Bombay Proc. Synp. Warm water Zooplankton*, pp. 48-56.

1983. *Alona taraporevalae* : Sharma and Michael, *Rec. zool. Surv. India*, 81 : 35-38 fig. 1, 1-f (Redescription)

Material examined and locality : As per redescription of species (Sharma and Michael, 1983).

Diagnostic characters : Female : Body oval, maximum height just before the middle. Dorsal margin strongly arched; ventral margin bulging in the middle and slightly concavity following it. Posteroventral corner without denticle. Valve without marking. Blunt rostrum. Eye moderately large; ocellus slightly smaller than eye. Antennules reaching tip of rostrum; olfactory seta in the middle and aesthetes unequal. Plate of labrum with convex anterior margin and rounded apex. Postabdomen broad, slightly tapering; 9 groups of anal denticles each with 3-4 denticles; few groups of lateral fascicles. Claw long, stout and curved with setae on concave margin; basal spine large about one third of claw. Length 0.50 mm.

Male : Smaller than female, same as female description; only postabdomen with ventral margin produced above base of claws. Distinct and robust penis present between the claws. First leg with

hook shaped structure and vas deferens opening near the base of claw. Length : 0.32 mm.

Distribution : India : Bombay, Maharashtra State; not recorded other locality than type locality.

53. *Alona pseudadentata anodonta* Daday, 1905

1905. *Alona pseudadentata anodonta* Daday, *Zoologica*, 18(44) : 175, pl.XI, figs.5,6.

Material examined and locality : Chandrapur Dist. : Tadoba-Andhari Tiger Reserve : 2exs., Tadoba lake, 28.03.1999 (Coll. R.M. Sharma).

Diagnostic characters : Maximum height in the middle, posterodorsal and posteroventral corner rounded. Antennule almost reaching apex of the rostrum. Plate of labrum rounded. Postabdomen with rounded and widened distally. Valves with rows of tubercles and granules. Anal denticles up to 10 decreasing in size proximally, lateral setae in groups. Claw with short basal spine. Preanal corner distinct but not projecting. Ocellus situated half way between eye and apex of rostrum. Length : 0.3 mm.

Distribution : India : First record.

Elsewhere : Paraguay, Lake Nyasa.

Remarks : The species without having tubercles on the valves was described by Brehm 1933b from Lake Nyasa and Philippines was named as *Alona pseudanodontata*.

54. *Alona monocantha tridentata* (Stingelin, 1906)

1906. *Alona acuticostata* var *tridentata* (Stingelin), *Zool. Jahrb. Syst.*, 21 : 327-367.

1971. *Alona monocantha tridentata* Smirnov, USSR, *Acad. Sci. Zool. Institute, Nova ser.*, 10, Leningrad : 539.

Material examined and locality : Nagpur Dist. : Pench National Park : 1ex., Totladoh, 26.02.1999 (Coll. M.S. Pradhan); Pune Dist. : Ujani Wetland : 2exs., Saha, 19.01.1991 (Coll. R.M. Sharma).

Diagnostic characters : Female : Body rectangular, valve with longitudinal lines. Posteroventral corner of valve with 1-3 denticles, attached submarginally. Ocellus smaller than eye. Antennules not reaching the apex of rostrum. Plate

of labrum with a denticle on the apex portion of at anterior margin. Postabdomen with 7-8 anal denticles. Claw with long basal spine. Length : 0.31 mm.

Distribution : India : Rajasthan, Maharashtra, Tripura, Tamil Nadu.

Elsewhere : South-East Asia.

55. *Alona intermedia* Stingelin, 1895

1895. *Alona intermedia* Stingelin, *Rev. Suisse Zool.*, 3, 248-249, pl. 7, figs. 34-35.

Material examined and locality : Aurangabad Dist. : Nathsagar wetland : 2 exs., Talegaon, 9.2.01 (Coll. P.P. Kulkarni); 1 ex., Dahigaon, 27.9.97 (Coll. R.M. Sharma).

Diagnostic characters : Length of female - 0.33 mm. Valve with longitudinal lines; posterodorsal and posteroventral corners rounded. Rostrum blunt, antennules not reaching apex of rostrum. Ocellus smaller than eye and situated halfway between eye and apex of rostrum. Plate of labrum rounded anteriorly with group of setules ventrally. Postabdomen with 8-9 anal denticles and 9-10 lateral setae. Claw with basal spine.

Distribution : India : West Bengal, Tripura. First record of species from Maharashtra State.

56. *Alona archeri* Sars, 1888

1888. *Alona archeri* Sars. *Forth. Uidensk. Selsk. Christiania*, 7p. 59, pl. 6, figs. 1-4.

Material examined and locality : Aurangabad Dist. : Nathsagar wetland : 5 exs., Brahmagavan, 10.10.97 (Coll. P.P. Kulkarni).

Diagnostic characters : Length of female 0.3 mm to 0.5 mm. Ventral margin of valve almost straight with rounded posterodorsal and posteroventral corner. Valve pitted. Rostrum pointed. Antennule not reaching apex of rostrum. Postabdomen with parallel margin; preanal corner projecting; distal 3-4 anal denticles with small setae on the inner margin and 6 thin marginal spines. Anal margin with setae. Ocellus much smaller than eye. Claw with a basal spine. Intestine forming loops with caecum.

Distribution : India : First record of species from India.

Elsewhere : Central Asia, Indo-Malayan and Australian, USSR, Northern Caucasus, Central Asia.

57. *Alona capensis* Ruhe, 1921

1921. *Alona capensis* Ruhe, *Zoologie*, VIII : 19-20, figs. 5a,b.

Material examined and locality : Pune Dist. : Ujani Wetland : 5exs., Khanota, 20.01.1991 (Coll. R.M. Sharma).

Diagnostic characters : Female : Valves with rounded posterodorsal and posteroventral corner. Valves with reticulation of polygons in the posterior part. Antennules not reaching apex of rostrum; aesthetes projecting beyond the apex of rostrum. Postabdomen with 7-8 anal denticles. Proximal large accompanied by smaller denticles. Claw with setae on concave side. Ocellus slightly smaller than eye. Length : 0.6 mm.

Distribution : India : Maharashtra (First record).

Elsewhere : South Africa.

58. *Alona macronyx* Daday, 1898

1898. *Alona macronyx* Daday, *Termtud. Fuz.*, 21 : 35-37, figs. 15 a-c.

1966. *Kurzia yunnanensis* Shen, Tai and Chang, *Anim. Taxon.*, 3 : 29-42.

1983. *Indialona jabalpurensis* Rane, *J. Bombay Nat. His. Soc.*, 80 : 194-195.

Material examined and locality : Nagpur Dist. : Pench National Park -4 exs., Piparia tank, 4.12.95 (Coll. R.M. Sharma); 1 ex., Gavalighat, 11.10.96 (Coll. A. Mahabal).

Diagnostic characters : Body, broadly rectangular, dorsal margin uniformly curved, forming a distinct angle with posterior margin. Rostrum short, tapering to blunt apex. Ocellus about half size of eye; closer to eye than to apex of rostrum. Three head pores. Antennules not reaching apex of rostrum. Sensory setae unequal in size with one seta longer than others. Antenna short, weakly developed. Each branch with 3

terminal swimming setae. Labrum strongly curved, ventral margin varies from round to truncate, sometimes with small notch near posteroventral angle. About 10 groups of fine spines along the posteroventral angle, posterior most spine each group is the longest. There spine groups followed by a marginal row of fine setules which continue as a submarginal series towards the posterodorsal corner. Posterior half of the carapace with 10-15 prominent longitudinal setae. Postabdomen, tapers gradually towards the distal end. Ventral margin straight with 12-15 long denticles and lateral surface with 9-12 groups of setules. Claw long, strong, concave surface with two groups of fine setules. Basal spine single, slender and long (about half the length of claw). Length: 0.42-0.50 mm.

Distribution : India : New record.

Elsewhere : Sri Lanka, Celebes, Philippines, W. Malaysia, Southern China, Indonesia, Burma, Bangladesh, Sumatra, Thailand.

Remarks : This is distributed only in the oriental region. *Alona macronyx* has unique combination of characters that facilitates its diagnosis from all other Cladocera. They are broadly rectangular body and a broad based distally tapering postabdomen with long basal spine about the half the length of claw. *Indialona jabalpurensis* was described by Rane (1983). It differs from *A. macronyx* in having a claw without any situles on the concave surface of claw, the postabdomen having about 30 denticles, the posterior corner of carapace with 6 small equally spaced denticles and the sensory setae of antennule not extending beyond the apex of rostrum. However, Rajapaksha and Fernando (1985) stated that the postabdomen claw of all Chydorids species have row of fine setules on the concave surface. Rajapaksha and Fernando have studied material of *A. macronyx* from different places of oriental region and stated that there are two distinct groups of setules present on claw but these setules are sometimes very difficult to observe even under high magnification. This may be the reason that Rane (1983) considered the claw setules absent in *I. jabalpurensis*. The presence of 5-10 groups of

fine spines along posteroventral corner of carapace of *A. macronyx* and in this group the posterior most spine is stoutest and largest in each group, this is visible as equally spaced discrete spines and appears as 6 denticles which was one of the distinctive character of *I. jabalpurensis*. In *A. macronyx* about 12-15 denticles on the postabdomen which are in groups and each group with few subsidiary denticles all if are counted they are appeared to be more than 30. Rajapaksha and Fernando (1985) *Indialona jabalpurensis* Rane treated as junior synonym of *A. macronyx*.

Genus *Camptocercus*

59. *Camptocercus rectirostris* Schoedler 1862

1851. *Lynceus macrurus* Fischer, *Mem., Acad. Sci. St. Petersb. Mem. Sav. etrang.*, 7, p. 188-187, p. 1, viii, figs. 8, pl. IX, figs. 1-2.

1862. *Camptocercus rectirostris* Schoedler, *Berlin, Jahrb. Dorotheenstadt. Realschule, Berlin*, p. 25, pl. 11., fig. 43.

Material examined and locality : Aurangabad Dist. : Nathsagar wetland : 2 exs., Sagardarshan, 23.2.99 (Coll. A. Mahabal); Pune Dist. : Ujani Wetland : 2exs., Khanota, Palasdeo, 14.04.1992 (Coll. S.G. Patil).

Diagnostic characters : Length of female 0.7 mm. Body oval, maximum height in front of middle. Posterodorsal corner of valve rounded and posteroventral corner with 3-5 denticles. Valve marked with curved stripes. Head keel present. Rostrum pointed, directed anteriorly or ventrally. Antennules not reaching apex of rostrum. Antennules with sensory setae and esthetascs, 2 of them longer than others. Plate of labrum with rounded apex. Postabdomen long, narrow with 11-17 denticles distal to anus. Sides of postabdomen with a row of small setae groups of about 5. Anal margin with setae. Claw with basal spine and a row of about 25 setae on the concave margin which become longer distally and terminal seta larger than others followed by row of hairs. Intestine with long caecum. Ocellus situated near the eye than to apex of rostrum.

Distribution : India : West Bengal, Kashmir, Gujarat, Meghalaya, Maharashtra, Goa.

Elsewhere : Holartic, Ethiopian, Indo-Malayan, New Zealand and European USSR.

Genus *Graptoleberis*

60. *Graptoleberis testudinaria nathsagerensis*

Rane, 2005

2005b. *Graptoleberis testudinaria nathsagerensis* Rane, Cladocera In Fauna of Nathsagar wetland and Jaikawadi Bird Sanctuary, Maharashtra, *Wetland Ecosystem Series No.*, 7 : 93-95. Published - Director, Zoological Survey of India, Kolkata.

Material examined and locality : Aurangabad Dist. : Nathsagar-Jaikawadi wetland : 11exs., Paithan, 03.07.1998 (Coll. P.D. Rane).

Diagnostic characters : Length of female - 0.5 mm. Dorsal margin of valve and ventral margin almost straight. Valves are strongly reticulated with pentagonal and hexagonal cells all over, even on the head. Ventral marginal setae are feathered and quite longer than the typical species. They are slightly smaller at starting near anterior side and become larger of same length later on and ends upto slightly after middle of ventral margin. Posteroventral corner with two conical pointed-tipped denticles. Rostrum very wide with double continuous bordered, anterior circulate and lateral side. Three connected head pores on the head shield. Antennules thick and a sensory seta at distal-lateral end and distal end with many esthetascs of different length coming out of the rostral margin. Plate of labrum slightly elongated with rounded apex and 5-6 small spinules present at posterior distal curve surface. Ocellus small than eye and situated near to eye than apex of rostrum. Postabdomen tapering distally with distinct preanal corner with 7-8 groups of anal spines which are present laterally and in group of 3-5 spinules. Anal region also with row of small spinules. After anal region above at proximal side 3-4 large spines present arise from small elevation. Claw with 2-3 denticles on the convex side of which first is largest almost reaching anterior end of the claw.

Distribution : India : Aurangabad Dist., Maharashtra State.

Remarks : *Graptoleberis testudinaria nathsagarensis* Rane, 2005 shows similarities with Australian subspecies *Graptoleberis testudinaria occidentalis* Sars, 1901 by having 2 spinules on the convex margin of the postabdominal claw but differs in smaller ventral marginal setae and smaller posteroventral denticles than present new subspecies. *G. t. nathsagarensis* also comes close similar with Hungarian subspecies *Graptoleberis testudinaria pannonica* Daday, 1904 by having similar larger ventral marginal feathered setae on the valve but differ in number of spines on the convex margin of postabdominal claw. In present new subspecies the number of is always 2 or rarely 3 but in *G. t. pannonica* the number is always 4. The difference also in the number of posteroventral denticles. In present new subspecies they are always 2 in number while in *G. t. pannonica* they are generally 3 to 5.

Genus *Leydigia* Kurz, 1875

Key to the species of genus *Leydigia*

1. Postabdomen not narrowing distally, widest in the distal part. Distal groups of lateral setae, each in groups of two. Ocellus larger than eye
Leydigia acanthocercoides (Fischer, 1854)
2. Postabdomen slightly narrowing distally, widest in the middle. Distal groups of lateral setae with three in each group
.. *Leydigia ciliata melghatensis* Rane, 2005

61. *Leydigia acanthocercoides* (Fischer, 1854)

1854. *Lynceus acanthocercoides* Fisher, *Bull. Soc. Jap. Nat. Mosc.*, 27, p. 431-433, pl. 111, figs. 21-22.
1875. *Leydigia acanthocercoides* Kurz, *Sitzber. K. Acad. Wiss. Wein. Math. Nat.*, 70, p. 59-60.

Material examined and locality : Aurangabad Dist. : Nathsagar wetland : 1 ex., Sagardarshan, 3.7.98 (Coll. P.P. Kulkarni); 1 ex., Gangapur, 13.10.99 (Coll. P.P. Kulkarni).

Diagnostic characters : Length of female 1.1 mm. Valve with longitudinal lines. Posterior margin of valves without marginal row of spinules on the inner side. Rostrum blunt, short

directed anteriorly and slightly ventrally. Plate of labrum with setae on the anterior margin. Postabdomen broadly rounded; anal margin concave. Lateral part of anus with several rows of setae. Lateral setae on the postabdomen in group of 2. Anal denticles very small. Two small terminal groups near the claws. Claws without basal spine. Ocellus larger than eye.

Length of male—1.00 mm. Valve with longitudinal lines. Antennules reaching to apex of rostrum. Plate of labrum with pubescent anterior margin. Anal margin with setae. Vas difference opening into penis like process. Antennule with thick horn like spine at the anterior end. Ocellus larger than eye.

Distribution : India : West Bengal, Rajasthan, Andaman & Nicobar Islands, Tripura, Gujarat, Maharashtra and Goa.

Elsewhere : Holartic, Ethiopian, Indo-Malayan, Neotropical and European USSR.

62. *Leydigia ciliata melghatensis* Rane, 2005

2005. *Leydigia ciliata melghatensis* Rane, *Cladocera fauna of Melghat Tiger Reserve, Maharashtra, In Conservation Area Series No.*, 24 : 486-490, figs. 1-10, Published - Director, Zoological Survey of India, Kolkata.

Material examined and locality : Amaravati Dist. : Melghat Tiger Reserve : 9exs., Gavilghat tank, near Chikhaldhara, 19.12.1997 (Coll. P.P. Kulkarni).

Diagnostic characters : Female : Body almost oblong, posterodorsal corner blunt, posteroventral corner rounded without denticles. Valve yellowing-brown in colour with fine longitudinal anastomosing lines anteroposteriorly; sometimes at dorsal region hexagonal bricklike reticulation, ephippial females have granulate valves, under high magnification the granules appears like irregular stars. Antennules not reaching apex of the rostrum, with a unequal sensory setae at tip and one stout seta at 1/4 length near the tip. Antenna small with 3 segmented dorsal and ventral ramus. Setae on antenna 0-0-3/1-1-3. Exopodite of antenna with group of 4 spines on first and group of 4 spine on

second segment. The proximal are almost one and half larger than distal. Third segment with one large spine and three setae. Endopodite of antenna with large lateral spine on first and third segment, larger spine on first is almost reaching the tips of second segment. Plate of labrum large, triangular with many hair like setae on anterior upper margin. Postabdomen large, slightly narrow at the proximal end near natatorial setae and broad at distal middle region. Postabdomen with large 8-9 lateral setae which are in groups of 3; first is very large and third in each group very small. Posterior to these lateral setae 15-16 groups of small setae in group of 5-6, of which the first is the largest but these are hardly reaching out of ventral margin of postabdomen. Anal margin slightly convex. 3-4 rounded club like process present between natatorial setae and the preanal corner. Above natatorial setae is slight concavity with hairs and a knob with many long setae. Claw long, slightly curved with two sets of hairs on the concave side, first group larger than second and their is large seta at the junction of both groups. Small basal spine but that is generally not well marked. Eye and ocellus present. Ocellus is larger then eye. Ventral margin of valve with several unequal setae; first 1/3 group with small, marginal setae; later 2/3 part with large feathered setae placed submarginally and are replaced later by fine spinnules at the postero-lateral angle. Length: 0.5-0.8 mm.

Male : Length : 0.6mm. Males are smaller and wider than females. Postero-dorsal corner of valve at the level of maximum height. Antennules thicker than female, donot reach apex of rostrum. Antennules with stout spine at antero-dorsal margin and olfactory setae at tips. Plate of labrum with small cilialike setae on anterior margin; posterior margin sinuate. Ocellus slightly larger than eye. Vasdeference open on apex of penis like process above the claw. Postabdomen with 6 lateral groups of setae, each with 3 setae each; 7th with 2 setae only. First and second segments of exopodite of antenna with group of 4 spines each. Spines of first segment quite larger than group of second segmental spines. Leg first with strongly

developed hook which has transverse rugae near tip on concave side. Anteroventral corner of valve is markedly incised. Endite of leg first anteriorly with brush of setae opposite to hook. Length : 0.6 mm.

Ephippium : Length : 0.38-0.45 mm. One sexual egg in the ephippium. Oval egg placed centrally in the ephippium, covered distinctly with darker yellow reticulated vacuole.

Distribution : India : Melghat, Amravati Dist. Only found recorded from type locality (Endemic).

Genus *Biapertura* Smirnov, 1971

Key to the species of genus *Biapertura*

1. Posteroventral corner of valve with denticles *Biapertura karua* (King, 1853)
- Posteroventral corner of valves without denticles 2
2. Plate of labrum with denticles. Valves tuberculated
..... *Biapertura verrucosa* (Sars, 1901)
- Plate of labrum without denticles. Valves not tuberculated 3
3. Postabdomen not widening distally. Anal spines large, lateral setae not projecting beyond margin of postabdomen
..... *Biapertura affinis* Leydig, 1860

63. *Biapertura affinis* (Leydig, 1860)

1860. *Lynceus affinis* Leydig, *Naturgeschichte der Daphniden*, Tübingen., 223 p., pl. 1x, figs. 68-69.

1971. *Biapertura affinis affinis*: Smirnov, *USSR, Acad. Sci. Zool. Institute. Nova Ser. No., 101, Leningrad*, 467-462 pp., figs., 582-587.

Material examined and locality : Amaravati Dist. : Melghat Tiger Reserve : 3exs., Chadeurpati, 14.02.1993 (Coll. S.G. Patil); Chandrapur Dist. : Tadoba-Andhari Tiger Reserve : 2exs., Tadoba lake, 28.03.1999 (Coll. R.M. Sharma).

Diagnostic characters : Body oblong and maximum height in the middle region. Posteroventral corner of valves with in a row of spinnules on the inner side of the posterior margin.

Plate of labrum of varying forms with convex anterior margin. Ocellus smaller than eye. Postabdomen with usually uniformly widening. Dorsal distal margin rounded. Anal denticles 12-16, most anal denticles with pubescent proximal side. Lateral setae in groups. Claw and basal spine with setae on their concave margins. Length : 0.6 mm.

Distribution : India : Kashmir, Meghalaya, Gujarat, West Bengal, Maharashtra (Melghat and Tadoba-Andhari Tiger Reserve), Goa.

Elsewhere : Cosmopolitan, Philippines, USSR and Central Asia.

64. *Biapertura karua* (King, 1853)

1853. *Alona karua* King, *Pap. Proc. R. Soc. Van. Diemens Land.*, 2 : 260, pl. VIII.

1971. *Biapertura karua* Smirnov, *USSR, Acad. Sci. Zool. Institute, Nova Ser. Leningrad No.*, 101 : 479-480, figs. 600-603.

Material examined and locality : Chandrapur Dist. : Tadoba-Andhari Tiger Reserve : 1ex., Vasant Bandhara, 12.09.1998 (Coll. P.P. Kulkarni); 2exs., Jamunbodi tank, 15.09.1998 (Coll. P.P. Kulkarni); 1ex., Kolsa lake, 22.04.2000 (Coll. P.P. Kulkarni); Nagpur Dist. : Pench National Park : 5exs., Ambakhori, 25.09.1994 (Coll. M. S. Pradhan); Pune Dist. : Ujani Wetland : 2exs., Bhigwan, Khanota, 11.04.1992 (Coll. S.G. Patil). Length : 0.35 mm.

Diagnostic characters : Body oval, maximum height slightly before middle. Posteroventral corner of valves with 3 denticles. Valves with lines, a pattern of polygons and weak, striations. Postabdomen with broadly rounded dorsal distal margin. Antennules almost reaching apex of rostrum. Plate of labrum rounded. Ocellus smaller than eye. About 8 small anal denticles. Lateral setae in groups, distal seta being longest, projecting beyond the postabdomen and in about 8 groups. Claw with very small basal spine.

Distribution : India : Meghalaya, West Bengal, Tamil Nadu, Maharashtra (Ujani, Melghat, Pench), Andaman and Nicobar Islands, Tripura, Goa.

Elsewhere : Cosmopolitan.

65. *Biapertura verrucosa* (Sars, 1901)

1901. *Alona verrucosa* Sars, *Arch. Math. Nat.*, 23, p. 56-57, pl. IX, figs. 7, 7a.

1979. *Biapertura verrucosa* Swar and Fernando, *Hydrobiologia*, 66, p-126, figs. 63-65.

Material examined and locality : Aurangabad Dist. : Nathsagar wetland : 5 exs., Dahigaon, 27.9.92 (27.9.97); 1 ex., Sagardarshan, 23.2.97 (A. S. Mahabal); 2 exs., Ramdoh, 23.11.98 (Coll. S.G. Patil); 3 exs., Lakhephal, 26.9.97; Sagardarshan, 3.7.98 (Coll. P.D. Rane).

Diagnostic characters : Length of female-0.29 mm. Posterodorsal and posteroventral corners of valves rounded. Valves with tubercles. Antennule almost reaching apex of rostrum. Plate of labrum with convex anterior margin with denticle or incisor in the middle anterior margin and deep notch before posterior margin. Ocellus smaller than eye and situated nearer to the eye than to apex of rostrum. Postabdomen short, with curved dorsal margin and rounded distal margin. Anal corner projecting. Postabdomen with 6-8 small anal denticles. Lateral setae in groups, first is longest and almost coming out from the margin of postabdomen. Claw with basal spine and setae on the lateral concave margin.

Distribution : India : Maharashtra, Gujarat, Tripura, Tamil Nadu, Kerala, Uttar Pradesh.

Elsewhere : Indo-Malayan, Ethiopian and Neotropical regions.

Genus *Oxyurella* Dybowski and Grochowski, 1894

66. *Oxyurella singalensis* (Daday, 1898)

1898. *Alonopsis singalensis* Daday, *Termes, Fuzetek.*, 21 : 43-45, figs. 20, a-b.

1957. *Oxyurella singalensis* Fryer, *Arch. Hydrobiol.*, 53 : 232.

Material examined and locality : Chandrapur Dist. : Tadoba-Andhari Tiger Reserve : 1ex., Tadoba lake, 15.09.1998 (Coll. P.P. Kulkarni); Dhulia Dist. : 1ex., Dondaecha dam, 06.06.2008 (Coll. A. Chaudhari).

Diagnostic characters : Body oval in outline. Posteroventral corner of valves rounded, without denticles. Rostrum blunt. Valve with dots and lines parallel to ventral margin. Antennule almost reaching apex of rostrum. Plate of labrum with slightly pointed apex, anterior margin not pubescent. Postabdomen slightly narrowing distally. Distal anal denticles the longest, setae in groups. Claw large, with one large and 3 small accessory basal spines. Length : 0.55 mm.

Distribution : India : West Bengal, Madhya Pradesh, Goa.

Elsewhere : Ethiopian and Indo-Malayan region, Philippines and North East China.

Genus *Kurzia* Dybowski and Grochowski, 1894

67. *Kurzia longirostris* (Daday, 1898)

1898. *Alona longirostris*, Daday, *Termes fuzetek.*, **21** : p.34, figs.14. a-b.

1971. *Kurzia longirostris*: Smirnov, *USSR, Acad. Sci. Zool. Inst. Nova ser* No., 101, p.399-400, figs. 479-482.

Material examined and locality : Aurangabad Dist. : 20 exs., Nathsagar wetland, 7.7.99 (Coll. S.G. Patil).

Diagnostic characters : Length of female 0.5 mm. Posterodorsal and posteroventral corner round. Rostrum long, pointed, slightly curved posteriorly. Valve with longitudinal lines and fine dots. Antennules reaching middle of rostrum. Antenna not reaching apex of rostrum. Postabdomen long and narrow slightly concave dorsally with deep indentation on the distal side. Preanal corner not projecting. Anal denticles 12-20. Claw with basal spine and row of small setae on concave margin. Intestine has one and half loops. Ocellus smaller than eye, twice as nearer to eye as to the apex of rostrum. Lives in vegetation.

Distribution : India : West Bengal, Tamil Nadu, Maharashtra, Goa. First record of species from Maharashtra.

Elsewhere : Ethiopian, Indo-Malayan, Neotropical, N/E China, New Guinea.

Genus *Eryalona* Sars, 1901

68. *Eryalona orientalis* (Daday, 1848)

1898. *Alonopsis orientalis* (Daday), *Termes, Fuzetek.*, **21** : 45-46, figs. 21-22.

1905. *Eryalona orientalis* Daday, *Zoologica Stuttgart.*, **18** : 180-181, pl. XI, figs. 14-15.

Material examined and locality : Nagpur Dist. : Pench National Park : 2 exs., Bukhari tank of Sillari, 23.2.99 (Coll. : M.S. Pradhan).

Diagnostic characters : Body almost quadrangular in outline. Posterodorsal and posteroventral corners of valve rounded, without denticles. Head shield with only one head pore. Antennules almost reaching apex of rostrum. Plate of labrum with convex anterior margin without apex and Ocellus smaller than eye. Postabdomen long, narrow and slightly curved with about 20 anal denticles, decreasing in size proximally. Claw with basal spine and with setae on the proximal half of concave margin. Length: 0.8 mm.

Distribution : India : Tamil Nadu, Andaman and Nicobar Islands, Tripura, West Bengal, Maharashtra, Goa.

Elsewhere : Indo-Malayan, Ethiopian and Neotropical regions.

Genus *Indialona* Petkovski, 1966

69. *Indialona ganapati* Petkovski, 1966

1966. *Indialona ganapati* Petkovski, *Fragmenta, Balcanica Musei Macedonici Scientiarum naturalium*, V, 2, p. 157-165, pl. 1-9.

Material examined and locality : Aurangabad Dist. : Nathsagar wetland : 10 exs., Telegaon, 9.2.01 ; 5 exs., Dhakaphal, 26.9.97; 20 exs., 9.10.99, Lakhaphal (Coll. P.P. Kulkarni); 5 exs., Lakhaphal 22.2.99; 12 exs., 23.2.99, Sagardarshan, 10 exs., Saukheda, 25.2.99 (Coll. A.S. Mahabal).

Diagnostic characters : Length of female : 0.25 mm. Body almost oval with maximum height anterior to the middle region. Posterodorsal corner of valve distinct and posteroventral corner rounded without spinules. Valve with sparse setae on ventral margin. Valve marked with small polygons. Antennule almost reaching apex of rostrum.

Aesthetes of almost uniform length, as long as the rostrum. Plate of labrum with convex anterior margin and blunt apex. Ocellus smaller than eye and situated halfway between eye and apex of rostrum. Postabdomen narrow and slightly curved; without forming a dorsal corner with, 20 anal denticles decreasing in size proximally. Claw with one basal spine and with setae on proximal half of concave margin.

Distribution : India : Amhadabad-Gujarat, Bhopal-Madhya Pradesh and Ujani & Nathasagar wetland-Maharashtra, Goa.

Elsewhere : Endemic to India.

Genus *Notoalona* Rajapaksa and Fernando, 1987

70. *Notoalona globulosa* (Daday, 1893)

1898. *Alona globulosa* Daday, Termes, Fuzetek., **21** : 1-123.

1997. *Notoalona globulosa* Rajapaksa and Fernando, *Hydrobiologia*, **144** : 131-153.

Material examined and locality : Chandrapur Dist. : Tadoba-Andhari Tiger Reserve : 2exs., Vasant Bandhara, 12.09.1998 (Coll. P.P. Kulkarni); Nagpur Dist. : Pench National Park : 1ex., Piparia tank, 04.12.1995 (Coll. R.M. Sharma).

Diagnostic characters : **Female** : Valve with striations. Rostrum short and blunt, antennules not reaching apex of rostrum. Ocellus smaller than eye, situated closer to the eye than to the apex of rostrum. Labrum serrated on anteroventral margin. Postabdomen long with 12 to 13 anal denticles. Claw long with short basal spine. Length : 0.32 mm.

Distribution : India : Andaman and Nicobar Islands, Madhya Pradesh Maharashtra, Tamil Nadu and Goa.

Elsewhere : South-East Asia, Neotropical and Neoafrican region.

Genus *Ephemeroporus* Frey, 1982

71. *Ephemeroporus barroisi* (Richard, 1894)

1894. *Pleuroxus barroisi* Richard, *Ann. Sci. natur. Zool.*, **18**, 375-377 pp., figs. 9-12.

1982. *Ephemeroporus barroisi* (Richard) = nomen dubium, Frey, *Hydrobiologia*, **86**, pp. 233-237, pl. 1.

Material examined and locality : Amravati Dist.

: Melghat Tiger Reserve: 7 exs., Chipidoh, 18.2.93, 2 exs., Koktu river doh, 21.2.93 (Coll. S.G. Patil). 1 ex., Turma river pool near Bodkheda, 18.2.91 (Coll. D.F. Singh); Satara Dist. : 1ex., Mahabaleshwar tank, 18.01.2007 (Coll. P.D. Rane); Sindhudurg Dist. : 1ex., Savantwadi tank, 13.01.2004 (Coll. P.D. Rane).

Diagnostic characters : Body broadly elliptical in outline, maximum height in the middle, dorsal and ventral margin similarly convex, posterior margin almost straight. Posterodorsal corner of valves rounded. Posteroventral corner of each valve with denticle. Rostrum with apical notch. Antennule short, conical and not reaching apex of rostrum. Plate of labrum with produced apex and with 3-5 denticles on anterior margin. Ocellus smaller than eye, situated halfway between eye and apex of rostrum. Postabdomen short, with 9 unequal anal spines. Preanal corner projecting. Claw with two basal spines and setae on concave margin. Length 0.35 mm.

Distribution : India : Tamil Nadu, Kerala, West Bengal, Gujarat, Maharashtra (Ujani wetland), Goa.

Elsewhere : Cosmotropical.

Remarks : This species was earlier refers as *Chydorus barroisi* Richard. Frey (1982) relocated this genera with group of species into newly erected genus *Ephemeroporus* (meaning is short lived passage i.e. named because the median head pore occurs only in instar I)

SUMMARY

This paper deals with diagnosis, distribution and key for identification of 6 families (including 3 subfamilies) of freshwater Cladocera from various freshwater habitats from Maharashtra State of India. 60 species and 11 subspecies belonging to 30 genera were collected and recorded. Only one species *Alona taraporevalae* Shirgur and Naik was previously recorded from Bombay, excluding this all other species and subspecies were new records from Maharashtra, recorded first time. The freshwater bodies of Maharashtra harbor Indo-Malayan, Palaearctic and Tropico-Indian Elements.

ACKNOWLEDGEMENTS

Author is thankful to the Director, Zoological Survey of India, Kolkata for approving present assignment. Author also grateful to Dr. A.S.

Mahabal, Scientist F and Officer-in-Charge, Western Regional Station, Pune for various facilities to undertake this work and for his constant encouragement for this study.

REFERENCES

- Baird, W. 1860. Descriptions of two new species of Entomostracous Crustacea from India. *Proc. Zool. Soc., London*, : 213-234.
- Biswas, S. 1966a. A new species of the Cladoceran genus *Alona* Straus, 1820 (Crustacea, Cladocera, Sididae) from Rajasthan, India. *Proc. zool. Soc. Calcutta*, **17** : 149-152.
- Biswas, S. 1964b. Five species of Daphniidae (Crustacea : Cladocera) from Simla Hills in India, with a new record of *Alona costata* Sars from NEFA. *J. zool. Soc. India*, **16** : 92-98.
- Biswas, S. 1966. A new species of the genus *Chydorus* Leach, 1843 (Crustacea : Cladocera: Chydoridae) from Rajasthan, India. *Crustaceana*, **11** : 113-114.
- Biswas, S. 1971. Fauna of Rajasthan, India Part II. (Crustacea : Cladocera). *Rec. zool. Surv. India*, **63** : 95-141.
- Brehm, V. 1936. Yale North India Expedition. Report on Cladocera. Article XVI. *Mem. Conn. Acad. Arts. Sci.*, **10** : 283-297.
- Brehm, V. 1952. *Diaphanosoma hydrocephalus* nov. spec. eine eigenartige Sidide aus Vorder-Indien. *Zool. Anz.*, **149** : 138-140.
- Brehm, V. 1953. Indische Diaptomiden, Pseudodiaptomiden und Cladoceren. *Ost. Zool. Zeit.*, **4** : 241-345.
- Brehm, V. 1963. Einige Bemerkungen zu vier Indischen Entomostraken. *Int. Rev. ges. Hydrobiol.*, **48** : 159-172.
- Brehm, V. and Woltereck, R. 1939. Die Daphniden der Yale-North India Expedition. *Int. Rev. ges. Hydrobiology*.
- Daday, E. 1911. Egy új Cladocera-faj Keletindia-ból. *Allattani Közlemények.*, **10** : 63-68, 110-112.
- Fernando, C.H. and Kunduru, A. 1984. Some remarks on latitudinal distribution of Cladocera on the Indian Subcontinent. *Hydrobiologia*, **13** : 69-76.
- Gurney, R. 1906. On some freshwater Entomostraca in the collection of Indian Museum, Calcutta. *J. Asiatic Soc. Bengal (N.S.)*, **2** : 273-281.
- Gurney, R. 1907. On some freshwater Entomostraca in the collection of the Indian Museum, Calcutta. *J. Asiatic Soc. Bengal (N.S.)*, **2** : 273-281.
- Gurney, R. 1911. On some freshwater Entomostraca. *Rec. Indian Mus.*, **1** : 21-33.
- Igor, Hudec. 1987. *Moina oryzae* n. sp. (Cladocera : Moinidae) from Tamil Nadu (South India). *Hydrobiologia*, **145** : 147-150.
- Michael, R.G. and Sharma, B.K. 1988. Fauna of India and adjacent Countries, Indian Cladocera. Ed. Director, Zoological Survey of India Calcutta. Pp. 262.

- Nasar, S.A.K. 1977. The zooplankton fauna of Bhagalpur (Bihar) II. Cladocera. *Carcinological Society of Japan. Research on Crustacea* No., **8** : 32-36.
- Nayar, C.K.G. 1971. Cladocera of Rajasthan. *Hydrobiologia*, **37** : 509-519.
- Patil, S.G. 1976. Freshwater Cladocera (Arthropoda : Crustacea) from North East India. *Curr. Sci.*, **45** : 312-313.
- Patil, S.G. and Gouder, B.Y. 1982. Cladocera of Dharwad (Karnataka State), *J. Bombay nat. Hist. Soc.*, **85** : 112-122.
- Petkovski, T.K. 1966. Eine neue Cladoceren. Gattung aus dem Western Indiens *Indialona ganapati* n. gen. et. n. sp. *Fragmenta Balcanica musei Macedonici Scientiarum naturalium*, V. **2** : 157-165.
- Quadri, M.Y. and Yousuf, A.R. 1978. Some new records of crustacean from Kashmir. *Curr. Sci.*, **46** : 859-860.
- Raghunathan, M. 1988. Planktonic cladoceran from Kerala. *J. Aquar*, **2**(1) : 11-13.
- Raghunathan, M.B. and Rane, P.D. 2001. Studies on Cladocera : Crustacea of Nilgiri Biosphere Reserve. *Fauna of Conservation Area* No., **11** : 31-37. Zoological Survey of India Publication.
- Rane, P.D. 1983a. A new species of genus *Latonopsis* Sars, 1888 (Cladocera, Sididae) from M.P., India. *Crustaceana* (Leiden), **45**(1) : 82-84.
- Rane, P.D. 1983b. A new species of genus *Simocephalus* Scholter, 1858 (Cladocera : Daphniidae) from M.P., India. *Crustaceana* (Leiden), **45**(2) : 154-156.
- Rane, P.D. 1983c. A new species of cladocera *Indialona* Petkovski, 1966 (Family : Chydoridae) from India. *J. Bombay nat. Hist. Soc., Bombay*, **80**(1) : 194-195.
- Rane, P.D. 1984a. A new species of the genus *Oxyurella* Dybowski and Grochowski, 1894 (Cladocera : Chydoridae) from India. *J. Bombay nat. Hist. Soc. Bombay*, **81**(3) : 665-667.
- Rane, P.D. 1984b. A new species of *Bosminopsis* Richard, 1895 (Crustacea : Cladocera : Bosminidae) from India. *J. Bombay nat. Hist. Soc. Bombay*, **81**(3) : 668-669.
- Rane, P.D. 1984c. Occurrence of *Pleuroxus similis* Vavra (Cladocera: Crustacea) in India. *J. Bombay nat. Hist. Soc. Bombay*, **81**(3) : 713.
- Rane, P.D. 1984d. New records of *Grimaldina brazzai* Richard and *Bosminopsis deitersi* Richard (Crustacea : Cladocera) from India. *J. Bombay nat. Hist. Soc. Bombay*, **81** (3) : 713-714.
- Rane, P.D. 1984e. Occurrence of *Kurzia latissima* (Kurz, 1874) in India. *J. Bombay nat. Hist. Soc. Bombay*, **80** (3) : 660-661.
- Rane, P.D. 1985a. Studies on cladocera of Jabalpur, M. P. *Symp. Nat. Acad. Sci.*, : 103 (Abstract).
- Rane, P.D. 1985b. New species of genus *Camptocercus* Baird, 1843 (Cladocera : Chydoridae) from Madhya Pradesh, India; *Crustaceana*, Leiden, **48**(2) : 113-116.
- Rane, P.D. 1985c. A new Cladoceran *Simocephalus vamani* sp. nov. from Jabalpur, M. P. India. *Bull. zool. Surv. India, Calcutta*, **7**(2-3) : 225-229.
- Rane, P.D. 1985d. A new species of genus *Simocephalus* Schoedler, 1858 (Cladocera : Daphniidae) from M. P. India. *J. Bombay nat. Hist. Soc. Bombay*, **82**(1) : 159-161.

- Rane, P.D. 1985e. On a new Cladoceran *Latona narendrai* sp. nov. from Madhya Pradesh, India. *J. Bombay nat. Hist. Soc. Bombay*, **82**(2) : 387-389.
- Rane, P.D. 1986a. A new subspecies of *Simocephalus vidyae* Rane, 1983 (Cladocera : Daphniidae) from Jabalpur, M.P. India. *J. Bombay nat. Hist. Soc. Bombay*, **83**(1) : 168-170.
- Rane, P.D. 1986b. Discription of two new species of Cladocera of family Daphniidae from M.P. India. *J. Bombay nat. Hist. Soc. Bombay*, **83**(3) : 638-642.
- Rane, P.D. 1987a. A new species of cladocera *Moina dodhui* sp. nov. from Jabalpur, M.P., India. *Crustaceana* (Leiden), **52**(3) : 245-250.
- Rane, P.D. 1992. New Distributional record for *Indialona ganapati* Petkovski (Crustacea: Cladocera) from Ujani Wetland, Maharashtra with first description of male and reproductive female. *J. Bombay nat. Hist. Soc. Bombay*. **89**(2) : 263-265.
- Rane, P.D. 2002. Cladocera. In : *Fauna of Ujani Wetland, Pune Maharashtra. Wetland Ecosystem Series* No., **3** : 71-85, Published by Zool. Surv. India.
- Rane, P.D. 2004. Cladocera fauna of Pench National Park, Maharashtra, In *Conservation Area Series* No., **20** : 159-174. Published Director, Zoological Survey of India, Kolkata.
- Rane, P. D. 2005a. Cladocera fauna of Melghat Tiger Reserve, Maharashtra, In *Conservation Area Seriea* No., **24** : 451-500, 29 plates, Published Director, Zoological Survey of India, Kolkata.
- Rane, P.D. 2005b. Cladocera fauna of Nathsagar wetland and Jaikawadi Bird Sanctuary, Maharashtra, *Wetland Ecosystem Series* No., **7** : 77-99. Published-Director, Zoological Survey of India, Kolkata.
- Rane, P.D. 2006. Cladocera fauna of Tadoba-Andhari Tiger Reserve, Maharashtra. *Conservation Area Series* No., **25** : 177-196. Published-Director, Zoological Survey of India, Kolkata.
- Rane, P.D. 2008. Cladocera. *Fauna of Goa State. State Fauna Series* No., **16** : 79-101. Published by Zool. Surv. India.
- Rane, P.D. (2009). Cladocera : Crustacea. In : *Fauna of Bhimashankar Wildlife Sanctuary, Maharashtra State., Conservation Area Series*, **42** : 263-272 Zoological Survey of India Publication.
- Rane, P.D. and Jafri, S.N. 1990. A new species of cladocera *Daphnia madhurae* sp. nov. from Madhya Pradesh, India. *Crustaceana* (Leiden), **59**(1) : 62-68.
- Rane, P.D. and Jafri, S.N. 1993. relocation of *Latonopsis fernandoi* Rane (Cladocera : Sididae) to new genus *Sarsilatona* Korovchinsky. *Biome*, Raipur, **6**(1) : 41-44.
- Rane, P.D., Jafri, S.N. and Rafiq, M. 1998. A new species of Cladocera *Daphnia katrajansis* (Family : Daphniidae) from Pune, Maharashtra State, India. *Marathwada University Jour. Sci. Aurangabad*, pp. 73-75.
- Rane, P.D. and Harshey, D.K. 1979. A new records of *Latonopsis fasciculata* Daday (Cladocera : Crustacea) from India. *Sci. and Cult.*, **45**(11) : 456.
- Saini, R.S. and Singh, R.S. 1984. Studies on the aquatic crustacean of Rewa. *Rec. zool. Surv. India*, **81** : 27-34.
- Sharma, B.K. 1978. A note on Freshwater Cladocerans from West Bengal. *Bangladesh J. Zool.*, **6** : 149-151.

- Sharma, B.K. and Michael, R. G. 1983. Redescription of *Alona taraporevalae* Shirgur and Naik, 1977 (Cladocera : Chydoridae : Aloninae) *Rec. zool. Surv. India*, **81** : 35-39.
- Shirgur, G.A. and Naik, A.A. 1977. Observations on morphology, taxonomy, ephippial hatching and laboratory culture of new species of *Alona* (*Alona taraporevalae* Shirgur and Naik), a chydorid cladoceran from back bay, Bombay. *Proc. Symp. Warm Water Zooplankton*, Species publication, pp. 48-59.
- Smirnov, N.N. 1971. The world chydorid fauna (in Russian) *USSR Acad. Sc. Zool. Institute Nova Ser.*, **101** Leningrad. 539pp.
- Venkatraman, K. 1983. Taxonomy and Ecology of Cladocera of Southern Tamil Nadu. Ph.D. thesis Madurai Kamaraj University, India. pp. 1-190.
- Venkatraman, K. 1991. Freshwater cladocera of Little Andaman. *Andaman Sci. Assoc.*, **7**(2) : 43-49.
- Venkatraman, K. 1992. Cladocera of Keoladeo National Park, Bharatpur and its environs. *J. Bombay nat. Hist. Soc.*, **89** : 17-26.
- Venkatraman, K. 1993. Cladocera of Port Blair, Andaman. *J. Andaman Sci. Assoc.*, **8**(2) : 133-137.
- Venkatraman, K. and Das, S.R. 2000. Cladocera. *Fauna of Tripura, State Fauna Series No.*, **7**(4) : 277-316. Zoological Survey of India.
- Yousuf, A.R. and Quadri, M.Y. 1977. Cladocera of Malpur Sar, Kashmir, *J. Sci. Univ. Kash.*, **3** : 87-92.

FRESHWATER PRAWNS (ATYIDAE : PALAEMONIDAE : DECAPODA)

S.K. PATI and R.M. SHARMA

Zoological Survey of India, Western Regional Centre, Vidya Nagar, Sector No. 29, P.C.N.T Post,
Rawet Road, Akurdi, Pune-411 044, India

INTRODUCTION

Freshwater prawns of family Atyidae (Superfamily Atyoidea) and family Palaemonidae (Superfamily Palaemonoidea), respectively, include 449 and 934 extant species in the World (De Grave *et al.*, 2009). In total, 23 species of Atyidae belonging to genus *Caridina* and 58 species of Palaemonidae belonging to genus *Macrobrachium* are found in India (Valarmathi, 2011). Prawns recycle dead organic matters in aquatic systems and also form an important but minor fisheries resource in the country. Reports of freshwater prawns in India are not uncommon (Chopra and Tiwari, 1947; Tiwari, 1952, 1955; Jalihal *et al.*, 1988; Ghosh, 1997; Ghosh *et al.*, 1999, 2005; Mariappan, 1997; Ghosh and Roy, 2000; Jayachandran, 2001; Roy *et al.*, 2003, 2004; Jayachandran and Raji, 2004, 2005; Valarmathi and Raghunathan, 2006; Jayachandran *et al.*, 2007; Ghatak and Ghosh, 2008 & 2010 and Klotz, 2008). Almelkar (1983), Patil (2002), Almelkar and Sankolli (2006) and Patil *et al.* (2007) recorded freshwater prawn species in the state of Maharashtra. However, a complete systematic list on this group in Maharashtra is ever needed. Thus, specimens* present in the collections of Western Regional Centre, Zoological Survey of India, Pune and freshwater prawn species hitherto recorded from the state were brought out in the form of following list.

SYSTEMATIC LIST

- Phylum ARTHROPODA Latreille, 1829
Subphylum CRUSTACEA Brünnich, 1772
Class MALACOSTRACA Latreille, 1802
Order DECAPODA Latreille, 1802
Infraorder CARIDEA Dana, 1852
Superfamily ATYOIDEA De Hann, 1849
Family ATYIDAE De Hann, 1849
1. *Caridina sumatrensis* de Man, 1892*
Superfamily PALAEMONOIDEA
Rafinesque, 1815
Family PALAEMONIDAE Rafinesque, 1815
2. *Macrobrachium assamense assamense* (Tiwari, 1952)
3. *Macrobrachium banjarae* (Tiwari, 1958)
4. *Macrobrachium bombayense* Almelkar and Sankolli, 2006
5. *Macrobrachium hendersodayanum* (Tiwari, 1952)*
6. *Macrobrachium idella* (Hilgendorf, 1898)
7. *Macrobrachium kistnense* (Tiwari, 1952)*
8. *Macrobrachium kulkarni* Almelkar and Sankolli, 2006
9. *Macrobrachium lamarrei lamarrei* (H. Milne Edwards, 1837)
10. *Macrobrachium malcolmsonii* (H. Milne Edwards, 1844)
11. *Macrobrachium rosenbergii* (de Man, 1879)

SUMMARY

A total of 11 species of freshwater prawns are recorded so far from the state of Maharashtra. Of

these, Family Atyidae includes one species of the genus *Caridina* whereas Family Palaemonidae consists of 10 species belonging to the genus *Macrobrachium*.

REFERENCES

- Almelkar, G.B. 1983. Studies on the freshwater prawns of the Bombay area (Crustacea, Decapoda, Caridea). Ph.D. Thesis, Konkan Agricultural University, Dapoli.
- Almelkar, G.B. and Sankolli, K.N. 2006. Description of two new prawns of the genus *Macrobrachium* Bate, 1868 (family Palaemonidae) *Macrobrachium bombayense* and *Macrobrachium kulkarni* from Konkan, Maharashtra, India. In : C.M. Nair and D.D. Nambudiri (eds.), *Freshwater Prawns: Advances in Biology, Aquaculture & Marketing. Proceedings of Freshwater Prawns 2003, International Symposium on Freshwater Prawns, 20-23 August 2003, Kochi, India*, Allied Publishers, New Delhi, India. pp. 186-195.
- Chopra, B. and Tiwari, K.K. 1947. Decapod Crustacea of Patna State, Orissa. *Records of Indian Museum*, **45** : 213-224.
- De Grave, Sammy, Pentcheff, N.Dean., Ah Yong, Shane T., Chan, Tin-Yam., Crandall, Keith A., Dworschak, Peter C., Felder, Darryl L., Feldmann, Rodney M., Fransen, Charles H.J.M., Goulding, Laura Y.D., Lemaitre, Rafael., Low, Martyn E.Y., Martin, Joel W., Ng, Peter K.L., Schweitzer, Carrie E., Tan, S.H., Tshudy, Dale. and Wetzer, Regina. 2009. A classification of living and fossil genera of decapod crustaceans. *Raffles Bulletin of Zoology*, Supplement No., **21** : 1-109.
- Ghatak, S.S. and Ghosh, S.K. 2008. Crustacea : Decapoda : Palaemonidae : Gecarcinucidae. *Fauna of Goa, State Fauna Series, Zoological Survey of India*, **16** : 165-172.
- Ghatak, S.S. and Ghosh, S.K. 2010. Crustacea : Decapoda : Palaemonidae : Potamidae : Gecarcinucidae. *Fauna of Uttarakhand, State Fauna Series, Zoological Survey of India*, **18**(Part-3) : 199-207.
- Ghosh, S.K., Ghatak, S.S. and Roy, T. 2005. Crustacea : Decapoda : Palaemonidae : Potamonidae. *Fauna of Andhra Pradesh, State Fauna Series, Zoological Survey of India*, **5**(Part-5) : 551-558.
- Ghosh, Sunil Kumar. 1997. Crustacea : Decapoda. *Fauna of Delhi, State Fauna Series, Zoological Survey of India*, **6** : 141-144.
- Ghosh, Sunil Kumar. and Roy, Tusharendu. 2000. Palaemonidae (Crustacea : Decapoda). *Fauna of Tripura, State Fauna Series, Zoological Survey of India*, **7**(4) : 267-272.
- Ghosh, Sunil Kumar., Roy, Tusharendu. and Bhadra, Sipra. 1999. Crustacea : Decapoda : Palaemonidae. *Fauna of Meghalaya, State Fauna Series, Zoological Survey of India*, **4**(9) : 557-567.
- Jalihal, D.R., Shenoy, Sakuntala and Sankolli, K.N. 1988. Freshwater Prawns of the genus *Macrobrachium* Bate, 1868 (Crustacea, Decapoda, Palaemonidae) from Karnataka, India. *Records of Zoological Survey of India, Occasional Paper No.*, **112** : 1-74.
- Jayachandran K.V. 2001. *Palaemonid Prawns Biodiversity, Taxonomy, Biology and Management*. Oxford & IBH Publishing Co. Pvt. Ltd. Calcutta, pp. 1-624.
- Jayachandran, K.V. and Raji, A.V. 2004. An ornate new species of *Macrobrachium* Bate, 1868 (Palaemonidae) from Kerala, India. *Journal of Inland Fisheries Society of India*, **36**(1) : 41-44.

- Jayachandran, K.V. and Raji, A.V. 2005. Three new species of *Macrobrachium* Bate, 1868 (Decapoda, Palaemonidae) from the Western Ghats of Kerala state, India. *Crustaceana*, **77**(10) : 1179-1192.
- Jayachandran, K.V., Lal Mohan, R.S. and Raji, A.V. 2007. A new species of *Macrobrachium* Bate, 1868 (Decapoda, Palaemonidae) from the dolphin trenches of Kulsi River, N. India, possibly under threat. *Zoologischer Anzeiger*, **246** : 43-48.
- Klotz, W. 2008. *Macrobrachium agwi* – new species of freshwater prawn (Decapoda : Palaemonidae) from East Bengal, India. *Zootaxa*, **1844** : 47-54.
- Mariappan, N. 1997. Studies on the freshwater prawns of Atyidae and Palaemonidae of Chengalput MGR Dist., Tamilnadu, India. Ph.D. Thesis. Madras University, Madras.
- Patil, S.G. 2002. Contribution to freshwater Decapoda (Crustacea : Arthropoda) from Ujani Wetland, Maharashtra. *Zoos'Print Journal*, **17**(10) : 918.
- Patil, S.G., Yadav, B.E. and Jadhav, S.S. 2007. Addition to the freshwater Decapoda (Crustacea) from Nathasagar Wetland, Maharashtra. *Bionotes*, **9**(3) : 85.
- Roy, T., Ghosh, S.K. and Ghatak, S.S. 2003. Crustacea : Decapoda : Palaemonidae and Potamonidae. *Fauna of Sikkim, State Fauna Series, Zoological Survey of India*, **9**(5) : 117-119.
- Roy, T., Ghosh, S.K. and Ghatak, S.S. 2004. Crustacea : Decapoda : Palaemonidae and Potamonidae. *Fauna of Manipur, State Fauna Series, Zoological Survey of India*, **10** : 119-123.
- Tiwari, K.K. 1952. Diagnosis of new species and subspecies of the genus *Palaemon* Fabricius (Crustacea : Decapoda). *Annals and Magazine of Natural History*, **5** : 27-32.
- Tiwari, K.K. 1955. New species and sub-species of freshwater prawns. *Records of Indian Museum*, **52**(1&2) : 297-300.
- Valarmathi, K. 2011. *A checklist of the freshwater prawns of the families: Atyidae and Palaemonidae, reported from India*. [http://zsi.gov.in/checklist/Checklist of fauna of India-Crustacea-Decapoda Atyidae Palaemonidae .pdf](http://zsi.gov.in/checklist/Checklist%20of%20fauna%20of%20India-Crustacea-Decapoda%20Atyidae%20Palaemonidae.pdf) (Accessed on 09.09.2011).
- Valarmathi, K. and Raghunathan, M.B. 2006. Studies on the Diversity of Freshwater prawns (Decapoda : Caridea) from Southern India. *Proceedings of the National Conference on Wetland Biodiversity*, Thrissur, pp. 22-25.

FRESHWATER CRABS (GECARCINUCIDAE : BRACHYURA : DECAPODA)

S.K. PATI and R.M. SHARMA

Zoological Survey of India, Western Regional Centre, Vidya Nagar, Akurdi, Pune-411 044

INTRODUCTION

Freshwater crabs, with 1280 known species under 4 Superfamilies constitute 20% of the brachyuran species of the World (Cumberlidge *et al.*, 2009). These animals are very important in the sense that they cause human diseases; play important role in nutrient recycling; serve as food for many predators; form basis for small-scale fisheries in some countries and act as excellent indicators of good water quality. Gecarcinucidae (including Parathelphusidae) is the only Family of Superfamily Gecarcinucoidea comprising 58 Genera and 349 extant species (De Grave *et al.*, 2009). Family Gecarcinucidae is well studied in India (Alcock, 1910; Chhapgar, 1956; Bott, 1970; Dutta, 1983; Ghosh and Ghatak, 2000; Patil, 2002; Roy *et al.*, 2003 & 2004; Ghosh *et al.*, 2005; Srivastava, 2005, 2007 & 2009; Patil *et al.*, 2007 and Ghatak and Ghosh, 2008 & 2010) particularly from south India (Bahir and Yeo, 2007). However, a complete systematic list of Gecarcinucid crabs of Maharashtra state is always wanting. The present paper gives a list of freshwater crabs compiled from various literature and identified specimens* in the collection of Western Regional Centre of Zoological Survey of India, Pune.

SYSTEMATIC LIST

Phylum ARTHROPODA Latreille, 1829
Subphylum CRUSTACEA Brünnich, 1772

Class MALACOSTRACA Latreille, 1802

Order DECAPODA Latreille, 1802

Infraorder BRACHYURA Linnaeus, 1758

Superfamily GECARCINUCOIDEA Rathbun, 1904

Family GECARCINUCIDAE Rathbun, 1904

1. *Barytelphusa cunicularis* (Westwood, 1836)*
2. *Barytelphusa guerini* (H. Milne Edwards, 1853)*
3. *Barytelphusa jacquemontii* (Rathbun, 1905)*
4. *Cylindrotelphusa stenions* (Alcock, 1909)*
5. *Liotelphusa laevis* (Wood-Mason, 1871)
6. *Gecarcinucus edwardsi* (Alcock, 1909)*
7. *Gecarcinucus jacquemontii* (H. Milne Edwards, 1844)*
8. *Globitelphusa pistorica* (Alcock, 1909)*
9. *Gubernatoriana gubernatoris* (Alcock, 1909)*
10. *Gubernatoriana pilosipes* (Alcock, 1909)
11. *Inglethelphusa fronto* (Alcock, 1909)*
12. *Oziotelphusa wagrakarowensis* (Rathbun, 1904)*
13. *Spiralothelphusa hydrodroma* (Herbst, 1794)*

SUMMARY

A total of 13 species of gecarcinucid freshwater crabs belonging to 9 genera were recorded from Maharashtra.

REFERENCES

- Alcock, A. 1910. Brachyura I. Fasc. II. *The Indian Freshwater Crabs—Potamonidae. Catalogue of the Indian Decapod Crustacea in the collection of the Indian Museum*. Calcutta, pp. 1-135.
- Bahir, Mohamed M. and Yeo, Darren C.J. 2007. The gecarcinucid freshwater crabs of southern India (Crustacea : Decapoda : Brachyura). *The Raffles Bulletin of Zoology*, Supplement No. 16 : 309-354.
- Bott, Richard. 1970. Die Süßwasserkrabben von Europa, Asien, Australien und ihre Stammesgeschichte. Eine Revision der Potamoidea und Parathelphusoidea (Crustacea, Decapoda). *Abhandlungen der Senckenbergischen Naturforschenden Gesellschaft*, Frankfurt, 526 : 1-338, Pls. 1-58.
- Chhapgar, B.F. 1956. Extension of range of the freshwater crab *Paratelphusa (Oziotelphusa) hydrodromus* (Herbst). *Journal of Bombay Natural History Society*, 53(4) : 732.
- Cumberlidge, Neil., Ng, Peter K.L., Yeo, Darren C.J., Magalhaes, Celio., Campos, Martha R., Alvarez, Fernando., Naruse, Tohru., Daniels, Savel R., Esser, Lara J., Attipoe, Felix Y.K., Clotilde-Ba, France-Lyse., Darwall, William., McIvor, Anna., Baillie, Jonathan E.M., Collen, Ben. and Ram, Mala. 2009. Freshwater crabs and the biodiversity crisis: Importance, threats, status, and conservation challenges. *Biological Conservation*, 142 : 1665-1673.
- De Grave, Sammy, Pentcheff, N.Dean., Ah Yong, Shane T., Chan, Tin-Yam., Crandall, Keith A., Dworschak, Peter C., Felder, Darryl L., Feldmann, Rodney M., Fransen, Charles H.J.M., Goulding, Laura Y.D., Lemaitre, Rafael., Low, Martyn E.Y., Martin, Joel W., Ng, Peter K.L., Schweitzer, Carrie E., Tan, S.H., Tshudy, Dale. and Wetzler, Regina. 2009. A classification of living and fossil genera of decapod crustaceans. *Raffles Bulletin of Zoology*, Supplement No. 21 : 1-109.
- Dutta, N.K. 1983. Studies on the systematics and distribution of crabs in Assam. *Journal of Bombay Natural History Society*, 80 : 539-548.
- Ghatak, S.S. and Ghosh, S.K. 2008. Crustacea : Decapoda : Palaemonidae : Gecarcinucidae. *Fauna of Goa, State Fauna Series, Zool. Surv. India*, 16 : 165-172.
- Ghatak, S.S. and Ghosh, S.K. 2010. Crustacea : Decapoda : Palaemonidae : Potamidae : Gecarcinucidae. *Fauna of Uttarakhand, State Fauna Series, Zool. Surv. India*, 18(Part-3) : 199-207.
- Ghosh, S.K. and Ghatak, S.S. 2000. Crustacea : Decapoda : Potamonidae. *Fauna of Tripura, State Fauna Series, Zool. Surv. India*, 7(Part-4) : 273-275.
- Ghosh, S.K., Ghatak, S.S. and Toy, T. 2005. Crustacea : Decapoda : Palaemonidae : Potamonidae. *Fauna of Andhra Pradesh, State Fauna Series, Zool. Surv. India*, 5(Part-5) : 551-558.
- Patil, S.G. 2002. Contribution to freshwater Decapoda (Crustacea: Arthropoda) from Ujani Wetland, Maharashtra. *Zoos'Print Journal*, 17(10) : 918.
- Patil, S.G., Yadav, B.E. and Jadhav, S.S. 2007. Addition to the freshwater Decapoda (Crustacea) from Nathsagar Wetland, Maharashtra. *Bionotes*, 9(3) : 85.
- Roy, T., Ghosh, S.K. and Ghatak, S.S. 2003. Crustacea : Decapoda : Palaemonidae and Potamonidae. *Fauna of Sikkim, State Fauna Series, Zool. Surv. India*, 9(Part-5) : 117-119.
- Roy, T., Ghosh, S.K. and Ghatak, S.S. 2004. Crustacea : Decapoda : Palaemonidae and Potamonidae. *Fauna of Manipur, State Fauna Series, Zool. Surv. India*, 10 : 119-123.
- Srivastava, O.P. 2005. Freshwater crabs (potamonids) in the collection of the Southern Regional Station, Zoological Survey of India, Chennai. *Rec. zool. Surv. India*, 104(Part 1-2) : 115-122.
- Srivastava, O.P. 2007. Decapoda : Brachyura-Brachyuran (Gecarcinucidae) Crabs. *Fauna of Andhra Pradesh, State Fauna Series, Zool. Surv. India*, 5(Part-4) : 245-248.
- Srivastava, O.P. 2009. Crustacea : Decapoda : Gecarcinucidae. *Fauna of Tamil Nadu, State Fauna Series, Zool. Surv. India*, 17 : 29-30.

CRUSTACEA : ISOPODA

M.K. DEV ROY, S. MITRA and S.K. PATI*

Crustacea Section, Zoological Survey of India, 27 Jawaharlal Nehru Road, Kolkata-700016

INTRODUCTION

Isopoda is a large diverse speciose group containing about 11000 described species, of which nearly 300 species occur in India. They are found almost in all types of habitats in the seas and oceans as well as in brackish water, freshwater and also on land. As reducer, they play an important role in the ecosystem by way of converting dead and dying organisms, animal or plant matter (either whole or parts of the whole organism) to smaller particles. The wood-boring species in particular are probably the most economically important and of much interest to man because of the ravages they cause to wooden structures in maritime systems. There are other species which cause considerable loss to fishing industries.

Very little information is available on isopod fauna of the state of Maharashtra. Palekar and Bal (1955, 1957) and Joshi (1957) reported the crustacean wood-borers of Bombay waters. Later, Joshi and Bal (1959) mentioned about the occurrence of more than 30 species from the "then Bombay" but without supplementing any list of species; they dealt with only six marine species in the said communication, of which, two were new to science. In the same year, Bal and Joshi published three new species of the family Corallanidae. In 1962, Joshi and Bal described another new species of the family Sphaeromatidae. Further, Pillai (1961) and Kensley (1980) reported two new species belonging to the families

Sphaeromatidae and Anthuridae from Bombay waters. Parulekar (1981) in his work on marine fauna of Malvan included five species of marine isopods while Swami and Udhayakumar (1997) reported *Limnoria (Limnoria) platycauda* from Bombay. Nair and Salim (1994) in their work on marine timber destroying organisms of Indian coasts included five species of crustacean borers namely, *Sphaeroma terebrans*, *S. annandalei*, *S. walkeri*, *Limnoria indica* and *Limnoria bombayensis* from Maharashtra. In the present paper, a total of 23 species of marine and terrestrial isopods belonging to 5 suborders and 11 families have been dealt based on literature. This is the first consolidated report on the isopod fauna of Maharashtra state.

LIST OF ISOPOD SPECIES

Subphylum CRUSTACEA Brünnich, 1772

Order ISOPODA Latreille, 1817

Suborder CYMOTHOIDA Wägle, 1989

Family ANTHURIDAE Leach, 1814

1. *Haliophasma poorei* Kensley, 1880

Family CIROLANIDAE Dana, 1852

2. *Cirolana* sp.

3. *Excirolana orientalis* (Dana, 1853)

Family CORALLANIDAE Hansen, 1890

4. *Argathona muraeneae* Bal and Joshi, 1959

5. *Corallana nodosa* Schioedte and Meinert, 1879

Family CYMOTHOIDAE Leach, 1818

6. *Cymothoa cinerea* Joshi and Bal, 1959

7. *Nerocila depressa* H. Milne Edwards, 1840

Suborder LIMNORIIDEA Brandt and Poore, 2002

Family LIMNORIIDAE White, 1850

8. *Limnoria (Limnoria) bombayensis* Pillai, 1961

9. *Limnoria (Limnoria) indica* Kampf and Becker, 1958

10. *Limnoria (Limnoria) platycauda* Menzies, 1957

Suborder ONISCIDEA Latreille, 1803

Family LIGIDAE Leach, 1814

11. *Logia exotica* Roux., 1828

Family PHILOSCIIDAE Kinahan, 1857

12. *Philoscia londensis* Ramakrishna, 1969

Family PORCELLIONIDAE Brandt and Ratzeburg, 1831

13. *Porcellio ganesa* Ramakrishna, 1975

14. *Porcellio laevis* Latreille, 1804

15. *Porcellio scaber* Latreille, 1804

16. *Porcellio spinicornis* (Say, 1818)

Family TRACHELIPODIDAE Strouhal, 1953

17. *Trachelipus rathkei* (Brandt, 1833)

Suborder SPHAEROMATIDEA Wägle, 1989

Family SPHAEROMATIDAE Latreille, 1825

18. *Cassidina extenda* Bal and Joshi, 1962

19. *Sphaeroma annandalei* Stebbing, 1911

20. *Sphaeroma terebrans* Bate, 1866

21. *Sphaeroma walkeri* Stebbing, 1905

Suborder VALVIFERA Sars, 1882

Family IDOTEIDAE Samouelle, 1819

22. *Synidotea variegata* Collinge, 1917

23. *Synidotea worliensis* Joshi and Bal, 1959

SYSTEMATIC ACCOUNT

Family ANTHURIDAE

1. *Haliophasma poorei* Kensley, 1880

1980. *Haliophasma poorei* Kensley, *Smithson. Contrib. Zool.*, **304** : 22, figs. 16a-h.

Distribution : Indian Ocean. India—Maharashtra.

Elsewhere : Somalia.

Remarks : Type locality of this species is Bombay. This isopod has been recorded at a depth of 55 m in Bombay, at 0.5 m in Sri Lanka and 95 m off Somalia.

Family CIROLANIDAE

2. *Cirolana* sp.

Remarks : Parulekar (1981) recorded this unnamed species from Malvan waters.

3. *Exciorolana orientalis* (Dana, 1853)

1853. *Carolinas (Eurydice) orientalis* Dana, *U. S. Explor. Exped.*, **13**(1) : 773, pl. 51.

1959. *Cirolana bombayensis*: Joshi and Bal, *J. Univ. Bombay, N.S.*, **27**(5) : 58, pl. 1, figs. 1-8.

1986. *Exciorolana orientalis*: Bruce, *Rec. Australian Mus. Suppl.*, **6** : 41, fig. 24.

Distribution : Indo-Pacific. India - Maharashtra.

Elsewhere : East coast of Africa to Malaysia, Philippines and Australia.

Remarks : From Indian waters, this species has been recorded from Bombay by Joshi and Bal (*op. cit.*) who collected specimens of this species under bricks and stones.

Family CORALLANIDAE

4. *Argathona muraeneae* Bal & Joshi, 1959

1959. *Argathona muraeneae* Bal and Joshi, *J. Bombay nat. Hist. Soc.*, **56**(3) : 563, pl. 1, figs. 1-10.

Distribution : Arabian Sea. India—Maharashtra.

Remarks : This parasitic isopod was recorded from the fish *Muraena tessellata*. So far, this species is known from its type locality only.

5. *Corallana nodosa* Schiödte & Meinert, 1879

1879. *Corallana nodosa* Schiödte & Meinert, *Naturhist. Tidsskr.* ser. 3, **12** : 294, pl. 5, figs. 8, 9.

1954. *Corallana nodosa*: Pillai, *Bull. Cent. Res. Inst., Univ. Travancore*, **2**(1), ser. C : 6 (Kerala: Travancore).

1961. *Corallana nodosa* : Pillai, *Monograph: Wood-Boring Crustacea of India*, : 49, T. fig. 23.

1967. *Corallana nodosa* : Pillai, *J. Bombay nat Hist. Soc.*,

64(2) : 272 (Kerala, only from brackishwater localities, host not recorded).

Distribution : Indo-Pacific. India: Kerala, Maharashtra (Bombay).

Elsewhere : Sri Lanka, Philippines and Australia.

Type locality : Philippine Islands (Samar Palabar and Ubay).

Host : *Epinepheles chlorostigma*. Site of infection: Nostril.

Depth range : 200 m.

Habitat : Estuarine

Family CYMOTHIDAE

6. *Cymothoa cinerea* Bal & Joshi, 1959

1959. *Cymothoa cinerea* Bal & Joshi, *J. Bombay nat. Hist. Soc.*, 56(3) : 567, l. 2, figs. 1-5.

Distribution : Arabian Sea. India—Maharashtra.

Remarks : This is an external parasite of the fish *Stromateus cinereus* infesting the buccal cavity of the host. According to Bal & Joshi (*op. cit.*) this species has a close resemblance with regard to its shape and body form to that of its allied species *Cymothoa stromatea* parasitic on *Parastromateus niger* (Pillai, 1954). Type locality for this species is Bombay. This species is known from its type locality only.

7. *Nerocila depressa* H. Milne Edwards, 1840

1840. *Nerocila depressa* H. Milne Edwards : 254, pl. 31, fig. 17-20 (Patrie inconnue).

1959. *Nerocila pigmentata*: Bal and Joshi, *J. Bombay nat. Hist. Soc.*, 56(3) : 565, pl. 2, figs. 6-10.

1960. *Nerocila pigmentata*: Joshi and Bal, *Proc. 47th Indian Science Congress, Part 3* : 446.

1988. *Nerocila depressa*: Bruce and Harrison-Nelson, *Proc. Biol. Soc. Wash.*, 101(3) : 591, fig. 3.

Distribution : Indo-Pacific. India—Maharashtra.

Elsewhere : Gulf of Thailand, Sumatra.

Remarks : Bal and Joshi (1959) reported this species from the fish *Opithopterus turtoor* (= *O. tardoore*).

Family LIMNORIIDAE

8. *Limnoria (Limnoria) bombayensis* Pillai, 1961

1961. *Limnoria (Limnoria) bombayensis* Pillai, *Monograph : Wood-boring Crustacea of India*, : 29, pl. II, figs. 6 & T. fig. 16.

1971. *Limnoria (Limnoria) bombayensis*: Purushotham and Satyanarayana Rao, *J. Timb. Ass. India*, 17(4) : 25, fig. 21.

Distribution : Arabian Sea. India—Maharashtra.

Remarks : Pillai (*op. cit.*) described this isopod from Bombay waters while Parulekar (1981) recorded it from Malvan. This species is endemic to India.

9. *Limnoria (Limnoria) indica* Kampf and Becker, 1958

1958. *Limnoria indica*: Becker and Kampf, *Z. angew. Zool.*, 45 : 1-9.

1959. *Limnoria (Limnoria) indica*: Becker and Kampf, *J. Timb. Dry Preserv. Ass. India*, 5(1) : 13.

1961. *Limnoria (Limnoria) indica*: Pillai, *Monograph: Wood-boring Crustacea of India*, 23, pl. 2, figs. 4-6, T, figs. 11-12.

1971. *Limnoria (Limnoria) indica*: Purushotham and Rao, *J. Timb. Ass. India*, 17(4) : 23, fig. 18.

1994. *Limnoria (Limnoria) indica*: Nair and Salim, *Rec. zool. Surv. India, Occ. Paper*, 159 : 57, pl. 10, fig. 7, 8.

Distribution : Indo-Pacific. India—Maharashtra, Tamil Nadu, Andhra Pradesh (Visakhapatnam), Andamans and Lakshadweep.

Elsewhere : Hong Kong, Philippines, Japan, Malaysia, Belize, Admiralty Islands and Queensland.

Remarks : This species was first recorded from Bombay by Becker and Kampf (*op. cit.*).

10. *Limnoria (Limnoria) platycauda* Menzies

1957. *Limnoria (Limnoria) platycauda* Menzies, *Bull. mar. Sci. Gulf Carrib.*, 7(2) : 139.

1984. *Limnoria (Limnoria) platycauda*: Nair and Salim, *Rec. zool. Surv. India, Occ. Paper*, 159 : 59, pl. 11.

1997. *Limnoria (Limnoria) platycauda*: Swami and Udhayakumar, *Indian J. mar. Sci.*, 26(3) : 302-304.

Distribution : Indian Ocean, Atlantic Ocean and Pacific Ocean. India—Maharashtra, Karnataka (Karwar) and Andamans.

Elsewhere : Caribbean, Puerto Rico to Curaçao, Dutch West Indies, Japan, Thailand, Admiralty Islands, Belize, Cuba and Queensland.

Remarks : This species has been reported from Bombay Harbour by Swami and Udhayakumar (*op. cit.*).

Family LIGIDAE

11. *Ligia exotica* Roux, 1828

1828. *Ligia exotica* Roux, *Crust. Médit.*, 3, pl. 13, fig. 9

1959. *Ligia exotica*: Joshi and Bal, *J. Univ. Bombay*, 27(5) : 68.

1981. *Ligia exotica*: Parulekar, *Mahasagar-Bull. natn. Inst. Oceanogr.*, 14(1) : 37.

Distribution : Cosmopolitan. India—Maharashtra, Goa, Tamil Nadu and Odisha.

Elsewhere : California, Mexico, Florida, North Carolina, South Carolina, Panama, Brazil, West Indies, Chile, Mauritius, Singapore, Philippines, China, Japan and Hawaii.

Remarks : This species has been reported from Cuff Parache, Chowpatty, Breach Candy, Dadar, Mahim Creek, Madh Island (Joshi and Bal, *op. cit.*) and Malvan (Parulekar, *op. cit.*)

Family PHILOSCIIDAE

12. *Philoscia lodnensis* Ramakrishna, 1969

1969. *Philoscia lodnensis* Ramakrishna, *Bull. Syst. Zool. Calcutta*, 1(2) : 67.

1995. *Philoscia lodnensis*: Ramakrishna, *The Fauna of India and Adjacent Countries*, : 35, text-figs. 9a-i.

Distribution : India : Maharashtra, Karnataka, Goa, Kerala, Tamil Nadu, Odisha, Madhya Pradesh, Rajasthan, West Bengal, Assam, Arunachal Pradesh, Meghalaya and Manipur.

Elsewhere : Bhutan, Myanmar, Malaya, Singapore, Singapore, Hong Kong and China.

Remarks : This species has a wide distribution in India.

Family PORCELLIONIDAE

13. *Porcellio ganesa* Ramakrishna, 1975

1975. *Porcellio ganesa* Ramakrishna, *Dr. B.S. Chauhan Comm. Vol.*, : 198, text-fig. 1a-g.

1995. *Porcellio ganesa* : Ramakrishna, *The Fauna of India and Adjacent Countries*, : 68, figs. 23a-g.

Distribution : India—Maharashtra, Andhra Pradesh and Tamil Nadu.

Elsewhere : Pakistan.

14. *Porcellio laevis* Latreille, 1804

1804. *Porcellio laevis* Latreille, *Hist. Nat. Crust. Inst.*, 7 : 46.

1995. *Porcellio laevis* : Ramakrishna, *The Fauna of India and Adjacent Countries*, : 74, text-figs. 27 & 28a-e.

Distribution : India : Maharashtra, Gujarat, Tamil Nadu, West Bengal, Bihar, Madhya Pradesh, Uttar Pradesh, Punjab and Rajasthan.

Elsewhere : Africa, Middle and South Asia, East Asia, North and South America.

15. *Porcellio scaber* Latreille, 1804

1804. *Porcellio scaber* Latreille, *Hist. Nat. Crust. Inst.*, 7 : 45.

1995. *Porcellio scaber* : Ramakrishna, *The Fauna of India and Adjacent Countries*, : 71, text-figs. 24 & 25a-d.

Distribution : India—Maharashtra, Karnataka, Tamil Nadu, Odisha, Madhya Pradesh, Himachal Pradesh, Haryana, Punjab, Rajasthan, West Bengal, Assam and Meghalaya.

Elsewhere : Pakistan, Sri Lanka, Thailand, Europe, North America, Mexico, South Africa and St. Helena.

16. *Porcellio spinicornis* (Say, 1818)

1818. *Porcellio spinicornis* Say, *J. Acad. Nat. Sci. Philad.*, 1 : 431.

1995. *Porcellio spinicornis* : Ramakrishna, *The Fauna of India and Adjacent Countries*, : 65.

Distribution : India : Maharashtra, Rajasthan, Haryana and Himachal Pradesh, Madhya Pradesh, Bihar, Odisha and Tamil Nadu.

Elsewhere : Northern and Central Europe, North-eastern America.

Family TRACHELIPODIDAE

17. *Trachelipus rathkei* (Brandt, 1833)

1833. *Tracheoniscus rathkei* Brandt, *Consp. monogr. Crust. Isop. Terrestria*, : 75.
1995. *Tracheoniscus rathkei* : Ramakrishna, *The Fauna of India and Adjacent Countries*, : 109, text-figs. 43, 44a-e.

Distribution : India : Maharashtra, Karnataka, Tamil Nadu, Andhra Pradesh, Odisha, Madhya Pradesh, Uttar Pradesh, Rajasthan, Haryana, Himachal Pradesh, Punjab, Bihar, West Bengal, Assam, Arunachal Pradesh and Meghalaya.

Elsewhere : Europe, Southern Russia and America.

Family SPHAEROMATIDAE

18. *Cassidina extenda* Joshi & Bal, 1962

1962. *Cassidina extenda* Joshi & Bal, *Proc. Indian Acad. Sci.*, **56B**(6) : 372, figs. 1-9.

Distribution : Arabian Sea. India–Maharashtra.

Remarks : This species was collected from the dead barnacle, *Megabalanus tintinabulum* (Linnaeus) at Bandra, Bombay, the type locality of the species.

19. *Sphaeroma annandalei* Stebbing, 1911

1911. *Sphaeroma annandalei* Stebbing, *Rec. Indian Mus.*, **6** : 181, pl. 10.
1957. *Sphaeroma annandalei*: Palekar and Bal, *J. Timb. Dry Preserv. Ass. India*, **3**(2) : 2-3.
1959. *Sphaeroma annandalei*: Joshi & Bal, *J. Univ. Bombay*, **27**(5) : 62.
1961. *Sphaeroma annandalei* : Pillai, *Monograph: Wood-boring Crustacea of India*, 13, pl. 1, fig. 4, T, figs. 6-7.
1971. *Sphaeroma annandalei* : Purushotham and Satyanarayana Rao, *J. Timb. Dev. Ass. India*, **17**(4): 19, fig. 13.

Distribution : India–Maharashtra, Gujarat, Goa, Karnataka, Kerala, Tamil Nadu, Andhra Pradesh, Odisha (Off Puri), West Bengal, Lakshadweep and Puducherry (Yanam).

Elsewhere : South Africa.

Remarks : Palekar and Bal (1957) reported this species from Madh Islands. This species got introduced into Brazil by human-mediated dispersal.

20. *Sphaeroma terebrans* Bate, 1866

1866. *Sphaeroma terebrans* Bate, *Ann. Mag. nat. Hist.*, ser. 3, **17** : 28, pl. 2, fig. 5.
1866. *Sphaeroma vastator* : Bate, *Ann. Mag. nat. Hist.*, ser. 3, **17** : 28, pl. 2, fig. 5.
1961. *Sphaeroma terebrans*: Pillai, *Wood-boring Crustacea of India*, : 2, Fig. 1 and 2.
1989. *Sphaeroma terebrans* : Das and Dev Roy, *Zool. Surv. India, Fauna of Conservation Areas*, **4** : 40, 148.
2001. *Sphaeroma terebrans* : Sunil Kumar, *Zoos' Print Journal*, **16**(6): 509.

Distribution : Indo-Pacific and Atlantic coasts of America. India–Maharashtra, Gujarat, Goa, Karnataka, Kerala, Tamil Nadu, Andhra Pradesh, Odisha (Off Puri), Andaman Islands, Lakshadweep and Puducherry (Yanam).

Elsewhere : Gulf of Mexico, Florida, Georgia, South Carolina, Virginia, Trinidad, Venezuela, Brazil, Ecuador, Kenya and New Washington.

Remarks : Bate (*op. cit.*) first described the species *Sphaeroma terebrans* from Brazil. Ironically, simultaneously he also described another species under a different name, *S. vastator* from his home waters differing morphologically only in breadth. *S. vastator* is presently considered as a synonym of *S. terebrans*. This species occurs widely throughout the Indo-Pacific and got introduced to tropical and sub-tropical Atlantic waters during nineteenth century by the bored hulls of wooden ships. It is distributed from South Carolina to Brazil in the western Atlantic and from Liberia to Congo River in the eastern Atlantic. Sunil Kumar (2001) has recorded the species from subsoil of Kerala mangroves.

21. *Sphaeroma walkeri* Stebbing, 1905

1905. *Sphaeroma walkeri* Stebbing, In : Herdmann, *Ceylon Pearl Oyster Fish.*, *Suppl. Rep.*, **23** : 31, pl. 7
1959. *Sphaeroma walkeri*: Joshi and Bal, *J. Univ. Bombay*, (N. S.), **27**(5) : 61.

1981. *Sphaeroma walkeri* : Parulekar, *Mahasagar, Bull. natn. Inst. Oceanogr.*, 14(1): 37.

Distribution : Indo-Pacific. India–Maharashtra, Kerala, Tamil Nadu, Andhra Pradesh, Odisha and Lakshadweep.

Elsewhere : Red Sea, Port Said, Ismailia, Natal, Sri Lanka, New South Wales.

Remarks : This species is thought to be native to India; however, in the light of recent researches, it is now treated as a cosmopolitan species. *S. walkeri* has been reported as fouler in Bombay (Anil *et al.*, 2004), Visakhapatnam (Pati *et al.*, 2011) and in Suez Canal (Emara *et al.*, 2004). It is one of the most abundant species on oyster and sabellid worm reef at Sebastian Inlet, Florida, USA and is suspected that it may alter food web dynamics and native populations (Nelson and Demetriades, 1992). This species got introduced into Hong Kong, Australia, Hawaii and the Atlantic waters by human agency.

This species was collected from Bombay Harbour (Palekar and Bal, 1957), Mahim, Worli and Madh Island (Joshi and Bal, 1959) and Malvan (Parulekar, *op. cit.*).

Family IDOTEIDAE

22. *Synidotea variegata* Collinge, 1917

1917. *Synidotea variegata* Collinge, *Trans. Roy. Soc. Edinburgh*, 51(3) :

1921. *Synidotea variegata* : Collinge, *Rec. Indian Mus.*, 13(1) : 2, pl. 1, figs. 1-10.

1959. *Synidotea variegata*: Joshi and Bal, *J. Univ. Bombay*, (N. S.), 27(5): 63.

1981. *Synidotea variegata* : Parulekar, *Mahasagar, Bull. Natn. Inst. Oceanogr.*, 14(1) : 37.

Distribution : Indo-Pacific. India–Maharashtra,

Kerala, Tamil Nadu and Odisha.

Elsewhere : Algoa Bay, Mozambique to South Africa, Madagascar, Suez Canal, Sri Lanka, Indo-China.

Remarks : This is a shallow water infra-tidal species occurring at depths ranging from 1-20 m. This species was reported from Bombay (Joshi and Bal, *op. cit.*) and Malvan (Parulekar, *op. cit.*) of Maharashtra.

23. *Synidotea worliensis* Joshi & Bal, 1959

1959. *Synidotea worliensis* Joshi and Bal, *J. Univ. Bombay* (N. S.), 27(5) : 64.

Distribution : Arabian Sea. India–Maharashtra.

Remarks : A marine, inter-tidal species; Joshi and Bal (*op. cit.*) obtained specimens of this species from algal zone of the shores of Worli Village, Maharashtra in the bed of Phaeophyceae. The species is so far known from its type locality only.

SUMMARY

The paper deals with the first consolidated account of marine and terrestrial isopods of the state of Maharashtra, which contains 23 species in 15 genera belonging to 11 families and 5 suborders.

ACKNOWLEDGEMENTS

Authors are thankful to the Director, Zoological Survey of India, Kolkata for the facilities. The first author expresses his gratitude to Dr. R. M. Sharma, Scientist-'D' and Officer-in-Charge, Zoological Survey of India, Western Regional Centre, Pune for his keen interest in this work.

REFERENCES

- Anil, A.C., Clarke, C., Hayer, T., Hilliard, R., Joshi, G., Krishnamurthy, N., Polglaze, J., Sawant, S.S. and Raaymakers, S. 2004. Ballast Water Risk Assessment, Ports of Mumbai and Jawaharlal Nehru, India, October, 2003: Final Report. *GloBallast Monograph Series* No. 11, IMO London, pp. 1-vi + 1-63, appendix 1-6.
- Bal, D.V. and Joshi, V.N. 1959. Some new isopod parasites on fishes. *Journal of Bombay natural History Society*, 56(3) : 563-569, pl. 1.

- Bate, C. Spence. 1866. Carcinological gleanings, II. *Annals and Magazine of Natural History*, (3)17 : 24-31.
- Becker, G. and Kampf, W.D. 1958. Funde der holzzerstorenden Isopodengattung *Limnoria* an der festlandkuste Indiens und neubeschreibung von *Limnoria indica*. *Zeitschrift fuer Angewandte Zoologie*, **45** : 1-9.
- Emara, Ahmed M. and Belal, Aisha A. 2004. Marine fouling in Suez Canal, Egypt. *Egyptian Journal of Aquatic Research*, **30**(A) : 189-206.
- Joshi, U.N. 1957. A study of isopods of Bombay. M. Sc. Thesis, University of Bombay, Bombay.
- Joshi, U.N. and Bal, D.V. 1959. Some of the littoral species of Bombay isopods, with detailed description of two new species. *Journal of University of Bombay, New series*, **27**(5) : 57-69.
- Joshi, U.N. and Bal, D.V. 1962. *Cassidina extenda*, a new species of isopod from Bombay. *Proceedings of Indian Academy of Science*, **B**, **56**(6) : 372-376, figs. 1-9.
- Kensley, B. 1980. Anthuridean isopod crustaceans from the International Indian Ocean Expedition, 1960-1965, in the Smithsonian Collections. *Smithsonian Contributions to Zoology*, **304** : 1-37.
- Nair, N.B. and Salim, M. 1994. Marine timber destroying organisms of the Andaman and Nicobar Islands and the Lakshadweep Archipelagoes. *Records of Zoological Survey of India, Occasional Paper No.*, **159** : 1-87, pls. 1-10.
- Nelson, W.G. and Demetriades, L. 1992. Pericarids associated with sabellarid worm rock (*Phragmatopoma lapidosakindberg*) at Sebastian Inlet, Florida, U. S. A. *Journal of Crustacean Biology*, **12** : 647-654.
- Palekar, V.C. and Bal, D.V. 1955. Marine organisms injurious to submerged timber in the Bombay Harbour. *Journal of Bombay natural History Society*, **53**(2) : 201-204.
- Palekar, V.C. and Bal, D.V. 1957. Stray occurrence of crustacean wood borers in Bombay waters. *Journal of Timber Dryers Association of India*, **3**(2) : 2-3.
- Parulekar, A.H. 1981. Marine fauna of Malvan, central west coast of India. *Mahasagar, Bulletin of national Institute of Oceanography*, **14**(1) : 33-44.
- Pati, S.K., Rao, M.V. and Balaji, M. 2011. Fouling communities of the static substrata in a tropical Indian Harbour. *Journal of Marine Biological Association of India*, **53**(1) : 81-85.
- Pillai, N.K. 1961. *Monograph: Wood-boring Crustacea of India*. Manager of Publications, Government of India Press, pp. 1-61.
- Sunil Kumar, R. 2001. Habitat selection, distribution and population density of *Sphaeroma terebrans* (Crustacea: Isopoda) in the littoral subsoil of a tropical estuarine mangrove ecosystem. *Zoos' Print Journal*, **16**(6) : 509-513.
- Swami, B.S. and Udhayakumar, M. 1997. Incidence of a crustacean wood-borer *Limnoria platycauda* Menzies (Isopoda: Limnoriidae) in Bombay Harbour, west coast of India. *Indian Journal of Marine Sciences*, **26**(3) : 302-304.

BARNACLES (CRUSTACEA : MAXILLOPODA : CIRRIPIEDIA)

S.K. PATI and R.M. SHARMA

Zoological Survey of India, Western Regional Centre, Pune-411 044, India

INTRODUCTION

Barnacles are exclusive marine and sessile (except two nektonic larval stages) arthropods belonging to infraclass Cirripedia of subclass Thecostraca under class Maxillopoda in the subphylum Crustacea. They primarily considered as fouling organisms causing hindrance to various maritime activities including shipping besides causing serious economical and ecological consequences as invasive species. Due to their high productivity as well as gregarious habit and nature of settlement, barnacles draw attention of many ecologists. Though 1220 species of barnacles are found in World (Walters and Johnson, 2007), only 64 species and few varieties of cirripedes were reported in India (Antony Fernando, 2006). Systematics of Indian barnacles were given by many researchers (*Loc. Cit.*), but only few intermittent reports are available for the state of Maharashtra (Annandale, 1909; Nilsson-Cantell, 1938; Bhatt and Bal, 1960; Karande and Palekar, 1963, 1966; Karande, 1965, 1967, 1974a, b; Ross, 1971; Wagh and Bal, 1974; Henry and McLaughlin, 1975; Antony Fernando, 2006; Gaonkar *et al.*, 2010 and Swami and Udhayakumar, 2010). The present paper is an effort to give comprehensive systematic list of all barnacles hitherto recorded from Maharashtra including collections* present in the Western Regional Centre of Zoological Survey of India, Pune.

SYSTEMATIC LIST

- Phylum ARTHROPODA Latreille, 1829
Subphylum CRUSTACEA Brünnich, 1772
Class MALACOSTRACA Dahl, 1956
Subclass THECOSTRACA Gruvel, 1905
Infraclass CIRRIPIEDIA Burmeister, 1834
Superorder THORACICA Darwin, 1854
Order SESSILIA Lamarck, 1818
Suborder LEPADOMORPHA Pilsbry, 1916
Family LEPADIDAE (Darwin, 1851)
1. *Lepas anatifera indica* Annandale, 1909*
[Locality : Bhagawati Nagar, Ganapati Pule, Ratnagiri District ; Maharashtra, Collector : R.H. Kamble; Date of Collection: 01.07.1987; Reg. No. : C. 325] (New record to west coast of India)
 2. *Conchoderma hunter* (Owen, 1830)
Family POECILASMATIDAE Nilsson-Cantell, 1851
 3. *Octolasmis angulata* (Arivillius, 1893)
Family IBLIDAE Leach, 1925
 4. *Ibla cumingi* Darwin, 1851
Suborder BALANOMORPHA Pilsbry, 1916
Superfamily CHTHAMALOIDEA Darwin, 1854
Family CHTHAMALIDAE (Darwin, 1854)
Subfamily EURAPHIINAE Nilsson-Cantell, 1921
 5. *Euraphia withersi* (Pilsbry, 1916)

Subfamily CHTHAMALINAE (Darwin, 1854)

6. *Chthamalus malayensis* Pilsbry, 1916

Superfamily CORONULOIDEA Leach, 1817

Family CORONULIDAE Leach, 1817

Subfamily CHELONIBIINAE (Pilsbry, 1916)

7. *Chelonibia patula* (Ranzani, 1818)

8. *Chelonibia testudinaria* (Linnaeus, 1758)*

[Locality : Malvan coast, Ratnagiri District, Maharashtra, Collector : M. Babu Rao; Date of Collection : 04.03.1973; Reg. No. : C. 327]

Family TETRACLITIDAE Gruvel, 1903

Subfamily TETRACLITELLINAE Newman and Ross, 1976

9. *Tetraclitella karandei* Ross, 1971

10. *Tetraclitella purpurascens* (Wood, 1815)

Superfamily BALANOIDEA Leach, 1817

Family ARCHAEOBALANIDAE Newman and Ross, 1976

Subfamily ARCHAEOBALANINAE Newman and Ross, 1976

11. *Chirona amaryllis* (Darwin, 1854)

Family BALANIDAE Leach, 1817

12. *Balanus amphitrite amphitrite* Darwin, 1854

13. *Balanus reticulatus* Utinomi, 1964

14. *Balanus variegatus* Darwin, 1854

15. *Balanus cirratus* Darwin, 1854

16. *Balanus kondakovi* Tarasov and Zevina, 1957

17. *Megabalanus tintinnabulum* (Linnaeus, 1758)*

[Locality : South coast of Ratnagiri; Collector: M. Babu Rao; Date of Collection : 23.02.1973; Reg. No. : C. 326]

SUMMARY

Barnacle fauna of Maharashtra comprised of 17 species belonging to 8 families of the order Sessilia under class Maxillopoda in the phylum Arthropoda. Among these, *Lepas anatifera indica* Annandale, 1909 is reported for the first time from west coast.

REFERENCES

- Annandale, N. 1909. An account of the Indian Cirripedia pedunculata. Pt.1, Fm. Lepadidae (S.Str.). *Records of Indian Museum*, 2(2) : 61-138.
- Antony Fernando, S. 2006. *Monograph on Indian Barnacles*. Ocean Science and Technology Cell on Marine Benthos, Cochin University of Science and Technology, Kochi and Centre for Marine Living Resources and Ecology, Department of Ocean Development, Kochi. pp. 199.
- Bhatt, Y.M. and Bal, D.V. 1960. New records of barnacles from Bombay shores. *Current Science*, 29(11) : 439-440.
- Gaonkar, Chetan A., Sawant, Subhash S., Anil, Arga Chandrashekar., Krishnamurthy, Venkat. and Harkantra, Sadanand N. 2010. Changes in the occurrence of hard substratum fauna: A case study from Mumbai harbour, India. *Indian Journal of Marine Sciences*, 39(1) : 74-84.
- Henry, D.P. and McLaughlin, P.A. 1975. The barnacles of the *Balanus amphitrite* complex. *Zoologische Verhandelingen, Leiden*, 141 : 1-254.
- Karande, A.A. 1965. On cirripede crustaceans (barnacles), an important fouling group in Bombay waters. *Proceedings of Symposium on Crustacea. Marine Biological Association of India*, 4 : 1245-1250.
- Karande, A.A. 1967. Field and laboratory investigations on some marine fouling and boring organisms in Bombay harbour. *Proceedings of the Symposium on Indian Ocean*, held in March 1967, under the joint auspices of the National Institute of Sciences of India and Indian National Committee on Ocean Research (Bulletin N.I.S.I. No. 38).

- Karande, A.A. 1974a. Development of pedunculate barnacle *Ibla cumingi* Darwin. *Indian Journal of Marine Sciences*, **3** : 173-177.
- Karande, A.A. 1974b. *Balanus variegatus*, the laboratory reared larvae compared with *Balanus amphitrite* (Cirripedia). *Crustaceana*, **26** : 56-63.
- Karande, A.A. and Palekar, V.C. 1963. On a shore barnacle *Chthamalus malayensis* Pilsbry from Bombay (India). *Annals and Magazine of Natural History, Series 13*, **6** : 231-234.
- Karande, A.A. and Palekar, V.C. 1966. The sessile Barnacles (Cirripedia) of the Bombay Coast. *Journal of Bombay Natural History Society*, **63**(1) : 139-151.
- Nilsson-Cantell, C.A. 1938. Cirripedes from the Indian Ocean in the collections of the Indian Museum, Calcutta. *Memoirs of Indian Museum*, **13**(1) : 1-81.
- Ross, A. 1971. Studies on Tetraclitidae (Cirripedia : Thoracica), a new tetraclitellan from India. *Transactions of San Diego Society of Natural History*, **16**(8) : 215-224.
- Swami, B.S. and Udhayakumar, M. 2010. Seasonal influence on settlement, distribution and diversity of fouling organisms at Mumbai harbour. *Indian Journal of Marine Sciences*, **39**(1) : 57-67.
- Wagh, A.B. and Bal, D.V. 1974. Observations on systematics of sessile barnacles from west coast of India. *Journal of Bombay Natural History Society*, **71**(1) : 109-123.
- Walters, M. and Johnson, J. 2007. *The World of Animals*. Parragon Inc., Somerset. pp. 256.

MARINE WOOD BORERS

D. SWAIN, S.K. PATI*, M.V. RAO and R.M. SHARMA*

Wood Biodegradation Centre (Marine), Institute of Wood Science and Technology, Beach Road,
via Yoga Village, Andhra University Post, Visakhapatnam- 530 003, India

INTRODUCTION

Marine wood borers are a heterogeneous assemblage of highly specialized animals adapted for boring mode of life. These forms inhabit all types of timber including wooden structures and craft in the sea and also dwell in the root systems, pneumatophores, trunks and floating nuts of mangrove vegetation thereby causing huge material and monetary losses. This collective group of organisms belongs to the Families Sphaeromatidae and Limnoriidae of the Order Isopoda together with the Family Cheluridae of the Order Amphipoda under the Class Malacostraca in the Phylum Arthropoda and to the Families Pholadidae and Teredinidae of the Order Myoida under the Class Bivalvia in the Phylum Mollusca. Several researchers have studied the taxonomy of marine borers from different regions of the world (Clapp and Kenk, 1963, Jones and Eltringham, 1971 and Cookson, 1991). In India also, several reports on the occurrence of different wood borers have emanated from various coastal localities (Santhakumaran, 1994) and recent literature in the line consists of Tarakanadha and Satyanarayana Rao (2006), Pachu *et al.* (2008) and Rao *et al.* (2008). A perusal of the pertinent literature revealed that 19 species of marine wood borers were recognized from Maharashtra State in addition to six species (asterisk marked in the

following list) recently collected from Borli of Raigad District.

SYSTEMATIC LIST

Phylum ARTHROPODA Latreille, 1829

Class MALACOSTRACA Latreille, 1802

Order ISOPODA Latreille, 1817

Family SPHAEROMATIDAE Latreille, 1825

1. *Sphaeroma walkeri* Stebbing, 1905 (Does not dwell inside wood)

2. *Sphaeroma annandalei* Stebbing, 1911

Family LIMNORIIDAE White, 1850

3. *Limnoria indica* Kampf and Becker, 1958

4. *Limnoria bombayensis* Krishna Pillai (1961)

Phylum MOLLUSCA Latreille, 1758

Class BIVALVIA Latreille, 1758

Order MYOIDA Stoliczka, 1870

Family PHOLADIDAE Lamarck, 1809

Subfamily MARTESIINAE Grant & Gale, 1931

5. *Martesia (Martesia) striata* (Linnaeus, 1758)*

6. *Martesia (Particoma) nairi* Turner and Santhakumarn, 1989*

Family TEREDINIDAE Rafinesque, 1815

Subfamily TEREDININAE Rafinesque, 1815

7. *Bactronophorus thoracites* (Gould, 1856)

8. *Dicyathifer manni* (Wright, 1866)*

*Zoological Survey of India, Western Regional Centre, Vidya Nagar, Sector No. 29, P.C.N.T Post, Rawet Road, Akurdi, Pune-411 044, India

Corresponding Author e-mail: sameer_pati@yahoo.co.in

9. *Teredora princessae* (Sivickis, 1928) [160 km off Mumbai]
10. *Teredo clappi* Bartsch, 1923
11. *Teredo fuller* Clapp, 1924
12. *Teredo furcifera* von Martens, 1894
13. *Teredo indomalaiica* Roch, 1935 [160 km off Mumbai]
14. *Teredo parksi* Bartsch, 1921 [160 km off Mumbai]
15. *Lyrodus pedicellatus* (Quatrefages, 1849)
16. *Lyrodus singaporeana* Roch, 1935 [160 km off Mumbai]
- Subfamily BANKININAE Turner, 1966
17. *Nototeredo edax* (Hedley, 1895)
18. *Nausitora hedleyi* Schepman, 1919
19. *Bankia campanellata* Moll and Roch, 1931
20. *Bankia carinata* (Gray, 1827)
21. *Bankia destructa* Clench and Turner, 1946*
22. *Bankia gracilis* Moll, 1935*
23. *Bankia nordi* Moll, 1935
24. *Bankia philippinensis* Bartsch, 1927*
25. *Bankia rochi* Moll, 1931

SUMMARY

A total of 25 species of marine wood borers (2 each of sphaeromatid, limnoriid and pholadid and 19 teredinids) were recorded from Maharashtra so far. Of these, *Bankia gracilis*, *B. philippinensis* and *B. destructa* form new records to the west coast of India.

ACKNOWLEDGEMENTS

The first and third authors are thankful to the Director, Institute of Wood Science and Technology, Bangalore and the second and fourth authors to the Director, Zoological Survey of India, Kolkata for kind encouragement.

REFERENCES

- Clapp, W.F. and Kenk, R. 1963. *Marine borers, an annotated bibliography*. ACR-74. Office of the Naval Research, Department of the Navy, Washington, D.C., : 1136 pp.
- Cookson, L.J. 1991. Australasian species of Limnoriidae (Crustacea: Isopoda). *Memoirs of the Museum of Victoria*, 52(2) : 137-262.
- Jones, E.B.G. and Eltringham, S.K. 1971. *Marine borers, fungi and fouling organisms of wood*. Proceedings of the OECD Workshop, March 1968. Organization of Economic Cooperation and Development, Paris : 365 pp.
- Pachu, A.V., Rao, M.V. and Balaji, M. 2008. Marine woodborer fauna in mangroves of the Krishna estuary, east coast of India. In : Solomon Raju, A.J. (ed.) *Bioresources Conservation and Management*, Today & Tomorrow's Printers and Publishers, New Delhi : 41-51.
- Rao, M.V., Balaji, M. and Pachu, A.V. 2008. Marine wood borers of Bhimunipatnam-Visakhapatnam coast, Bay of Bengal, India. *Journal Timber Developers Association of India*, 54(1-4): 59-77.
- Santhakumaran, L.N. 1994. *Marine wood-borers of India—An Annotated Bibliography*. Institute of Wood Science and Technology, Bangalore, India, p. 1-262.
- Tarakanadha, B. and Satyanarayana Rao, K. 2006. Marine wood borers from Krishnapatnam waters, Andhra Pradesh, east coast of India. *Journal of Institute of Wood Science*, 17(3) : 134-145.

MARINE CRABS (DECAPODA : ANOMURA AND BRACHYURA)

S.K. PATI, K.C. SAHU¹, D. SWAIN², S.K. BALIARSINGH³ and R.M. SHARMA

Zoological Survey of India, Western Regional Centre, Vidya Nagar, Sector No. 29, P.C.N.T Post, Rawat Road, Akurdi, Pune-411 044, India.

INTRODUCTION

Marine crabs belong to the order Decapoda of class Malacostraca in the phylum Arthropoda. Marine crabs can be distinguished into two infraorders, namely, Anomura and Brachyura. While Brachyura refers to true crabs, Anomura includes porcelain crabs, mole crabs, sand crabs, king crabs, hermit crabs, etc. About 600 species of marine crabs have been recorded in India and they form an important fishery resource contributing 8% of total crustacean landings in India (Manisseri and Radhakrishnan, 2011) besides having many ecological significance. Several systematic studies have been carried out on anomuran and brachyuran crabs of India and other parts of the world (Ng *et al.*, 2008 and De Grave *et al.*, 2009). In Maharashtra, marine crabs are reported by Chhapgar (1957a,b); Sankarankutty (1961); Sankolli (1966 and 1967); Parulekar (1981); Deb (1989); Gajbhiye *et al.* (1995); Mathew and Govindan (1995); Krishnamurti and Nair (1999); Dev Roy and Das (2000); Jeyabaskaran *et al.* (2002) and Gaonkar *et al.* (2010). Since no attempt was made to collect data on marine crabs of Maharashtra, the present effort was made to give complete systematic list following Ng *et al.* (2008).

SYSTEMATIC LIST

- Phylum ARTHROPODA Latreille, 1829
- Subclass CRUSTACEA Brünnich, 1772
- Class MALACOSTRACA Latreille, 1802
- Order DECAPODA Latreille, 1802
- Suborder PLEOCYEMATA Burkenroad, 1963
- Infraorder ANOMURA MacLeay, 1838
- Superfamily GALTHEROIDEA Samouelle, 1819
- Family PORCELLANIDAE Haworth, 1825
- 1. *Ancylocheles gravelei* (Sankolli, 1963)
- 2. *Raphidopus indicus* Henderson, 1893
- 3. *Pachycheles natalensis* (Krauss, 1843)
- 4. *Petrolisthes boscii* (Audouin, 1826)
- 5. *Petrolisthes lamarckii* (Leach, 1820)
- 6. *Pisidia serratifrons* (Stimpson, 1858)
- 7. *Polyonyx hendersoni* Southwell, 1909
- 8. *Polyonyx splendidus* Sankolli, 1963
- Superfamily HIPPOIDEA Latreille, 1825
- Family HIPPIDAE Latreille, 1825
- 9. *Emerita holthuisi* Sankolli, 1965
- Infraorder BRACHYURA Linnaeus, 1758
- Section PODOTREMATA Guinot, 1977
- Superfamily DROMIOIDEA De Hann, 1833

¹Fishery Survey of India, 2nd & 3rd Floor, Botawala Chambers, Sir P.M. Road, Fort, Mumbai-400 001, India.

²Fishery Survey of India, Post Box. No.46, Port Blair-744 101, India.

³Department of Marine Sciences, Berhampur University, Berhampur-760 004, India.

Corresponding author e-mail : sameer_pati@yahoo.co.in

- Family DROMIIDAE De Hann, 1833
 Subfamily DROMIINAE De Hann, 1833
 1. *Ascidiphilus caphyraeformis* Richters, 1880
 2. *Dromia dormia* (Linnaeus, 1763)
 Section EUBRACHYURA Saint Laurent, 1980
 Subsection HETEROTREMATA Guinot, 1977
 Superfamily CALAPPOIDEA De Hann, 1833
 Family CALAPPIDAE De Hann, 1833
 3. *Calappa lophos* (Herbst, 1782)
 Family MATUTIDAE De Haan, 1835
 4. *Ashtoret lunaris* (Forskål, 1775)
 5. *Matuta planipes* Fabricius, 1798
 6. *Matuta victor* (Fabricius, 1781)
 Superfamily DORIPPOIDEA MacLeay, 1838
 Family DORIPPIDAE MacLeay, 1838
 7. *Dorippoides facchino* (Herbst, 1785)
 Superfamily ERIPHIOIDEA MacLeay, 1838
 Family ERIPHIIDAE MacLeay, 1838
 8. *Eriphia smithii* MacLeay, 1838
 Family MENIPPIDAE Ortmann, 1893
 9. *Myomenippe hardwickii* (Gray, 1831)
 Family OZIIDAE Dana, 1851
 10. *Epixanthus frontalis* (H. Milne Edwards, 1834)
 11. *Ozius rugulosus* Stimpson, 1858
 Superfamily GONEPLACOIDEA MacLeay, 1838
 Family EURYPLACIDAE Stimpson, 1871
 12. *Eucrate crenata* (De Haan, 1835)
 13. *Trissoplax dentata* (Stimpson, 1858)
 Superfamily LEUCOSIOIDEA Samouelle, 1819
 Family LEUCOSIIDAE Samouelle, 1819
 Subfamily EBALIINAE Stimpson, 1871
 14. *Philyra corallicola* Alcock, 1896
 15. *Philyra globus* (Fabricius, 1775)
 Subfamily LEUCOSIINAE Samouelle, 1819
 16. *Leucosia sima* Alcock, 1896
 Superfamily MAJOIDEA Samouelle, 1819
 Family EPIALTIDAE MacLeay, 1838
 Subfamily PISINAE Dana, 1851
 17. *Doclea muricata* (Herbst, 1788)
 18. *Doclea rissoni* Leach, 1815
 19. *Hyastenus planasius* (Adams & White, 1848)
 Family HYMENOSOMATIDAE MacLeay, 1838
 20. *Elamena cristatipes* Gravely, 1927
 Family MAJIDAE Samouelle, 1819
 Subfamily MAJINAE Samouelle, 1819
 21. *Prismatopus aculeatus* (H. Milne Edwards, 1834)
 22. *Schizophrys aspera* (H. Milne Edwards, 1834)
 Superfamily PARTHENOPOIDEA MacLeay, 1838
 Family PARTHENOPIDAE MacLeay, 1838
 Subfamily PARTHENOPINAE MacLeay, 1838
 23. *Enoplolambrus pransor* (Herbst, 1796)
 Superfamily PILUMNOIDEA Samouelle, 1819
 Family GALENIDAE Alcock, 1898
 Subfamily GALENINAE Alcock, 1898
 24. *Galene bispinosa* (Herbst, 1783)
 Family PILUMNIDAE Samouelle, 1819
 Subfamily PILUMNINAE Samouelle, 1819
 25. *Eurycarcinus orientalis* A. Milne-Edwards, 1867
 26. *Heteropanope laevis* (Dana, 1852)
 27. *Heteropilumnus angustifrons* (Alcock, 1900)
 28. *Pilumnus longicornis* Hilgendorf, 1878
 29. *Pilumnus vespertilio* (Fabricius, 1793)
 Superfamily PORTUNOIDEA Rafinesque, 1815
 Family PORTUNIDAE Rafinesque, 1815
 Subfamily PORTUNINAE Rafinesque, 1815
 30. *Portunus (Portunus) pelagicus* (Linnaeus, 1758)
 31. *Portunus (Portunus) sanguinolentus* (Herbst, 1783)
 32. *Scylla serrata* (Forskål, 1775)
 Subfamily THALAMITINAE Paul'son, 1875
 33. *Charybdis (Charybdis) annulata* (Fabricius, 1798)
 34. *Charybdis (Charybdis) callianassa* (Herbst, 1789)
 35. *Charybdis (Charybdis) feriata* (Linnaeus, 1758)

36. *Charybdis* (*Charybdis*) *hellerii* (A. Milne-Edwards, 1867)
37. *Charybdis* (*Charybdis*) *lucifera* (Fabricius, 1798)
38. *Charybdis* (*Charybdis*) *orientalis* Dana, 1852
39. *Charybdis* (*Charybdis*) *riversandersoni* Alcock, 1899
40. *Charybdis* (*Goniohellenus*) *hoplites* (Wood-Mason, 1877)
41. *Thalamita* *crenata* Rüppell, 1830
42. *Thalamita* *prymna* (Herbst, 1803)
Superfamily PSEUDOZIOIDEA Alcock, 1898
Family PSEUDOZIIDAE Alcock, 1898
43. *Pseudozius* *caystrus* (Adams & White, 1849)
Superfamily XANTHOIDEA Macleay, 1838
Family XANTHIDAE Macleay, 1838
Subfamily ACTAEINAE Alcock, 1898
44. *Actaea* *savignii* (H. Milne Edwards, 1834)
Subfamily ETISINAE Ortmann, 1893
45. *Etisus* *laevimanus* Randall, 1840
Subfamily EUXANTHINAE Alcock, 1898
46. *Medaeops* *granulosus* (Haswell, 1882)
Subfamily XANTHINAE Macleay, 1838
47. *Demania* *baccalipes* (Alcock, 1898)
48. *Leptodius* *exaratus* (H. Milne Edwards, 1834)
49. *Macromedaeus* *crassimanus* (A. Milne-Edwards, 1867)
50. *Macromedaeus* *quinquedentatus* (Krauss, 1843)
Subfamily ZOSIMINAE Alcock, 1898
51. *Atergatis* *floridus* (Linnaeus, 1767)
52. *Atergatis* *integerrimus* (Lamarck, 1818)
53. *Atergatis* *roseus* (Rüppell, 1830)
54. *Atergatis* *amoyensis* de Man, 1879
55. *Platypodia* *cristata* (A. Milne-Edwards, 1865)
Subsection THORACOTREMATA Guinot, 1977
Superfamily GRAPSOIDEA MacLeay, 1838
Family GRAPSIDAE MacLeay, 1838
56. *Grapsus* *albolineatus* Latreille, in Milbert, 1812
57. *Metopograpsus* *latifrons* (White, 1847)
58. *Metopograpsus* *messor* (Forskål, 1775)
Family SESARMIDAE Dana, 1851
59. *Episesarma* *mederi* (H. Milne Edwards, 1853)
60. *Nanosesarma* *minutum* (De Man, 1887)
61. *Pseudosesarma* *edwardsii* (De Man, 1888)
Family VARUNIDAE H. Milne Edwards, 1853
Subfamily CYCLOGRAPSPINAE H. Milne Edwards, 1853
62. *Metaplex* *distincta* H. Milne Edwards, 1852
63. *Metaplex* *indica* H. Milne Edwards, 1852
Subfamily VARUNINAE H. Milne Edwards, 1853
64. *Pseudograpsus* *intermedius* Chhapgar, 1955
65. *Varuna* *litterata* (Fabricius, 1798)
Superfamily OCYPODOIDEA Rafinesque, 1815
Family DOTILLIDAE Stimpson, 1858
66. *Dotilla* *blanfordi* Alcock, 1900
67. *Dotilla* *myctiroides* (H. Milne Edwards, 1852)
Subfamily DOTILLINAE Stimpson, 1858
68. *Ilyoplax* *gangetica* (Kemp, 1919)
Family MACROPHTHALMIDAE Dana, 1851
Subfamily MACROPHTHALMINAE Dana, 1851
69. *Macrophthalmus* (*Macrophthalmus*) *sulcatus* H. Milne Edwards, 1852
70. *Macrophthalmus* (*Mareotis*) *crinitus* Rathbun, 1913
71. *Macrophthalmus* (*Mareotis*) *depressus* Rüppell, 1830
72. *Venitus* *dentipes* (Lucas, in Guérin Méneville, 1836)
73. *Venitus* *latreillei* (Desmarest, 1822)
Family OCYPODIDAE Rafinesque, 1815
Subfamily OCYPODINAE Rafinesque, 1815
74. *Ocypode* *ceratophthalmus* (Pallas, 1772)
75. *Ocypode* *cordimanus* Latreille, 1818
76. *Ocypode* *quadrata* (Fabricius, 1787)
77. *Ocypode* *rotundata* Miers, 1882
Subfamily UCINAE Dana, 1851
78. *Uca* (*Austruca*) *annulipes* (H. Milne Edwards, 1837)

79. *Uca (Austruca) lactea* (De Haan, 1835)
 80. *Uca (Gelasimus) vocans* (Linnaeus, 1758)
 Superfamily PINNOTHEROIDEA De Haan, 1833
 Family PINNOTHERIDAE De Haan, 1833
 Subfamily PINNOTHERINAE De Haan, 1833
 81. *Arcotheres placunae* (Hornell & Southwell, 1909)
 82. *Pinnotheres vicajii* Chhapgar, 1957

SUMMARY

A total of 91 species of marine crabs in two infraorders i.e. Anomura and Brachyura are reported from Maharashtra. Anomuran crabs of the state consists of 9 species in 7 genera of 2 families and 2 superfamilies whereas brachyuran crabs accounts for 82 species in 55 genera of 22 subfamilies and 25 families under 15 superfamilies of 2 subsections and 2 sections.

REFERENCES

- Chhapgar, B.F. 1957a. On the Marine Crabs (Decapoda Brachyura) of Bombay State. *Journal of Bombay Natural History Society*, **54** : 399-439.
- Chhapgar, B.F. 1957b. Marine crabs of Bombay state. Contribution No. 1 of the Taraporevala Marine Biological Station. *Marine Biological Station, Department of fisheries, Bombay* : 89 pp.
- De Grave, Sammy, Pentcheff, N.Dean., Ah Yong, Shane T., Chan, Tin-Yam., Crandall, Keith A., Dworschak, Peter C., Felder, Darryl L., Feldmann, Rodney M., Franssen, Charles H.J.M., Goulding, Laura Y.D., Lemaitre, Rafael., Low, Martyn E.Y., Martin, Joel W., Ng, Peter K.L., Schweitzer, Carrie E., Tan, S.H., Tshudy, Dale. and Wetzer, Regina. 2009. A classification of living and fossil genera of decapod crustaceans. *The Raffles Bulletin of Zoology, Supplement No.*, **21** : 1-109.
- Deb, M. 1989. Contribution to the study of Xanthidae: Actaeinae (Decapoda : Crustacea) of India. *Records of the Zoological Survey of India, Occasional Paper No.* **117** : 1-59.
- Dev Roy, M.K. and Das, A.K. 2000. Taxonomy, ecobiology and distribution pattern of the brachyuran crabs of mangrove ecosystem in the Andaman Islands. *Records of the Zoological Survey of India, Occasional Paper No.*, **185** : 1-211.
- Gajbhiye, S.N., Mehta, P., Mustafa, S. and Nair, V.R. 1995. A case study on the impact of industrial effluents disposal on the fisheries of Amba river estuary, Maharashtra. *Journal of the Indian Fisheries Association*, **25** : 25-38.
- Gaonkar, Chetan A., Sawant, Subhash S., Anil, Arga Chandrashekar., Krishnamurthy, Venkat. and Harkantra, Sadanand N. 2010. Changes in the occurrence of hard substratum fauna: A case study from Mumbai harbour, India. *Indian Journal of Marine Sciences*, **39**(1) : 74-84.
- Jeyabaskaran, R., Wafar, S. and Wafar, M. 2002. CD on Brachyuran Crabs of West Coast, India. Available at <http://www.nio.org/Biology/brachyuran/index.html>
- Krishnamurti, A.J. and Nair, V.R. 1999. Concentration of metals in shrimps and crabs Thane-Bassein creek system, Maharashtra. *Indian Journal of Marine Sciences*, **28** : 92-95.
- Manisseri, Mary K. and Radhakrishnan, E.V. 2011. Marine Crabs. In : Status of exploited marine fishery resources of India, Mohan Joseph, M. and Jayaprakash, A.A (ed.), Central Marine Fisheries Research Institute, Kochi, p. 188-194.
- Mathew, A. and Govindan, K. 1995. Macrobenthos in the nearshore coastal system of Bombay. *Proceedings of the National Academy of Sciences, India (Biological Sciences)*, **65**(IV) : 411-430.

- Ng, Peter K.L., Guinot, Daniele and Davie, Peter J.F. 2008. Systema Brachyurorum : Part I. An Annotated Checklist of Extant Brachyuran Crabs of the World. *The Raffles Bulletin of Zoology*, **17** : 1-286.
- Parulekar, A.H. 1981. Marine fauna of Malvan, central west coast of India. *Mahasagar -Bulletin of National Institute of Oceanography*, **14**(1) : 33-44.
- Sankarankutty, C. 1961. On Decapoda Brachyura from the Andaman and Nicobar Islands. 1. Families Portunidae, Ocypodidae, Grapsidae and Mictyridae. *Journal of the Marine Biological Association of India*, **3**(1-2) : 101-119.
- Sankolli, K.N. 1966. On the Porcellanidae (Crustacea-Anomura) of Ratnagiri along the west coast of India. *Proceedings of Symposium on Crustacea*, Marine Biological Association of India, Mandapam Camp, Part-I, p. 295-313.
- Sankolli, K.N. 1967. Studies on the larval development in Anomura (Crustacea, Decapoda)-I. *Symposium on Crustacea*, Marine Biological Association of India, Part-2, p. 744-776.

SHRIMPS (CRUSTACEA : DECAPODA : DENDROBRANCHIATA : PENAEIDAE)

M.K. DEV ROY and S. RATH*

Crustacea Section, Zoological Survey of India, 27, Jawaharlal Nehru Road, Kolkata-700016

INTRODUCTION

Prawns are an item of high economic value. Maharashtra with a coastline of 720 km occupies an important place in the prawn fishery in India. Henderson (1893) was the first to record two species of penaeid prawns namely, *Penaeus monodon* Fabricius and *P. affinis* Milne Edwards from Bombay coast, Maharashtra. After a short gap, Nobili (1903) recorded three more species viz., *Parapenaeopsis styliferus* (Edwards), *P. sculptilis* (Heller) and *P. cornuta* (Kish) from Bombay (now Mumbai). In 1958, Mehendale and Tembe reported two species namely, *Parapenaeopsis cornutus* and *P. maxillipedo* also from Bombay coast. In 1967, Kunju recorded 19 species of penaeid prawns from Maharashtra, of which, six were already reported by the previous workers. This list of species also contained *Solenocera indicus* Nataraj which is now included in the family Solenoceridae. Later on, Kagwade (1975) added one species, *Metapenaeus kutchensis* from Bombay. George (1979) also studied the penaeid prawns of Bombay coast. Aravindakshan and Karbhari (1983, 1985) reported three more species, namely, *Metapenaeopsis hilarula* (De Man), *M. stridulans* (Alcock) and *Parapenaeus longipes* (Alcock) from Maharashtra coast. Thus, a total of 26 species of penaeid prawns are so far known to occur in the coast of Maharashtra, which are collated and presented as an updated inventory of species.

INVENTORY OF PENAEID PRAWNS OF MAHARASHTRA COAST

Phylum CRUSTACEA

Class MALACOSTRACA

Subclass EUMALACOSTRACA

Superorder EUCARIDA

Order DECAPODA

Suborder DENDROBRANCHIATA

Family PENAEIDAE

1. *Atypopenaeus compressipes* (Henderson, 1893)
2. *Atypopenaeus stenodactylus* (Stimpson, 1860a)
3. *Fenneropenaeus indicus* (H. Milne Edwards, 1837)
4. *Fenneropenaeus merguensis* De Man, 1888
5. *Fenneropenaeus penicillatus* Alcock, 1905
6. *Kishinouyepenaeopsis maxillipedo* (Alcock, 1905)
7. *Marsupenaeus japonicus* Bate, 1888.
8. *Melicertus canaliculatus* (Olivier, 1811)
9. *Metapenaeopsis hilarula* (De Man 1911)
10. *Metapenaeopsis mogiensis* Rathbun, 1902
11. *Metapenaeopsis novaguineas* (Haswell, 1879)
12. *Metapenaeopsis stridulans* (Alcock, 1905)
13. *Metapenaeus affinis* (H. Milne Edwards, 1837)

*Cyto-Taxonomy Laboratory, Zoological Survey of India, 27, Jawaharlal Nehru Road, Kolkata-700016

14. *Metapenaeus brevicornis* (H. Milne Edwards, 1837)
15. *Metapenaeus dobsoni* (Miers, 1878)
16. *Metapenaeus kutchensis* George, George & Rao, 1963
17. *Metapenaeus monoceros* (Fabricius, 1798)
18. *Parapenaeopsis acclivirostris* Alcock, 1905
19. *Parapenaeopsis cornuta* (Kishinouye, 1900)
20. *Parapenaeopsis hardwickii* (Miers, 1878)
21. *Parapenaeopsis scuptilis* (Heller, 1862)
22. *Parapenaeopsis stylifera* (H. Milne Edwards, 1837)
23. *Parapenaeus longipes* Alcock, 1905
24. *Penaeus (Penaeus) monodon* Fabricius, 1798
25. *Penaeus (Penaeus) semisulactus* De Haan, 1844
26. *Trachypenaeus curvirostris* (Stimpson, 1860)

1. *Atypopenaeus compressipes* (Henderson, 1893)

1893. *Penaeus compressipes*, Henderson. *Tran. Linn. Soc. Lond. Zool., ser. 2, 5* : 450, pl. 21-22.
1967. *Atypopenaeus compressipes*, Kunju. *Proc. Symp. Crustacea, Mar. Biol. Ass. India, 4* : 1384.

Distribution : India : West coast: Maharashtra.

Elsewhere : China, Hong Kong and Macao.

Remarks : This species is reported from Alibag, Sassoon Dock, Worli, Arnala (Kunju, *op. cit.*) and Versova (Kunju, *op. cit.*; Deshmukh *et al.*, 2001).

2. *Atypopenaeus stenodactylus* (Stimpson, 1860)

1860. *Penaeus stenodactylus*, Stimpson. *Proc. Acad. Nat. Sci. Phila., 1860*: 44.
1967. *Miyadiella pedunculata*, Kunju. *Symp. Crustacea, Mar. Biol. Ass. India, 4* : 1384.
1969. *Atypopenaeus stenodactylus*, George, *Bull. Cent. Mar. Fish. Res. Inst., 14* : 40.

Distribution : India : East coast: West Bengal. West coast: Maharashtra.

Elsewhere : Myanmar.

Remarks : Kunju (*op. cit.*) observed this species to occur always with the juveniles of *Atypopenaeus*

compressipes. George (1979) reported this prawn at depths ranging from 10-20 m from off Bombay coast.

3. *Fenneropenaeus indicus* (H. Milne Edwards, 1837)

1837. *Penaeus indicus* H. Milne Edwards, *Hist. Nat. Crust., Paris, 2* : 415.
1967. *Penaeus indicus*, Kunju. *Proc. Symp. Crustacea, Mar. Biol. Ass. India, 4* : 1384.
2008. *Penacus (Fenneropenaeus) indicus*, Rath & Dev Roy, *Estuarine Ecosystem Series, 5 : Fauna of Krishna Estuary*, : 86.
2010. *Fenneropenaeus indicus*, Dev Roy, *J. Environ. & Sociobiol., 7(2)* : 168.

Distribution : India : East coast: West Bengal, Andhra Pradesh, Tamil Nadu. West coast: Maharashtra, Goa. Islands: Andaman and Nicobar Islands and Lakshadweep.

Elsewhere : Sri Lanka, China, East African coast, Madagascar, Red Sea, Philippines and Northern Australia.

4. *Fenneropenaeus merguensis* (De Man, 1888)

1888. *Penaeus merguensis*, De Man, *J. Linn. Soc. Lond. (Zool), 22* : 287.
1906. *Penaeus indicus var. mergiensis*, Alcock, *Cat. Indian Decapod Crust., 3(1)* : 13.
1967. *Penaeus merguensis*, Kunju. *Proc. Symp. Crustacea, Mar. Biol. Ass. India, 4* : 1384
2008. *Penaeus (Fenneropenaeus) merguensis*, Rath & Dev Roy, *Estuarine Ecosystem Series, 5 : Fauna of Krishna Estuary*, : 87.
2010. *Fenneropenaeus merguensis*, Dev Roy, *J. Environ. & Sociobiol., 7(2)* : 168.

Distribution : India : East coast: West Bengal, Andhra Pradesh, Tamil Nadu. West coast: Maharashtra, Goa.

Elsewhere : Northern eastern coasts of Arabian Sea, Gulf of Oman, Sri Lanka, Philippines, Australia and New Caledonia.

Remarks : This species has been reported from Versova as a commercial species by Deshmukh *et al.* (2001).

5. *Fenneropenacus penicillatus* (Acock, 1905)

1905. *Penaeus indicus* var. *penicillatus*, Acock, *Ann. Mag. Nat. Hist.*, ser. 7, **16** : 525.
1967. *Penaeus penicillatus*, Kunju. *Proc. Symp. Crustacea, Mar. Biol. Ass. India*, **4** : 1384
2009. *Penaeus (Fenneropenaeus) penicillatus*, Rath & Dev Roy, *Estuarine Ecosystem Series, 5 : Fauna of Krishna Estuary Prawns*, : 87.
2010. *Fenneropenacus penicillatus*, Dev Roy, *J. Environ. & Sociobiol.*, **7**(2) : 168.

Distribution : India : East coast: West Bengal, Andhra Pradesh. West coast: Maharashtra, Gujarat.

Elsewhere : North East Arabian Sea, Pakistan, China, Taiwan and Indonesia.

Remarks : This species has been recorded from Versova (Kunju, 1967; Deshmukh *et al.*, 2001) and from Harnai, Murud, Alibagh, Sassoon Dock, Worli, Arnala, Satpati, Dahan (Kunju, *op. cit.*).

6. *Kishinouyepenaeopsis maxillipedo* (Alcock, 1905)

1900. *Parapenaeopsis maxillipedo*, Alcock, *Ann. Mag. Nat. Hist.*, ser. 7, **16**: 522.
1967. *Parapenaeopsis maxillipedo*, Kunju. *Proc. Symp. Crustacea, Mar. Biol. Ass. India*, **4** : 1385.
1958. *Parapenaeopsis maxillipedo*, Mehendale and Tembe, *Curr. Sci.*, **27** : 351.
- 1969 *Parapenaeopsis maxillipedo*, George, *Bull. Cent. Mar. Fish. Res. Inst.*, **14** : 43.

Distribution : India : East coast: West Bengal. West coast: Maharashtra.

Elsewhere : Sri Lanka, Malaysia, Philippines, Indonesia, Papua, New Guinea and Australia.

Remarks : This species was recorded from Bombay by Mehendale and Tembe (*op. cit.*).

7. *Marsupenaeus japonicus* (Bate, 1888)

1888. *Penaeus canaliculatus* var. *japonicus* Bate, *Rep. Sci. Res. "Challenger"*, **24** : 245.
1969. *Penaeus Japonicus*, George, *Bull. Cent. Mar. Fish. Res. Inst.*, **14** : 21.
1989. *Penaeus japonicus*, Muthu, *Mar. Fish. Inf. Serv., Tech. Ext. Ser.*, **93** : 9-10.
2008. *Penaeus (Marsupenaeus) japonicus*, Rath & Dev

Roy, *Estuarine Ecosystem Series, 5 : Fauna of Krishna Estuary Prawns*, : 88.

2010. *Marsupenaeus japonicus*, Dev Roy, *J. Environ. & Sociobiol.*, **7**(2): 168.

Distribution : India : East coast : West Bengal, Andhra Pradesh, Tamil Nadu. West coast: Maharashtra. **Elsewhere**: South East Africa, Red Sea, Madagascar, Mauritius, Korea, Japan, New Guinea and Australia.

Remarks : This species has been reported from Maharashtra by Muthu (*op. cit.*) and Malvan (Parulekar, 1981).

8. *Melicertus canaliculatus* (Olivier, 1811)

1811. *Palaemon canaliculatus*, Olivier, *Encycl. Method. Hist. Nat. (Ins)*, **8** : 660.
1967. *Penaeus canaliculatus*, Kunju. *Proc. Symp. Crustacea, Mar. Biol. Ass. India*, **4** : 1384.
1991. *Penaeus (Melicertus) canaliculatus*, Paulpandian & Ramasamy, *Guide to the Prawns of Porto Novo, CAS, in Mar. biol., Annamalai Univ., Parangipettai, India* : 35, pl 29, fig.4.
2010. *Melicertus canaliculatus*, Dev Roy, *J. Environ. & Sociobiol.*, **7**(2) : 168.

Distribution : India : East coast: West Bengal, Andhra Pradesh, Tamil Nadu. West coast: Maharashtra. Islands : Andamans.

Elsewhere : Sri Lanka, South East Africa, Red Sea, Taiwan, Polynesia, Mauritius and New Guinea.

Remarks : This species has been reported from Versova (Kunju, 1967; Deshmukh *et al.*, 2001) and also from Sassoon Dock, Worli, Arnala, Satpati and Dahan (Kunju, *op. cit.*).

9. *Metapenaeopsis hilarula* (De Man 1911)

1911. *Penaeopsis hilarulus*, De Man. *Siboga. Exp. Mon.*, **39a** : 8, 71.
1969. *Metapenaeopsis hilarula*, George, *Bull. Cent. Mar. Fish. Res. Inst.*, **14** : 32.
1985. *Metapenaeopsis hilarula*, Arvindakshan and Karbhari, *Ind. J. Fish.*, **32**(4) : 499, fig. 3.

Distribution : India : East coast: Andhra Pradesh. West coast: Maharashtra.

Elsewhere : S.E Africa and Malaya.

Remarks : Arvindakshan and Karbhari (*op. cit.*) reported this species from Sassoon Dock, Bombay, also from off Murud-Harnai coast at a depth of 30-70 m.

10. *Metapenaeopsis mogiensis* Rathbun, 1902

1902. *Parapenaeus mogiensis*, Rathbun. *Proc. U.S. Natl. Mus.*, **26** : 39.
 1967. *Parapenaeopsis mogiensis*, Kunju, *Proc. Symp. Crustacea, Mar. Biol. Ass. India*, **4** : 1384.
 1969. *Parapenaeopsis mogiensis*, George, *Bull. Cent. Mar. Fish. Res. Inst.*, **14** : 45.

Distribution : India : East coast : Andhra Pradesh. West coast: Maharashtra, Goa.

Elsewhere : Australia.

Remarks : This species was reported from Versova by Kunju (*op. cit.*).

11. *Metapenaeopsis novaeguineae* (Haswell, 1879)

1879. *Penaeus novae-guineae*, Haswell. *Proc. Linn. Soc. N.S.W.*, **4** : 43.
 1967. *Metapenaeopsis novae-guineae*: Kunju. *Proc. Symp. Crustacea, Mar. Biol. Ass. India*, **4**: 1384.

Distribution : India : West coast: Maharashtra.

Elsewhere : New Guinea and Australia.

Remarks : Kunju (*op. cit.*) reported species from Sassoon Dock and Worli.

12. *Metapenaeopsis stridulans* (Alcock, 1905)

1905. *Metapenaeopsis stridulans* Alcock, *Ann. Mag. Nat. Hist.*, ser. 7, **6** : 518, 526.
 1969. *Metapenaeopsis stridulans*, George, *Bull. Cent. Mar. Fish. Res. Inst.*, **14** : 25.
 1983. *Metapenaeopsis stridulans*, Arvindakshan and Karbhari, *Mar. Fish. Infor. Serv. T & E.*, **53** : 20.

Distribution : India : East coast: Andhra Pradesh. West coast : Maharashtra. Islands: Andaman and Nicobar Islands.

Elsewhere : Gulf of Oman, Maldives, Sri Lanka, Malaysia, Singapore, Gulf of Thailand, China, Vietnam, Philippines, Indonesia and New Calendonina.

Remarks : Arvindakshan and Karbhari (*op. cit.*) reported this species from Maharashtra coast.

13. *Metapenaeus affinis* (H. Milne Edwards, 1837)

1837. *Penaeus affines* H. Milne Edwards, *Hist. Nat. Crust. Paris*, **2** : 416.
 1906. *Metapenaeus affinis*, Alcock, *Cat. Indian Decapod Crust.*, : **3**(7) : 20.
 1967. *Metapenaeus affinis*, Kunju. *Proc. Symp. Crust. Mar. Biol. Ass. India*, **4** :1384.
 1995. *Metapenaeus affinis*, Reddy, *Zool. Surv. India. Estuarine Ecosystem Series, Part-2 : Hugli Matla Estuary*, : 293.

Distribution : India : East coast: West Bengal, Tamil Nadu. West coast: Maharashtra, Goa.

Elsewhere : Gulf of Oman, Arabian Sea, Sri Lanka, Philippines and Taiwan.

Remarks : This species has been recorded from Versova (Kunju, 1967; Deshmukh *et al.*, 2001) and from Sassoon Dock and Arnala by Kunju (*op. cit.*).

14. *Metapenaeus brevicornis* (H. Milne Edwards, 1837)

1837. *Penaeus brevicornis* H. Milne Edwards, *Hist. Nat. Crust. Paris*, **2** : 417.
 1906. *Metepenaeus brevicornis*, Alcock, *Cat. India Decapod Crust.*, **3**(1) : 22.
 1967. *Metapenaeus brevicornis*, Kunju. *Proc. Symp. Crustacea, Mar. Biol. Ass. India*, **4** : 1384.
 1995. *Metepenaeus brevicornis*, Reddy, *Zool. Surv. India Estuarine Ecosystem Series, Part 2 : Hugli Matla Estuary*, : 293.

Distribution : India : East coast: West Bengal, Andhra Pradesh, Tamil Nadu. West coast: Maharashtra, Goa.

Elsewhere : Pakistan, Thailand, Malayasia, Indonesia and Borneo.

Remarks : This species has been recorded from Harnai, Alibagh, Sasson Dock, Worli, Arnala, Versova, Satpati and Dahan of Maharashtra by Kunju (*op. cit.*)

15. *Metapenaeus dobsoni* (Miers, 1878)

1878. *Penaeus dobsoni* Miers, *Proc. Zool. Soc. London*, : 302
1906. *Metapenaeus dobsoni*, Alcock, *Cat. Indian Decapod Crust.*, 3(1) : 21.
1967. *Metapenaeus dobsoni*, Kunju. *Proc. Symp. Crust., Mar. Biol. Ass. India*, 4 : 1384.
1995. *Metapenaeus dobsoni*, Reddy, *Zool. Surv. India. Estuarine Ecosystem Series, Part 2 : Hugli Malla Estuary*, : 294.

Distribution : India : East coast: West Bengal, Andhra Pradesh, Tamil Nadu. West coast : Maharashtra, Goa.

Elsewhere : Sri Lanka, Gulf of Thailand, Philippines and Indonesia.

16. *Metapenaeus kutchensis* George, George & Rao, 1963

1963. *Metapenaeus kutchensis*. George, George & Rao, *Joun. Mar. biol. Ass. India*, 5 : 284, fig. 1a-f.
1969. *Metapenaeus kutchensis*, George, *Bull. Cent. Mar. Fish. Res. Inst.*, 14 : 39.
1978. *Metapenaeus kutchensis*, Kagwade, *J. mar. biol. Ass. India*, 20(1 & 2) : 174-176.

Distribution : India : West coast : Maharashtra and Gujarat.

Remarks : This species is recorded from Maharashtra by Kagwade (*op. cit.*) and Deshmukh *et al.*, 2001). So far, it is known to occur in the west coast only.

17. *Metapenaeus monoceros* (Fabricius, 1798)

1798. *Penaeus monoceros* Fabricius, *Entom. Syst. Suppl.*, : 409.
1906. *Metapenaeus monoceros*, Alcock, *Cat. India Decapod Crust.*, 3 (1):18.
1967. *Metapenaeus monoceros*, Kunju. *Proc. Symp. Crustacea, Mar. Biol. Ass. India*, 4 : 1384.

Distribution : India : East coast: West Bengal, Andhra Pradesh, Tamil Nadu. West coast: Maharashtra, Goa.

Elsewhere : Mediterranean, South Africa, Red Sea, Madagascar, Mauritius, Sri Lanka and Malay Peninsula.

Remarks : This species has been reported from Versova (Kunju, *op. cit.*; Deshmukh *et al.*, 2001) and also from Sassoon Dock and Arnala (Kunju, *op. cit.*) and Malvan (Parulekar, 1981).

18. *Parapenaeopsis acclivirostris* Alcock, 1905

1905. *Parapenaeopsis acclivirostris* Alcock, *Ann. Mag. Nat. Hist.*, ser. 7, 16 :522.
1967. *Parapenaeopsis acclivirostris*, Kunju. *Proc. Symp. Crust. Mar. Biol. Ass. India*, 4 : 1384
1969. *Parapenaeopsis acclivirostris*, George, *Bull. Cent. Mar. Fish. Res. Inst.*, 14 : 45.

Distribution : India : East coast: West Bengal. West coast: Maharashtra, Goa, Kerala

Elsewhere : Indo-West Pacific from South and East Africa to India.

Remarks : This species has been reported from Versova (Kunju, 1967; Deshmukh *et al.*, 2001) and from Harnai, Murud, Alibagh, Sassoon Dock, Worli, Arnala, Satpati, Dahan (Kunju, *op. cit.*).

19. *Parapenaeopsis cornuta* (Kishinouye, 1900)

1901. *Penaeus cornutus* Kishinouye, *Joun. Fish. Bur.*, Tokyo, 8 : 23, pl. 1-9.
1958. *Parapenaeopsis cornutus*, Mehendale and Tembe, *Curr. Sci.*, 27 : 351.
1967. *Parapenaeopsis cornutus*, Kunju. *Proc. Symp. Crustacea, Mar. Biol. Ass. India*, 4 : 1384.
1969. *Parapenaeopsis cornuta*, George, *Bull. Cent. Mar. Fish. Res. Inst.*, 14 : 43.

Distribution : India : East coast: Andhra Pradesh. West coast: Maharashtra, Karnataka, Goa.

Elsewhere : Sri Lanka, Malaysia, Singapore, Philippines, Taiwan, Japan, Indonesia, Papua, New Guinea and Australia.

Remarks : This species has been reported from Mahim (Mehendale and Tembe, *op. cit.*), Versova (Kunju, *op. cit.*; Deshmukh *et al.*, 2001) and Sassoon Dock (Kunju, *op. cit.*).

20. *Parapenaeopsis hardwickii* (Miers, 1878)

1878. *Penaeus hardwickii* Miers, *Proc. Zool. Soc. Lond.*, : 300, 306.
1967. *Parapenaeopsis hardwickii*, Kunju. *Proc. Symp. Crustacea, Mar. Biol. Ass. India*, 4 : 1384.

2008. *Parapenaeopsis hardwickii*, Rath & Dev Roy, *Estuarine Ecosystem Series, 5 : Fauna of Krishna Estuary*, : 95.

Distribution : India : East coast : Andhra Pradesh. West coast: Maharashtra, Goa.

Elsewhere : Pakistan, China, Japan, Indonesia, Philippines and New Guinea.

Remarks : This species has been reported from Versova, Sassoon Dock and Arnala of Maharashtra coast by Kunju (*op. cit.*).

21. *Parapenaeopsis scuptilis* (Heller, 1862)

1862. *Penaeus scuptilis* Heller, *Verh. Zool.-bot. Ges. Wien.*, **12** : 528.
1967. *Parapenaeopsis scuptilis*, Kunju. *Proc. Symp. Crustacea, Mar. Biol. Ass. India*, **4** : 1384.
2008. *Parapenaeopsis scuptilis*, Rath & Dev Roy, *Estuarine Ecosystem Series 5 : Fauna of Krishna Estuary Prawns*, : 95.

Distribution : India : East coast: West Bengal, Andhra Pradesh, Tamil Nadu. West coast: Maharashtra, Goa.

Elsewhere : Pakistan, Philippines, China, Japan, Indonesia and New Guinea.

Remarks : This species has been recorded from Murud, Alibagh, Sassoon Dock, Worli, Arnala, Satpati, Dahan (Kunju, *op. cit.*) and Versova (Kunju, *op. cit.*; Deshmukh *et al.*, 2001).

22. *Parapenaeopsis stylifera* (H. Milne Edwards, 1837)

1837. *Penaeus styliferus* H.Milne Edwards, *Hist. Nat. Crust. Paris*, **2** : 418.
1967. *Parapenaeopsis stylifera*, Kunju. *Proc. Symp. Crustacea, Mar. Biol. Ass. India*, **4** : 1384.
1969. *Parapenaeopsis stylifera*, George, *Bull. Cent. Mar. Fish. Res. Inst.*, **14** : 34.

Distribution : India : East coast: West Bengal. West coast: Maharashtra.

Elsewhere : Sri Lanka, Malaysia, Indonesia and Borneo.

Remarks : This species has been recorded from Harnai, Murud, Alibagh, Sassoon Dock, Worli, Versova, Arnala, Satpati, Dahan (Kunju, 1967) and Malvan (Parulekar, 1981).

23. *Parapenaeus longipes* Alcock, 1905

1905. *Parapenaeus longipes* Alcock *Ann. Mag. nat. Hist.*, ser. 7, **6** : 520-523.
1969. *Parapenaeus longipes*, George, *Bull. Cent. Mar. Fish. Res. Inst.*, **14** : 26.
1983. *Parapenaeus longipes*, Arvindakshan & Karbhari, *Mar. Fish. Infor. Serv. T & E Ser.*, **53** : 20.

Distribution : India : East coast: Andhra Pradesh. West coast: Maharashtra, Kerala.

Elsewhere : East coast of Africa, Madagascar, Pakistan, Sri Lanka, China, Taiwan, Japan, Indonesia and Papua New Guinea.

Remarks : This is commonly called flamingo shrimp and occurred in a fishable quantity in Maharashtra Coast (Arvindakshan and Karbhari, *op. cit.*; Deshmukh *et al.*, 2001).

24. *Penaeus (Penaeus) monodon* Fabricius, 1798

1798. *Penaeus monodon* Fabricius, *Ent. Syst. Suppl. Hafniae*: 408.
1967. *Penaeus monodon*, Kunju. *Proc. Symp. Crustacea, Mar. Biol. Ass. India*, **4** : 1384.
2008. *Penaeus (penaeus) monodon*, Rath & Dev Roy, *Estuarine Ecosystem Series, 5 : Fauna of Krishna Estuary Prawns, (Crustacea : Decapoda)* : 85.

Distribution : India : East coast: West Bengal, Andhra Pradesh, Tamil Nadu. West coast: Maharashtra, Goa. Islands: Andaman and Nicobar Islands and Lakshadwip.

Elsewhere : East Africa, West coast of Madagascar, Mauritius, Red Sea, Gulf of Aden, Pakistan, Sri Lanka, Philippines, China, Japan, New Guinea and Australia.

Remarks : This species was recorded from Bombay (Henderson, 1893) and from Harnai, Murud, Alibagh, Sassoon Dock, Worli, Arnala, Satpati, Dahan (Kunju, *op. cit.*) and Versova (Kunju, *op. cit.*; Deshmukh *et al.*, 2001).

25. *Penaeus (Penaeus) semisulcatus* De Haan, 1844

1844. *Penaeus semisulcatus* De Haan, In : von Siebold, *Fauna Japonica, Crustacea* (6/7) : 46 fig. 1
1967. *Penaeus semisulcatus*, Kunju. *Proc. Symp. Crust., Mar. Biol. Ass. India*, **4** : 1384.

2009. *Penaeus (Penaeus) semisulcatus*, Rath & Dev Roy, *Estuarine Ecosystem Series, 5 : Fauna of Krishna Estuary*, : 85.

Distribution : India : East coast: West Bengal, Odisha, Andhra Pradesh, Tamil Nadu. West coast: Maharashtra, Goa. Islands: Andaman and Nicobar Islands, Lakshadweep.

Elsewhere : East coast of Africa, Madagascar, Red Sea, Sri Lanka, Philippines, China and Northern Australia.

Remarks : This species was recorded from Sassoon Dock by Kunju (*op. cit.*).

Elsewhere : Red Sea, East Africa, Madagascar, China, Japan, Australia, Egypt and Turkey.

Remarks : Kunju (*op. cit.*) reported this species from Sassoon Dock and Versova.

SUMMARY

A consolidated account of penaeid prawns of Maharashtra has been dealt in this communication. This comprises of 26 species belonging to 11 genera. Distribution of these species both in India as well in other parts of the world has been provided.

26. *Trachypenaeus curvirostris* (Stimpson, 1860)

1860. *Penaeus curvirostris*, Stimpson. *Proc. Acad. Nat. Sci. Philad.*, 1860 : 44.

1969. *Trachypenaeus curvirostris*, George, *Bull. Cent. Mar. Fish. Res. Inst.*, 14 : 40.

1985. *Trachypenaeus curvirostris*, Arvindakshan and Karbhari, *Mar. Fish. Infor. Serv., T. & E. Ser.*, 53 : 20.

Distribution : India : West coast : Maharashtra.

ACKNOWLEDGEMENTS

Authors are thankful to the Director, Zoological Survey of India, Kolkata for the facilities. One of us (MKDR) expresses his deep gratitude to Dr. R.M. Sharma, Scientist-D & Officer-in-Charge, Western Regional Centre, Zoological Survey of India, Pune for his keen interest and encouragement in this work.

REFERENCES

- Aravindakshan, M. and Karbhari, J.P. 1983. New Penaeid Prawn Resources showing up along Maharashtra Coast. *Mar. Fish. Infor. Serv. T & E Ser.*, 53 : 20-23.
- Aravindakshan, M. and Karbhari, J.P. 1985. Notes on three species of crabs and two species of prawns recorded for the first time from Maharashtra. *Indian J. Fish.*, 32(4) : 496-502.
- Deshmukh, V.D., Patkar, D.S. and Karnik, P.C. 2001. Penaeid Prawn Fishery and its maximum sustainable yield at Versova, Mumbai. *Indian J. Fish.*, 48(2) : 165-175.
- George, M.J. 1979. Taxonomy of Indian Prawns (Penaeidae: Crustacea, Decapoda). In: *Contributions to Marine Sciences Dedicated to Dr. C. V. Kurian*, 1979 : 21-59.
- Henderson, J.R. 1893. A Contribution to Indian Carcinology. *Trans. Linn. Soc. Lond. (Zool.)*, ser. 2, 5 : 325-458, pls. 36-40.
- Kagwade, P.V. 1978. New record of the penaeid prawn *Metapenaeus kutchensis* from Bombay with redescription of the species. *J. mar. biol. Ass. India*, 20(1 & 2) : 174-176.
- Kunju, M. 1967. Observation on the prawn fishery of the Maharashtra coast. *Proc. Symposium on Crustacea*, Part 4 : 1382-1397. Marine Biological Association of India.
- Mehendale, D.D. and Tembe, V.B. 1958. Occurrence of *Parapenaeopsis cornuta* Kishinouye in the seas of India. *Curr. Sci.*, 27 : 351.
- Nobili, G. 1903. Crostaceidi Pondichéry, Mahé, Bombay etc. *Boll. Musei. Zool. Ant. Comp. R. Univ. Torino*, 18 : 1-24.
- Parulekar, A.H. 1981. Marine Fauna of Malvan, Central West coast of India. *Mahasagar, Bull. natn. Inst. Oceanogr.*, 14(1) : 33-44.

INSECTA : EPHEMEROPTERA (MAYFLIES)

R.M. SHARMA and KAILASH CHANDRA*

Zoological Survey of India, Western Regional Centre, Pune-411044

INTRODUCTION

Adult mayflies or short-lived insects are slender and uniform in appearance but the group is very diverse in morphology in the nymphal stage. Adults have triangular wings held vertically over the body and can not be folded flat. There are 2 or 3 long thread-like caudal filaments at the end of the abdomen in both sexes. The lateral pair is cerci; the middle one when present is called the terminal filament. Adults are unable to feed with their nonfunctional mouthparts. Males have a pair of clasper-like forceps at the end of the abdomen. Males often congregate in dense swarms during mating flights and mating lasts for a few seconds. Females land on the water surface after mating to release eggs and die while still in the water. Most species develop in fresh water, a few may occur in brackish water of estuaries. World wide 3000 species occur where as from India 124 species are known, Sivaramakrishna *et al.* (2009). A perusal of literature reveals that 19 species of 15 genera under 10 families are reported from Maharashtra State.

The studies conducted in the past on this group from the state are restricted to a few places like Khandala, Lonavala, Mumbai and Pune. Thus it can safely be said that the entire state remains unexplored as far as mayflies are concerned.

Order EPHEMEROPTERA

Family BAETIDAE

1. *Baetis dipsicus* Gillies, 1949
River Mutha, Pune, Maharashtra

2. *Baetis fluitans* Gillies, 1949
River Mutha, Pune, Maharashtra
3. *Labiobatis palmyrae* Gillies, 1949
River Mutha, Pune, Maharashtra
4. *Cloeon marginale* (Hagen, 1858)
Maharashtra
5. *Cloeon taeniatum* Navas, 1931
Bandra, Mumbai, Maharashtra
6. *Procloeon harveyi* Kimmins, 1947
Pune, Maharashtra

7. *Pseudocloeon rubellum* Navas

Family CAENIDAE

8. *Caenis nigrostriata* Navas, 1931
Bandra, Mumbai, Maharashtra
9. *Clypeocaenis bisetosa* Soldan, 1978
Pune, Maharashtra
10. *Clypeocaenis multisetosa* Soldan, 1978
Pune, Maharashtra

Family TELOGANODIDAE

11. *Teloganodes dentatus* Navas, 1931
Khandala, Mumbai, Maharashtra

Family EPHEMERIDAE

12. *Ephemera (Ephemera) fulcata* Navas, 1935
Lonavala nr Khandala, Mumbai,
Maharashtra

Family EUTHYPLOCIIDAE

13. *Euthyplocia punensis* Dubey, 1970
Territory, Pune, Maharashtra

Family HEPTAGENIIDAE

Subfamily HEPTAGENIINAE

14. *Ecdyonurus annulifer* (Walker, 1860)
Khandala, Mumbai, Maharashtra

15. *Epeorus gilliesi* Braasch, 1981
Khandala, Mumbai, Maharashtra

Family LEPTOPHLEBIIDAE

16. *Thraululus semicastaneus* (Gillies, 1951)
River Mutha nr Pune, Maharashtra

Family PALINGENIIDAE

17. *Anagenesia minor* (Eaton, 1892)
Maharashtra

Family POLYMITARCYIDAE

Subfamily POLYMITARCYINAE

18. *Ephoron indicus* (Pictet, 1843)
Maharashtra

Family POTAMANTHIDAE

19. *Potamanthus subcostalis* Navas, 1931
Khandala, Mumbai, Maharashtra

SUMMARY

The present paper provides an account of 19 species under 15 genera spread over 10 families of mayflies reported from Maharashtra State.

REFERENCES

- Braasch, D. 1981. *Epeorus gilliesi* n. sp. aus Indien (Ephemeroptera, Heptageniidae) *Reichenbachia*, **19**(20) : 117-118.
- Dubey, O.P. 1970. Description of a new ephemerid from India. *Agra Univ. J. Res. (Sci.)* **19** : 67-68.
- Hubbard, M.D. and Peters, W.L. 1978. A Catalogue of the Ephemeroptera of the Indian Subregion. *Oriental Insects Suppl. No. 9* : 1-43.
- Sivaramakrishna, K.G., Subramanian, K.A., Ramamorthy, V.V., Sharma, R.M. and Chandra, K. 2009. Checklist of Ephemeroptera of India. [http://www.zsi.gov.in/Zoological Survey of India/zsidata/checklist](http://www.zsi.gov.in/Zoological%20Survey%20of%20India/zsidata/checklist).
- Soldan, T. 1978. New genera and species of Caenidae (Ephemeroptera) from Iran, India and Australia. *Acta-Entomologia-Bohemoslovaca*, **75**(2) : 119-129.

INSECTA : ODONATA

P.P. KULKARNI, R. BABU*, S.S. TALMALE, CHHAYA SINHA and S.B. MONDAL

Zoological Survey of India, Western Regional Centre, Sector 29, Ravet Road, Pune-411 044

INTRODUCTION

Odonates form the prominent insects while on flight as well as at rest. Being active, while on flight, this group attracted attention of workers since long and first record of Indian Odonate dates back to more than 250 years. Fraser (1933-36) published 3 volumes on Fauna of British India : Odonata which are still regarded as most authentic consolidated taxonomic work. Recently Prasad & Varshney (1995) published checklist of Indian Odonates which includes 499 species

Prasad (1996) published an account of Odonata from Maharashtra state, based on the 46 species present in National Zoological Collection of Zoological survey of India, Calcutta and Pune. He also presented a consolidated list of 83 species of Odonata so far recorded from Maharashtra state.

In recent years Western Regional Centre of Zoological Survey of India surveyed few conservation areas and wetlands of Maharashtra State. Based on the collection from these areas, Kulkarni *et al.*, 1999; Prasad *et al.*, 2000; Sharma *et al.*, 2000; Kulkarni, *et al.*, 2002; Kulkarni and Prasad, 2002; Talmale and Kulkarni, 2003; Kulkarni *et al.*, 2004; Kulkarni and Prasad, 2005; Kulkarni and Talmale, 2005, 2009; Kulkarni *et al.* 2006 a & b, and Babu *et al.*, 2009 published taxonomic information on Odonata. Thus now the number of Odonata species recorded from the state has risen to 101. The National Zoological Collection of the Zoological Survey of India now holds 65 species. Data for all the 101 species is presented here.

Order ODONATA

Suborder ZYGOPTERA

Superfamily COENAGRIONOIDEA

Family COENAGRIONIDAE

Subfamily PSEUDAGRIONINAE

Genus *Ceriagrion* Selys 1876

1. *Ceriagrion cerinorubellum* (Brauer)
2. *Ceriagrion coromandelianum* (Fabr.)
3. *Ceriagrion olivaceum* Laidlaw
4. *Ceriagrion rubiae* Laidlaw

Genus *Pseudagrion* Selys 1876

5. *Pseudagrion decorum* (Rambur)
6. *Pseudagrion hypermelas* Selys
7. *Pseudagrion microcephalum* (Rambur)
8. *Pseudagrion rubriceps rubriceps* Selys
9. *Pseudagrion spencei* Fraser

Subfamily COENAGRIONINAE

Genus *Cercion* Navas, 1907

10. *Cercion malayanum* (Selys)

Subfamily ISCHNURINAE

Genus *Aciagrion* Selys, 1891

11. *Aciagrion hisopa hisopa* (Selys)
12. *Aciagrion hisopa krishna* Fraser
13. *Aciagrion occidentale* Laidlaw
14. *Aciagrion pallidum* Selys

Genus *Enallagma* Charp., 1840

15. *Enallagma parvum* Selys

Genus *Ischnura* Charp., 1840

16. *Ischnura aurora aurora* (Brauer)

* Zoological Survey of India, 535, M-Block, New Alipur, Kolkata-700 053

17. *Ischnura senegalensis* (Rambur)
Genus ***Rhodischnura*** Laidlaw, 1919
18. *Rhodischnura nursei* (Morton)
Subfamily AGRIOCNEMIDINAE
Genus ***Agriocnemis*** Selys, 1877
19. *Agriocnemis femina* (Brauer)
20. *Agriocnemis lacteola* Selys
21. *Agriocnemis pieris* Laidlaw
22. *Agriocnemis pygmaea* (Rambur)
23. *Agriocnemis splendidissima* Laidlaw
Genus ***Mortonagrion*** Fraser, 1920
24. *Mortonagrion varralli* Fraser
Family PLATYCENEMIDIDAE
Subfamily PLATYCENEMIDINAE
Genus ***Copera*** Kirby, 1890
25. *Copera ciliata* (Selys)
26. *Copera marginipes* (Ramb.)
27. *Copera vittata deccanensis* Laidlaw
Family PLATYSTICTIDAE
Subfamily PLATYSTICTINAE
Genus ***Protosticta*** Selys, 1885
28. *Protosticta gravelyi* Laidlaw
Family PROTONEURIDAE
Subfamily DISPARONEURINAE
Genus ***Disparoneura*** Selys, 1860
29. *Disparoneura quadrimaculata* (Ramb.)
Genus ***Elatoneura*** Cowley, 1935
30. *Elatoneura nigerrima* (Laidlaw)
Superfamily LESTOIDEA
Family LESTIDAE
Subfamily LESTINAE
Genus ***Lestes*** Leach, 1815
31. *Lestes elatus* Hagen
32. *Lestes umbrinus* Selys
33. *Lestes viridulus* Rambur
Superfamily CALOPTERYGOIDEA
Family CALOPTERYGIDAE
Subfamily CALOPTERYGINAE
Genus ***Neurobasis*** Selys, 1853
34. *Neurobasis chinensis chinensis* (Linnaeus)
- Genus ***Vestalis*** Selys, 1853
35. *Vestalis apicalis apicalis* Selys
36. *Vestalis gracilis gracilis* (Rambur)
Family CHLOROCYPHIDAE
Genus ***Rhinocypha*** Rambur, 1842
Subgenus ***Heliocypha*** Fraser, 1949
37. *Rhinocypha bisignata* (Selys)
Genus ***Libellago*** Selys, 1840
38. *Libellago lineata indica* (Fraser)
39. *Libellago lineata lineata* (Burm.)
Suborder ANISOPTERA
Superfamily AESHNOIDEA
Family GOMPHIDAE
Subfamily GOMPHINAE
Genus ***Anormogomphus*** Selys, 1854
40. *Anormogomphus heteropterus* Selys, 1854
Genus ***Burmagomphus*** Williamson, 1907
41. *Burmagomphus pyramidalis* Laidlaw
Genus ***Cyclogomphus*** Selys, 1854
42. *Cyclogomphus heterostylus* Selys
43. *Cyclogomphus vesiculosus* Selys
44. *Cyclogomphus wilkinsi* Fraser
45. *Cyclogomphus ypsilon* Selys
Genus ***Macrogomphus*** Selys, 1857
46. *Macrogomphus annulatus* (Selys)
Genus ***Microgomphus*** Selys, 1857
47. *Microgomphus torquatus* (Selys)
48. *Microgomphus verticalis* (Selys)
Subfamily ONYCHOGOMPHINAE
Genus ***Onychogomphus*** Selys, 1854
49. *Onychogomphus grammicus* (Rambur)
Genus ***Paragomphus*** Cowley, 1934
50. *Paragomphus lineatus* (Selys)
Subfamily GOMPHOIDINAE
Genus ***Gomphidia*** Selys, 1854
51. *Gomphidia t-nigrum* Selys
Subfamily LINDENIINAE
Genus ***Ictinogomphus*** Cowley, 1934
52. *Ictinogomphus rapax* (Rambur)
Family AESHNIDAE

Subfamily AESHNINAE

Genus *Anax* Leach, 181553. *Anax guttatus* (Burmeister)54. *Anax immaculifrons* RamburGenus *Hemianax* Selys, 188355. *Hemianax ephippiger* (Burmeister)Genus *Gynacantha* Rambur, 184256. *Gynacantha bayadera* SELYS

Superfamily LIBELLULOIDEA

Family CORDULIIDAE

Subfamily CORDULIINAE

Genus *Hemicordulia* Selys, 187057. *Hemicordulia asiatica* Selys

Subfamily MACROMIINAE

Genus *Epophthalmia* Burmeister, 183958. *Epophthalmia frontalis frontalis* Selys59. *Epophthalmia vittata vittata* BurmeisterGenus *Macromia* Rambur, 184260. *Macromia flavicincta* Selys61. *Macromia cingulata* Rambur

Family LIBELLULIDAE

Subfamily TETRATHEMISTINAE

Genus *Tetrathemis* Brauer, 186862. *Tetrathemis platyptera* Selys

Subfamily BRACHYDIPLACTINAE

Genus *Brachydiplax* Brauer, 186863. *Brachydiplax sobrina* (Rambur)

Subfamily LIBELLULINAE

Genus *Cratilla* Kirby, 190064. *Cratilla lineata calverti* FoersterGenus *Lathrecista* Kirby, 188965. *Lathrecista asiatica asiatica* (Fabr.)Genus *Orthetrum* Newman, 183366. *Orthetrum anceps* (Schneider)67. *Orthetrum chrysis* (Selys)68. *Orthetrum glaucum* (Brauer)69. *Orthetrum japonicum internum* MacLachlan, 189470. *Orthetrum luzonicum* (Brauer)71. *Orthetrum pruinatum neglectum* (Rambur)72. *Orthetrum sabina sabina* (Drury)73. *Orthetrum taeniolatum* (Schn.)74. *Orthetrum testaceum testaceum* (Burmeister)Genus *Potamarcha* Karsch, 189075. *Potamarcha congener* (Rambur)

Subfamily SYMPETRINAE

Genus *Acisoma* Rambur, 184276. *Acisoma panorpoides panorpoides* RamburGenus *Brachythemis* Brauer, 186877. *Brachythemis contaminata* (Fabr.)Genus *Bradinopyga* Kirby, 189378. *Bradinopyga geminata* (Rambur)Genus *Crocothemis* Brauer, 186879. *Crocothemis servilia servilia* (Drury)Genus *Diplacodes* Kirby, 188980. *Diplacodes lefebvrei* (Rambur)81. *Diplacodes nebulosa* (Fabricius)82. *Diplacodes trivialis* (Rambur)Genus *Indothemis* Ris, 190983. *Indothemis limbata limbata* (Selys)Genus *Neurothemis* Brauer, 186784. *Neurothemis fulvia* (Drury)85. *Neurothemis intermedia intermedia* (Rambur)86. *Neurothemis tullia tullia* (Drury)Genus *Rhodothemis* Ris, 191187. *Rhodothemis rufa* (Rambur)Genus *Sympetrum* Newman, 183388. *Sympetrum hypomelas* (Selys)

Subfamily TRITHEMISTINAE

Genus *Trithemis* Brauer, 186889. *Trithemis aurora* (Burmeister)90. *Trithemis festiva* (Rambur)91. *Trithemis pallidinervis* (Kirby)

Subfamily PALPOPLEURINAE

Genus *Palpopleura* Rambur, 184292. *Palpopleura sexmaculata sexmaculata* (Fabr.)

Subfamily TRAMEINAE

Genus *Rhyothemis* Hagen, 186793. *Rhyothemis variegata variegata* (Linnaeus)

Genus *Hydrobasileus* Kirby, 1889

94. *Hydrobasileus croceus* (Brauer)

Genus *Pantala* Hagen, 1861

95. *Pantala flavescens* (Fabr.)

Genus *Tramea* Hagen, 1861

96. *Tramea basilaris burmeisteri* Kirby

97. *Tramea limbata similata* (Rambur)

98. *Tramea virginia* (Rambur)

Genus *Tholymis* Hagen, 1867

99. *Tholymis tillarga* (Fabr.)

Genus *Zyxomma* Rambur, 1842

100. *Zyxomma petiolatum* Rambur

Subfamily UROTHEMISTINAE

Genus *Urothemis* Brauer, 1868

101. *Urothemis signata signata* (Rambur)

SYSTEMATIC ACCOUNT

Order ODONATA

Suborder ZYGOPTERA

Superfamily COENAGRIONOIDEA

Family COENAGRIONIDAE

Subfamily PSEUDAGRIONINAE

Genus *Ceriagrion* Selys 1876

1. *Ceriagrion cerinorubellum* (Brauer)

1865. *Pyrrhosoma cerinorubellum* Brauer, *Verh. zool.-bot. Ges. Wien*, Vol. xv, p. 511.

1933. *Ceriagrion cerinorubellum*, Fraser, *Fauna Brit. India, Odonata*, 1 : 326-328.

Material examined/Source : Fraser, 1933; Prasad, 1996.

Distribution : Through out India.

Elsewhere : Malaysia; Myanmar; Sri Lanka; Java; Sumatra and Borneo.

2. *Ceriagrion coromandelianum* (Fabr.)

1798. *Agrion coromandelianum* Fabricius, *Ent. Syst. Suppl.*, : 287.

1933. *Ceriagrion coromandelianum*, Fraser, *Fauna Brit. India, Odonata*, 1 : 315-316.

Diagnostic characters : Head : Labium pale yellow; labrum, clypeus, genae, bases of mandibles

and frons bright citron yellow; vertex olivaceous; occiput and postocular area ochreous; basal three joints of antennae pale yellow. Prothorax and thorax uniformly olive green. Legs citron yellow. Wings hyaline, pterostigma golden yellow. Abdomen uniformly citron yellow, segment 10 deeply emarginate on dorsum. Anal appendages citron yellow. Female more robust and dull coloured.

Material examined/Source : Prasad, 1996; Kulkarni and Talmale, 2003; Kulkarni, *et al.*, 2004; 2006a, b.

Distribution : Throughout India (Maharashtra : Pench National Park, Nagpur; Tadoba-Andhari Tiger Reserve, Chandrapur; Sanjay Gandhi National Park, Birivali, Mumbai).

Elsewhere : Sri Lanka, Myanmar, Malaysia, Indochina and South China.

Remarks : Recorded as a very common species from Estuarine areas of Eastern India (Prasad and Ghosh, 1988).

3. *Ceriagrion olivaceum* Laidlaw

1914. *Ceriagrion olivaceum* Laidlaw *Rec. Indian Mus.*, 8 : 345-346.

1923. *Ceriagrion olivaceum*, Fraser, *J. Bombay Nat. Hist. Soc.*, 9 : 748.

1995. *Ceriagrion olivaceum*, Prasad and Varshney, *Oriental Ins.*, 29 : 389.

Diagnostic characters : Head : Labium dirty brown or pale yellow; Labrum and whole head pale olivaceous brown, lighter ochreous tint behind eyes and across occiput. Prothorax and thorax pale olivaceous. Legs yellow, with black spines. Wings hyaline, palely enfumed in adults; pterostigma pale brown. Abdomen uniform oilvaceous brown and yellowish beneath. Female resembles male with nodal index slightly lower than in males.

Material examined/Source : Kulkarni *et al.*, 2006.

Distribution : India : Aranuchal Pradesh, Assam, Kerala, Manipur, Maharashtra (Tadoba-Andhari National park, Chandrapur), Meghalaya, Orissa, South Andaman, Uttar Pradesh and West Bengal.

4. *Ceriagrion rubiae* Laidlaw

1916. *Ceriagrion rubiae* Laidlaw, *Rec. Ind. Mus.*, **12** : 132-133.
1933. *Ceriagrion rubiae*, Fraser, *Fauna Brit. India, Odonata*, **1** : 318-319.
1995. *Ceriagrion rubiae*, Prasad and Varshney, *Oriental Ins.*, **29** : 389.

Material examined/Source : Fraser, 1933.

Distribution : India : Maharashtra (Khandala, Pune Dist.); Orissa and Western Ghats.

Genus *Pseudagrion* Selys, 1876

5. *Pseudagrion decorum* Rambur

1842. *Agrion decorum* Rambur, *Ins. Neurop.*, : 258.
1933. *Pseudagrion decorum*, Fraser, *Fauna Brit. India, Odonata*, **1** : 286-289.

Diagnostic characters : This species has white labrum with rest of the head up to posterior ocelli pale bluish green. Light blue ground colour, thorax pale blue, pterostigma diamond shaped with fine black lines, mid dorsal carinal ridge and a thick black humeral strip. Beautifully bluish green colour distinguishes this species from other species of the genus. Anal appendages narrowly bifid at the apex. Inferior anal appendages short and half of the length of superior.

Material examined/Source : Prasad, 1996; Kulkarni and Prasad, 2002; Talmale and Kulkarni, 2003; Kulkarni *et al.*, 2004, 2006a, b; Kulkarni and Prasad, 2005; Kulkarni and Talmale, 2005; Kulkarni and Talmale, 2009.

Distribution : Throughout continental India.

Elsewhere : Myanmar, Nepal and Sri Lanka.

Remarks : Common species in India, found on permanent and temporary water bodies. Rare in hill streams.

6. *Pseudagrion hypermelas* Selys

1876. *Pseudagrion hypermelas* Selys, *Bull. Acad. Belg.*, (2) Vol. xi, p. 519.
1933. *Pseudagrion hypermelas* Fraser, *Fauna Brit. India, Odonata*, **1** : 289-292.

Material examined/Source : Fraser, 1933; Prasad, 1996.

Distribution : India : Maharashtra (Bor dharan, Wardha); Bihar; Gujarat, Madhya Pradesh; Punjab; West Bengal and Western Ghats.

7. *Pseudagrion microcephalum* (Rambur)

1842. *Agrion microcephalum* (Rambur). *Ins Neurop.*, : 25.
1876. *Pseudagrion microcephalum*, Selys *Bull. Acad. Belg.*, (2) : xiii, : 504.
1933. *Pseudagrion microcephalum* Fraser, *Fauna Brit. India, Odonata*, **1** : 278-280.

Diagnostic characters : Labium white, bases of mandibles, gene, frons and fore part of vertex azure blue, post clypeus with three small black spots at base; Prothorax blue, anterior lobe and five parallel lines on middle lobe all confluent in front and behind, black. Thorax blue with pale yellow to white below and beneath. Abdomen azure blue marked with black on segment 2 and segments 3 to 7 dorsally with apical narrow rings; 8 with a thick apical dorsal ring & 9th unmarked. Segment 10 with saddle shaped dorsal mark extending from base to apex.

Material examined/Source : Kulkarni and Prasad, 2005; Kulkarni *et al.* 2002.

Distribution : Throughout the plains in India (Maharashtra : Melghat Tiger Reserve).

Elsewhere : Mynamar and Sri Lanka, extending to Australia.

Remarks : Dwells near permanent and temporary water bodies. Variations in colour markings in males are recorded.

8. *Pseudagrion rubriceps rubriceps* Selys

1876. *Pseudagrion rubriceps* Selys, *Bull. Acad. Belg.*, (2) **42** : 510.
1933. *Pseudagrion rubriceps* Fraser, *Fauna Brit. India, Odonata*, **1** : 296-299.
1988. *Pseudagrion rubriceps* Prasad and Ghosh, *Rec. zool. Surv India*, **85**(2) : 201.
1995. *Pseudagrion rubriceps rubriceps*, Prasad and Varshney, *Oriental Ins.*, **29** : 389.

Diagnostic characters : Head : Labium citron yellow; labrum, bases of mandibles, genae, clypeus and frons bright orange; vertex and occiput dark olivaceous but posterior occiput changing to blue.

Prothorax black, marked with pale blue stripes. Thorax olivaceous green, with a golden tinge and the sides azure blue. Legs yellow, femora black on the outer and posterior surface. Abdomen marked broadly with black on dorsum. Female differs in colour and markings from male in Labium, face, vertex and the occiput uniform dark olivaceous. Prothorax and thorax similar to as in male. Abdomen with dorsal markings broad.

Material examined/Source : Prasad, 1996; Kulkarni, *et al.*, 2004; Kulkarni and Prasad, 2005; Kulkarni and Talmale, 2005; Kulkarni *et al.*, 2006.

Distribution : Throughout India : Maharashtra (Nathsagar Wetland, Aurangabad, Melghat Tiger Reserve, Amravati, Pench National Park, Nagpur, Tadoba-Andhari Tiger Reserve, Chandrapur).

Elsewhere : Nepal; Malaysia; Myanmar; Formosa; Taiwan.

9. *Pseudagrion spencei* Fraser

1922. *Pseudagrion spencei* Fraser, *Mem. Dept. Agric. India (Ent.)*, 7(7) : 47-48.

1923. *Pseudagrion spencei*, Fraser, *J. Bombay nat. Hist. Society*, 29 : 755-759.

1987. *Pseudagrion spencei*, Prasad, *et al.*, *Bull. zool. Surv. India*, 8(1-3) : 317-318.

Diagnostic characters : Head : Labium white; labrum, bases of mandibles, genae, clypeus, frons, basal joints of antennae and the vertex as far as the anterior ocellus pale greenish blue, rest of head black. Prothorax black on dorsum, with small geminate spot on the mid dorsum. Thorax pale azure blue, with the mid dorsum broadly black. Legs pale, femora rather broadly black on the exterior surface. Wings hyaline, pterostigma very narrow. Abdomen azure blue, marked with black. Female differs from male mainly in Labrum, bases of mandibles and genae pale ochreous, rest of head olivaceous, tinged with ochreous. Prothorax pale ochreous or greenish blue. Thorax pale bluish green, wings and legs similar to male. Abdomen ochreous with black markings.

Material examined/Source : Kulkarni, *et al.*, 2006.

Distribution : India : Maharashtra (Tadoba-

Andhari Tiger Reserve, Chandrapur), Asam, Bihar, Chandigarh, Maharashtra, Uttar Pradesh, West Bengal.

Remarks : Mainly found in plains but also recorded from Ootakmund Nilgiris, 7250' and Coorg 4000' elevations.

Subfamily COENAGRIONINAE

Genus *Cercion* Navas, 1907

10. *Cercion malayanum* (Selys)

1876. *Enellagma malayanum* Selys, *Bull. Acad. Belg.*, (2) Vol. xii : 536.

1933. *Enellagma malayanum*, Fraser, *Fauna Brit. India, Odonata*, 1 : 375-376.

1995. *Cercion malayanum*, Prasad and Varshney, *Oriental Ins.*, 29 : 389.

Material examined/Source : Fraser, 1933; Prasad, 1996.

Distribution : India : Assam; Maharashtra (Nagpur).

Elsewhere : Sri Lanka.

Subfamily ISCHNURINAE

Genus *Aciagrion* Selys, 1891

11. *Aciagrion hisopa hisopa* (Selys)

1876. *Pseudagrion hisopa* Selys, *Bull. Acad. Belg.*, (2) Vol. xii : 509.

1995. *Aciagrion hisopa hisopa*, Prasad and Varshney, *Oriental Ins.*, 29 : 390.

Material examined/Source : Fraser, 1933; Prasad, 1996.

Distribution : India : Maharashtra, Karnataka, Kerala, Goa.

12. *Aciagrion hisopa krishna* Fraser

1921. *Aciagrion hisopa racei krishna* Fraser, *J. Bombay Nat. Hist. Soc.*, 27 : 543.

1995. *Aciagrion hisopa krishna* Prasad and Varshney, *Oriental Ins.*, 29 : 390

Material examined/Source : Fraser, 1933.

Distribution : India : Maharashtra (Pune, Mahabaleshwar, Western Ghats).

13. *Aciagrion occidentale* Laidlaw

1919. *Aciagrion hisopa* (Selys)? *Race occidentalis* Laidlaw, *Rec. Indian Mus.*, **15** : 186.
1933. *Acegrion occidentale*, Fraser, *Fauna Brit. India, Odon.*, **1** : 335-337.
1996. *Aciagrion occidentale*, Prasad, 1996, *Rec. Zool. Surv. India*, **95**(3-4) : 182.

Diagnostic characters : Head : labium white, labrum pale blue, with a median spot and its base narrowly black; genae, anteclypeus, and frons pale azure blue; post clypeus black, rest of head black. Eyes bottle green above, with a small black cap, palest blue beneath. Prothorax black on dorsum, azure blue laterally, anterior lobe entirely blue posterior is finely lined by yellow. Thorax pale azure blue, the dorsum steely black as far as mid way, marked with a narrow greenish-yellow antehumeral stripe on each side. Legs palest blue, femora broadly black on extensor surface. Wings hyaline, very narrow; pterostigma of fore-wing almost double the size of that of hind-wing. Abdomen extremely slender and long, pale azure blue at sides of segment 1 to 3, pale yellow from 4 to 7, blue from 8 to 10. Anal appendages black. Female : Similar to male but robust and with stouter abdomen. Anal appendages very small, conical, black.

Material examined/Source : Prasad, 1996; Kulkarni and Prasad, 2002.

Distribution : India : Maharashtra (Ujani Wetland, Pune Dist.), South India.

Elsewhere : Sri Lanka.

14. *Aciagrion pallidum* Selys

1891. *Aciagrion pallidum* Selys, *Ann. Mus. Civ. Genova*, (2) **10**(30) : 512-513.
1933. *Aciagrion pallidum*, Fraser, *Fauna Brit. India, Odonata*, **1** : 344-345.

Material examined/Source : Fraser, 1933; Prasad, 1996.

Distribution : India : Assam, Bihar, Eastern and Western Himalayas, Maharashtra (Pune and Satara Dists.), Orissa, Uttar Pradesh, Western Ghats.

Elsewhere : Myanmar.

Genus *Enallagma* Charp., 1840**15. *Enallagma parvum* Selys**

1876. *Enallagma parvum* Selys, *Bull. Acad. Belg.*, (2) **41** : 537.
1933. *Enallagma parvum*, Fraser, *Fauna Brit. India, Odonata*, **1** : 376-378.

Diagnostic characters : Head : Labium white, labrum, bases of mandibles, genae and anteclypeus pale sky blue; vertex & occiput black. Prothorax broadly black on dorsum, the sides pale blue, Thorax black on dorsum laterally pale blue; legs white, spines short 4-5 on hind tibiae. Wings, pterostigma small, less than one cell, blackish in adults. Abdomen pale sky blue. In females ground colour of thorax greenish yellow to yellow abdomen with dorsal strips broader. Heterochrome females also recorded (Fraser, 1933). Female specimens not present in the collection.

Material examined/Source : Kulkarni and Prasad, 2005; Kulkarni *et al.*, 2006.

Distribution : Throughout India, Maharashtra (Melghat Tiger Reserve, Amravati, Tadoba – Andhari Tiger Reserve, Chandrapur).

Elsewhere : Nepal, Myanmar and Sri Lanka.

Remarks : It is a small damselfly, smallest within the genus and is found on waters of weedy tanks, almost throughout the year.

Genus *Ischnura* Charp., 1840**16. *Ischnura aurora aurora* (Brauer)**

1858. *Agrion delicatum* Hagen, *Verh. Zool-bot. Ges. Wien.*, **8** : 479.
1865. *Ischnura aurora*, Brauer, *Verh. Zool. bot. Ges. Wein.*, **15** : 509.
1954. *Ischnura aurora*, Lieftinck, *Treubia*, **22** : 74.
1995. *Ischnura aurora aurora*, Prasad and Varshney, *Oriental Ins.*, **29** : 390.

Diagnostic characters : Head : Labium white; Labrum citron yellow; vertex bronzed black; eyes beautifully olive green, with semi lunar spot bordering it. Prothorax bronzed black on dorsum, sides and anterior lobe blue. Thorax black on dorsum, Legs pale citron-yellow, wings: pterostigma differs in fore & hind wings, in fore wings kite shaped, broader than long rose red for

proximal half; in the hind wing much smaller about half the size. Abdomen citron yellow except segments 8 to 10 which are azure blue.

Material examined/Source : Prasad, 1996; Kulkarni and Prasad, 2002; Talmale and Kulkarni, 2003; Kulkarni *et al.*, 2004; Kulkarni and Prasad, 2005; Kulkarni and Talmale, 2005; Kulkarni *et al.*, 2006 and Kulkarni and Talmale, 2009.

Distribution : Throughout India : Maharashtra (Ujani Wetland, Pune Dist.; Laknani Bhandara Dist ; Pench National Park, Nagpur Dist.; Melghat Tiger Reserve, Amravati Dist.; Tadoba–Andhari Tiger Reserve, Chandrapur Dist.; Nathsagar Wetland, Aurangabad & Ahmednagar Dist.).

Elsewhere : Australia; Indonesia; Malaysia; Myanmar; Nepal; New Guinea; Papua; Philippines; Sri Lanka and Sondaic Archipelago.

Remarks : Widely distributed, found in grasses & marshy places around water bodies.

17. *Ischnura senegalensis* (Rambur)

1842. *Agrion senegalensis* Rambur, *Ins. Neurop.*, 276.

1933. *Ischnura senegalensis*, Fraser, *Fauna Brit. India, Odonata*, 1 : 348-351.

1988. *Ischnura senegalensis*, Prasad & Ghosh, *Rec. zool. Surv. India*, 85(2) : 202.

Diagnostic characters : Head : Labium pale yellow, labrum pale blue, narrowly black along the base. Prothorax black, the anterior collar pale blue, sides pale green; thorax bronzed black on dorsum. Legs black, exterior surfaces of tibiae and tarsi yellow. Wings hyaline, pterostigma of fore-wings very oblique, diamond shaped, black. Abdomen black, marked with yellow and blue. Anal appendages black and yellow. Female : Fraser (1933) described three forms of females with difference in colouration of head, prothorax, thorax and abdomen. All forms having similar wings and pterostigma.

Material examined/Source : Prasad, 1996; Kulkarni and Prasad, 2002; Kulkarni *et al.*, 2004; Kulkarni and Talmale, 2005; Kulkarni *et al.*, 2006 a & b.

Distribution : India : Maharashtra (Lone; Ujani Wetland, Pune Dist.; Pench National Park, Nagpur

Dist.; Nathsagar Wetland, Aurangabad & Ahmednagar Dist.; Tadoba–Andhari National Park, Chandrapur Dist.; Sanjay Gandhi National Park, Borivali, Mumbai); Manipur, Himachal Pradesh, South India, Uttar Pradesh.

Elsewhere : Australia, New Gunia, Philippines, Samoa and Sondaic Archipelago.

Genus *Rhodischnura* Laidlaw, 1919

18. *Rhodischnura nursei* (Morton)

1907. *Ischnura nursei* Morton, *Trans. Ent. Soc. Lond.*, 306-307.

1920. *Rhodischnura nursei*, Laidlaw, *Rec. Indian Mus.*, 15 : 171, 177.

1995. *Rhodischnura nursei*, Prasad & Varshney, *Oriental Ins.*, 29 : 391.

Diagnostic characters : The only species of the genus. Head : Labium bright yellow, labrum, bases of mandibles, genae, anteclypeus and frons pale greenish yellow, post clypeus, vertex and occiput black. Prothorax broadly black on dorsum. Thorax broadly black on dorsum, marked with narrow green antehumeral stripes. Legs pale yellow, with few black spines on the tibiae. Wings hyaline, pterostigma of fore wings diamond shaped. Abdomen segments 1–4 bright crimson, segment 5 and the basal two thirds of 6 citron yellow, segment 7 to 10 and apical third of 6 black. Anal appendages reddish. Heterochromes and isochromes forms are described (Fraser 1933).

Material examined/Source : Kulkarni *et al.*, 2004 and 2006.

Distribution : India : Agra, Bihar, Gujrat, Maharashtra (Pench National Park, Nagpur Dist.; Tadoba–Andhari tiger Reserve, Chandrapur Dist.), North India, Rajasthan, West Bengal.

Subfamily AGRIOCNEMIDINAE

Genus *Agrioncemis* Selys, 1877

19. *Agriocnemis femina* (Brauer)

1868. *Ischnura femina* Brauer, *Verh. Zool. Bot. Ges. Wien.*, Vol. xviii, p. 554.

1933. *Agriocnemis femina*, Fraser, *Fauna Brit. India, Odonata*, 1 : 402-404.

Material examined/Source : Prasad, 1996.

Distribution : India : Assam, Maharashtra (pune); West Bengal and South Andaman Islands; Annam.

Elsewhere : China; Indonesia; Lombok; Myanmar; North Celebes; Philippines; Singapore and Sri Lanka.

20. *Agriocnemis lacteola* Selys

1877. *Agriocnemis lacteola* Selys *Bull. Acad. Belg.*, 2(43) : 144.

1919. *Agriocnemis lacteola*, Laidlaw, *Rec. Indian Mus.*, 15 : 178.

1995. *Agriocnemis lacteola*, Prasad & Varshney, *Oriental Ins.*, 29 : 391.

Diagnostic characters : Head : Labium white, labrum creamy white; vertex and occiput black. Prothorax black on dorsum, palest blue or bluish white on sides; posterior lobe produced at its central part. Thorax black on dorsum as far as lateral as the anterior lateral suture, with two very narrow anterior lateral stripes. Legs white, spines black, few, on the hind tibiae. Wings hyaline, pterostigma pale blue, but with the three fourths black beneath. Abdomen pale blue, almost white on the proximal segments, marked with black. Anal appendages pale blue. Female stouter, with the markings more significant.

Material examined/Source : Kulkarni *et al.*, 2006.

Distribution : India: Assam, Bihar, Maharashtra (Tadoba-Andhari Tiger Reserve, Chandrapur Dist.), Meghalaya, Orissa, Sikkim and West Bengal.

21. *Agriocnemis pieris* Laidlaw

1919. *Agriocnemis pieris* Laidlaw, *Rec. Indian Mus.*, 16 : 179-180.

1933. *Agriocnemis pieris*, Fraser, *Fauna Brit. India, Odonata*, 1 : 284-385.

Material examined/Source : Fraser, 1933; Prasad, 1996.

Distribution : India : Karnataka; Maharashtra.

22. *Agriocnemis pygmaea* (Rambur)

1842. *Agriocnemis pygmaea*, Rambur, *Ins. Neurop.*, : 278.

1933. *Agriocnemis pygmaea*, Fraser, *Fauna Brit. India, Odonata*, 1 : 398-401.

1988. *Agriocnemis pygmaea*, Prasad and Ghosh, *Rec. zool. Surv. India*, 85(2) : 203.

Diagnostic characters : Head : Labium palest yellow, labrum metallic blue, anteclypeus, bases of mandibles, genae and frons pale apple green. Prothorax black on dorsum, anterior lobe and extreme edge of posterior lobe apple green. Thorax black on dorsum, marked with narrow antehumeral apple green stripes. Legs yellow, extensor surface of femora black. Wings hyaline, pterostigma pale yellow. Abdomen segments 1 to 6 pale greenish yellow, terminal segments brick red. Anal appendages brick red. Female more robust than male and is known to exhibit polymorphic forms.

Material examined/Source : Prasad, 1996; Kulkarni and Prasad, 2002; Talmale and Kulkarni, 2003; Kulkarni *et al.*, 2004 and 2006a, b & Kulkarni and Talmale, 2009.

Distribution : India : Assam, Himachal Pradesh, Chennai, Maharashtra (Ujani Wetland, Pune Dist.; Bhandara Dist.; Pench National Park, Nagpur Dist.; Tadoba-Andhari Tiger Reserve, Chandrapur Dist.; Sanjay Gandhi National Park, Borivali, Mumbai; Pune), Malabar, Manipur, Nicobar, Punjab, Rajasthan, Uttar Pradesh, West Bengal.

Elsewhere : Australia, Myanmar, Sri Lanka, China, Formosa, Java, Malaysia, Manila, North Guinea, Philippines, Singapore and Seychelles.

23. *Agriocnemis splendidissima* Laidlaw

1919. *Agriocnemis splendidissima* Laidlaw, *Rec. Indian Mus.*, 16 : 180-182.

1933. *Agriocnemis splendidissima* Fraser, *Fauna Brit. India, Odonata*, 1 : 392-394.

Material examined/Source : Fraser, 1933, Prasad, 1996.

Distribution : India : Madhya Pradesh, Maharashtra (Khandala, Pune Dist. and Kalyan, Thane Dist.), South India and West Bengal.

Genus *Mortonagrion* Fraser, 1920

24. *Mortonagrion varralli* Fraser

1920. *Mortonagrion varralli* Fraser, *J. Bombay Nat. Hist. Soc.*, 27 : 148.

1933. *Mortonagrion varralli*, Fraser, *Fauna Brit. India, Odonata*, 1 : 409-411.

Material examined/Source : Fraser, 1933.

Distribution : India : Maharashtra (Vihar and Pawai Lakes, Mumbai suburban Dist.), North-East India and Western Ghats, Goa (Kulkarni and Talmale, 2008).

Family PLATYCNEMIDIDAE

Subfamily PLATYCNEMIDINAE

Genus *Copera* Kirby, 1890

25. *Copera ciliata* (Selys)

1963. *Psilocnemis annulata* Selys, *Bull. Acad. Belg.*, (2)16 : 172.

1886. *Psilocnemis subannulata* Selys, *Mem. Cour.*, 38 : 125.

1933. *Copera annulata*, Fraser, *Fauna Brit. India, Odon.*, 1 : 203-206.

1995. *Copera ciliata*, Prasad & Varshney, *Oriental Ins.*, 29 : 392.

Diagnostic characters : Labium white; labrum, genae, bases of mandibles and clypeus pale blue. Labrum with a tiny median black point at base. Frons and vertex in front and laterally pale blue, with a broad bronzed black triangular area. Thorax dark bronzed blackish green on dorsum, marked on each side with a narrow, complete pale blue antehumeral stripes lying in juxtaposition to the humeral suture. Legs very long, hind femora extending nearly to the end of 2nd abdominal segment wholly black on dorsum. Anal appendages strongly arched, black at apices. Wings hyaline, pterostigma reddish-brown, framed in white and thick black nervures, poorly braced. 13-16 post nodal nervures in fore wings, 12-14 in the hind wings.

Material examined/Source : Kulkarni *et al.*, 2004, 2006.

Distribution : India : Assam, Himachal Pradesh, Maharashtra (Sanjay Gandhi National Park, Borivali, Mumbai; Pench National Park, Nagpur Dist.), Meghalaya, Uttar Pradesh, West Bengal, Manipur, South India.

Elsewhere : Malaysia, Indo-China, China, Japan.

Remarks : This species breeds in weedy ponds and small lakes. Specimens from the Pench National Park found 12-16 post nodal nervures in fore wings and 9-15 in hind wings.

26. *Copera marginipes* (Rambur)

1842. *Platycnemis marginipes* Rambur *Ins. Neurop.* : 240.

1933. *Copera marginipes*, Fraser, *Fauna Brit. India, Odonata*, 1 : 192-197.

Diagnostic characters : Head : Labium pale brownish white, labrum pale greenish yellow, frons and vertex bronzed black, eyes bordered with white stripes. Prothorax and thorax bronzed black on dorsum, legs variably bright orange to dull reddish. Wings, pterostigma brown. Abdomen bronzed black upto middle of segment 8, from which to the end pale bluish white to creamy white. Superior anal appendages only one fourth the length of interiors. Females with posterior lobe of prothorax without spines. Fraser (1933) has described Ceylon, Coorg, Westcoast, Deccan, Assam & Bengal forms with variation in colour patterns.

Material examined/Source : Fraser, 1933; Prasad, 1996; Talmale and Kulkarni, 2003; Kulkarni *et al.*, 2004, 2006 a, b; Kulkarni and Prasad, 2005; and Kulkarni and Talmale, 2009.

Distribution : India : Assam, Bihar, Chandigarh, Madhya Pradesh, Maharashtra (Lone, Khandala, Dist. Pune, Gondhoner, Wardha, Hingni, Wanarwira, Mahabaleshwar, Satara Dist., Lakhani, Bhandara Dist.; Pench National Park, Nagpur Dist.; Melghat Tiger Reserve, Amravati Dist.; Tadoba-Andhari Tiger Reserve, Chandrapur Dist., Sanjay Gandhi National Park, Borivali, Mumbai), Rajasthan, South Andaman Islands, West Bengal, Western Ghats & Western Himalaya.

Elsewhere : Indonesia; Malaysia; Myanmar; Nepal; Sri Lanka and Thailand.

27. *Copera vittata deccanensis* Laidlaw

1914. *Copera vittata* Laidlaw, *Rec. Indian Mus.*, 8 : 342.

1923. *Copera vittata deccanensis*, Laidlaw, *Rec. Indian Mus.*, 13 : 322.

1995. *Copera vittata deccanensis*, Prasad and Varshney, *Oriental Ins.*, 29 : 393.

Diagnostic characters : Head : Upper lip, genae and anteclypeus greenish white, frons, occiput black, with a broad creamy white transverse band covering ocelli. A pair of linear post ocular lines. Prothorax black above, with lateral yellow marks, bright lemon yellow below. Thorax black dorsally; creamy white antehumeral bands present., sides yellow, mottled with black. Abdomen black, segment 2 with fine longitudinal yellow line dorsally, 9 white above 10 entirely white. Legs lemon yellow. The females resemble male, but dull in color.

Material examined/Source : Kulkarni *et al.*, 2004 ; 2006a and b; Kulkarni and Talmale, 2009.

Distribution : India : Andhra Pradesh, Karnataka, Kerala, Maharashtra (Tadoba–Andhari Tiger Reserve, Chandrapur Dist.; Pench National Park, Nagpur Dist.; Sanjay Gandhi National Park, Borivali, Mumbai) and Tamil Nadu.

Family PLATYSTICTIDAE
Subfamily PLATYSTICTINAE
Genus *Protosticta* Selys, 1885
28. *Protosticta gravelyi* Laidlaw

1915. *Protosticta gravelyi* Laidlaw, *Rec. Indian Mus.*, 11 : 389-390.
1933. *Protosticta gravelyi* Fraser, *Fauna Brit. India, Odonata*, 1 : 103-105.

Material examined/Source : Fraser, 1933; Prasad and Varshney, 1995; Prasad, 1996.

Distribution : India : Maharashtra, South India, Western Ghats.

Family PROTONEURIDAE
Subfamily DISPARONEURINAE
Genus *Disparoneura* Selys, 1860

29. *Disparoneura quadrimaculata* (Rambur)

1842. *Argia quadrimaculata*, Ramb. *Ins. Neurop.*, : 255.
1859. *Disparoneura quadrimaculata*, Selys, *Bull. Acad. Belg.*, (2) X : 446.
1955. *Platylestes orientalis*, Baijal and Agarwal, *Agra. Univ. J. Res. (Sci.)*, 4(2) : 469.
1995. *Disparoneura quadrimaculata*, Prasad & Varshney, *Oriental Ins.*, 29 : 494.

Diagnostic characters : Head : Labium pale whitish brown; labrum, clypeus, vertex and occiput dull brick red, labrum with a small median black spot, prothorax dull brick red, thorax bright brick red on dorsum, paler at sides, marked with black. Legs pale brown, femora speckled out with black. Wings hyaline, the fore pair traversed by a broad blackish brown fascia, wings of male broadly barred with blackish brown across middle. Wings in females without any black markings. Abdomen brick red, marked with white brown and black (Fraser, 1933). Female differs considerably from male and more robust in build (not in the present collection).

Material examined/Source : Prasad, 1996; Kulkarni *et al.*, 2004; Kulkarni and Prasad, 2005, Kulkarni *et al.*, 2006 a and b; Kulkarni and Talmale, 2009.

Distribution : India : Central India, Delhi, Maharashtra (Ambenali, Satara Dist.; Melghat Tiger Reserve, Amravati Dist.; Pench National Park, Nagpur Dist.; Tadoba–Andhari Tiger Reserve, Chandrapur Dist.; Sanjay Gandhi National Park, Borivali, Mumbai), Uttar Pradesh and Western Ghats.

Genus *Elatoneura* Cowley, 1935

30. *Elatoneura nigerrima* (Laidlaw)

1917. *Disparoneura nigerrima* Laidlaw, *Rec. Indian Mus.*, 13 : 346-347.
1933. *Disparoneura nigerrima*, Fraser, *Fauna Brit. India, Odonata*, 1 : 236-238.
1995. *Elatoneura nigerrima*, Prasad and Varshney, *Oriental Ins.*, 29 : 394.

Material examined/Source : Fraser, 1934; Prasad, 1996.

Distribution : India : Central and Western India; Maharashtra (Satara).

Superfamily LESTOIDEA

Family LESTIDAE

Subfamily LESTINAE

Genus *Lestes* Leach 1815

31. *Lestes elatus* Hagen

1858. *Lestes elatus* Hagen, *Verh. Zool.-bot. Ges. Wein.*, 8 : 478.

1933. *Lestes elata*, Fraaser, *Fauna Brit. India, Odonata*, 1 : 37-40.
 1995. *Lestes elatus* Prasad and Varshney, *Oriental Ins.*, 29 : 395.

Material examined/Source : Prasad, 1996.

Distribution : India : Karnataka, Maharashtra, Orissa and Peninsular India.

Elsewhere : Sri Lanka.

32. *Lestes umbrinus* Selys

1891. *Lestes umbrina* Selys, *Ann. Mus. Civ. Genova*, (2), Vol. 10(30) : 497-498.
 1920. *Lestes umbrina*, Laidlaw, *Rec. Ind. Mus.*, 19 : 150-151.
 1930. *Lestes umbrina*, Fraser, *J. Bombay Nat. Hist. Soc.*, 34 : 89-90.
 1996. *Lestes umbrinus*, Prasad and Varshney, *Oriental Ins.*, 29 : 395.
 1996. *Lestes umbrinus*, Prasad, *Rec. zool. Surv. India*, 95(3-4) : 323.
 2003. *Lestes umbrinus*, Talmale and Kulkarni, *Bionotes*, 5(3) : 67-68.

Diagnostic characters : Head : Labium pale brown; labrum, bases of mandibles, and cheeks pale-yellowish brown; rest of head pale reddish-brown; antennae dark brown except two basal segments, which are yellowish; eyes brown above, yellow beneath. Prothorax and thorax reddish-brown on dorsum, pale yellowish-brown laterally, without markings. Legs reddish-yellow; black on outer surface. Wings palely infused, hyaline; pterostigma elongate, pale brown, the outer and inner borders creamy-white, covering about 1½ cells, braced. Abdomen reddish-brown, the dorsum dark brown, intersegmental sutures dark brown. Anal appendages brownish-yellow, darkening at apex. Female : Exactly similar to male.

Material examined/Source : Talmale and Kulkarni, 2003.

Distribution : India : Central India, Maharashtra (Lakhani, Bhandara Dist.), West Bengal.

Elsewhere : Jawa; Philippines.

33. *Lestes viridulus* Rambur

1842. *Lestes viridula* Rambur, *Hist. Nat. Ins. Neurop.*, 252-253.

1890. *Lestes viridulus*, Kirby, *Cat. Odon.*, 163.

1995. *Lestes viridulus*, Prasad and Varshney, *Oriental Ins.*, 29 : 395.

Diagnostic characters : Head : Labium pale yellow, Labrum, clypeus, frons, vertex and occiput pale brown, behind the eyes pale yellow; eyes brown above, golden yellow below, prothorax pale brown uniformly, thorax pale yellow; dorsum of thorax with two very narrow conspicuous metallic green stripes running parallel. Legs pale yellow with black spines. Abdomen pale yellow at sides and almost white beneath. Anal appendages yellow, tipped with black. Females coloured as in males with a longitudinal black stripe on all femora.

Material examined/Source : Prasad, 1996; Kulkarni *et al.*, 2004; Kulkarni and Prasad, 2005, Kulkarni *et al.*, 2006.

Distribution : Throughout India, Maharashtra (Chinchani, Dist. Satara; Melghat Tiger Reserve, Dist. Amravati; Tadoba-Andhari Tiger Reserve, Dist. Chandrapur; Pench National park, Dist. Nagpur).

Elsewhere : Thailand.

Remarks : Common in dry season and usually among dry long grasses.

Superfamily CALOPTERYGOIDEA

Family CALOPTERYGIDAE

Subfamily CALOPTERYGINAE

Genus *Neurobasis* Selys, 1853

34. *Neurobasis chinensis chinensis* (Linnaeus)

1758. *Libellula chinensis* Linnaeus, *Syst. Nat.*, 1 : 545.
 1933. *Neurobasis chinensis chinensis*, Fraser, *Fauna Brit. India, Odonata*, 2 : 121-124.

Material examined/Source : Fraser, 1933; Prasad, 1996.

Distribution : Throughout India.

Genus *Vestalis* Selys, 1853

35. *Vestalis apicalis apicalis* Selys

1873. *Vestalis apicalis* Selys, *Bull. Acad. Belg.*, (2)36 : 612.
 1921. *Vestalis apicalis* Fraser, *J. Siam. Soc.*, 4 : 164.
 1933. *Vestalis apicalis apicalis* Fraser, *Fauna Brit. India, Odonata*, 2 : 128-130.

1995. *Vestalis apicalis apicalis* Prasad & Varshney, *Oriental Ins.*, **29** : 397.

Diagnostic characters : Head : Labium, labrum, cheeks, bases of mandibles and basal joints of antennae bright yellow, rest of head metallic emerald green. Posterior lobe of prothorax more conspicuously bordered with yellow. Wings hyaline, apices of all wings broadly tipped with blackish brown for about distal 5 mm. Abdomen as in *Vestalis gracilis gracilis* (Rambur). Anal appendages black. Females closely similar to males, abdomen more coppery and less metallic. Apical markings on the wings usually paler and less sharply defined.

Material examined/Source : Kulkarni *et al.*, 2006.

Distribution : India : Assam, Maharashtra, (Sanjay Gandhi National Park, Borivali, Mumbai), Goa, Western and Eastern Ghats, West Bengal.

Elsewhere : Myanmar, Thailand.

36. *Vestalis gracilis gracilis* (Rambur)

1842. *Calopteryx gracilis* Rambur, *Ins. Neorop.*, : 224.
1934. *Vestalis gracilis gracilis* Fraser, *Fauna Brit. India, Odonata*, **2** : 126-128.
1988. *Vestalis gracilis gracilis* Prasad and Varshney, *Rec. zool. Surv. India, Occ. Paper*, **110** : 13-14.

Diagnostic characters : Head : labium, labrum, bases of mandibles, cheeks, basal segments of antennae bright yellow. Eyes : upper two thirds portion dark brown, the rest greenish yellow. Thorax brilliant metallic emerald green. Legs pale to dark brown. Wings hyaline, iridescent with colour of mother of pearl or blue in some, light uniformly so. Abdomen metallic green or blue. Anal appendages black. Females exactly similar to males in colour, but abdomen usually more dully metallic and segments 8 to 10 yellow laterally.

Material examined/Source : Kulkarni *et al.*, 2006 b.

Distribution : India : Maharashtra (Sanjay Gandhi National park, Borivali, Mumbai), Goa, Western and Eastern Ghats, West Bengal, Myanmar, Thailand.

Family CHLOROCYPHIDAE

Genus *Rhinocypha* Rambur, 1842

Subgenus *Heliocypha* Fraser, 1949

37. *Rhinocypha bisignata* (Selys)

1853. *Rhinocypha bisignata* Selys, *Syn. Cal.*, : 62.
1934. *Rhinocypha bisignata*, Fraser, *Fauna Brit. India, Odonata*, **2** : 49-52.
1995. *Rhinocypha (Heliocypha) bisignata*, Prasad and Varshney, *Oriental Ins.*, **29** : 397.

Material examined/Source : Prasad, 1996.

Distribution : India : Maharashtra (Khandala, Dist. Pune; Igatpuri, Dist. Nasik), Goa, South India.

Genus *Libellago* Selys, 1840

38. *Libellago lineata indica* (Fraser)

1919. *Micromerus lineatus* Fraser, *Rec. Ind. Mus.*, **16** : 197-198.
1934. *Libellago lineata indica*, Fraser, *Fauna Brit. India, Odonata*, **2** : 63-65.

Material examined/Source : Prasad, 1996.

Distribution : India : Maharashtra (Pune, Khandala, Pune Dist.), Western Ghats.

39. *Libellago lineata lineata* (Burmeister)

1839. *Calopterys lineate* Burmeister, *Handb. Ent.*, **2** : 826.
1934. *Libellago lineata lineata*, Fraser, *Fauna Brit. India, Odonata*, **2** : 60-63.

Material examined/Source : Prasad, 1996.

Distribution : India : Andaman Islands, Assam, Maharashtra (Pune, Hingni, Pune Dist. Lone, Wanarwira, Wardha Dist.), Meghalaya, North India and West Bengal.

Elsewhere : Indonesia; Penang; Thailand and throughout Sundaic Archipelago.

Suborder ANISOPTERA

Superfamily AESHNOIDEA

Family GOMPHIDAE

Subfamily GOMPHINAE

Genus *Anormogomphus* Selys, 1854

40. *Anormogomphus heteropterus* Selys, 1854

1854. *Anormogomphus heteropterus* Selys, *Bull. Acad. Belg.*, **21** : 61.

1934. *Anormogomphus heteropterus*, Fraser, *Fauna Brit. India, Odonata*, 2 : 174-176

Material examined/Source : Babu et al. (2009).

Distribution : India : Arunachal Pradesh, Bihar, Himachal Pradesh, Maharashtra (Aurangabad), Orissa, Punjab and Uttarakhand.

Elsewhere : Pakistan.

Genus *Burmagomphus* Williamson, 1907

41. *Burmagomphus pyramidalis pyramidalis*
Laidlaw

1922. *Burmagomphus pyramidalis* Laidlaw, *Rec. Ind. Mus.*, 24 : 371.

1934. *Burmagomphus pyramidalis*, Fraser, *Fauna Brit. India, Odonata*, 2 : 213-215.

Material examined/Source : Fraser, 1934; Prasad, 1996.

Distribution : India : Western Ghats, Maharashtra (Pune).

Genus *Cyclogomphus* Selys, 1854

42. *Cyclogomphus heterostylus* Selys

1854. *Cyclogomphus heterostylus* Selys, *Bull. Acad. Belg.* 21, Pt. 2, p. 62.

1943. *Cyclogomphus heterostylus*, Fraser, *Fauna Brit. India, Odonata*, 2 : 182-183.

Material examined/Source : Fraser, 1934; Prasad, 1996.

Distribution : India : Maharashtra (Katraj lake, Pune).

43. *Cyclogomphus vesiculosus* Selys

1873. *Cyclogomphus vesiculosus* Selys, *Bull. Acad. Belg.*, (2) 36 : 300.

1995. *Cyclogomphus vesiculosus*, Prasad & Varshney, *Oriental Ins.*, 29 : 400.

Material examined/Source : Fraser, 1934; Prasad, 1996.

Distribution : India : Maharashtra (Katraj lake, Pune), Madhya Pradesh.

44. *Cyclogomphus wilkinsi* Fraser

1925. *Cyclogomphus wilkinsi* Fraser, *J. Bombay Nat. Hist. Soc.*, 30 : 854.

1934. *Cyclogomphus wilkinsi* Fraser, *Fauna Brit. India, Odonata*, 2 : 183-185.

Material examined/Source : Fraser, 1934; Prasad, 1996.

Distribution : India : Karnataka, Maharashtra, (Pune, Moshi).

45. *Cyclogomphus ypsilon* Selys

1854. *Cyclogomphus ypsilon* Selys, *Bull. Acad. Belg.*, 21 : 62.

1934. *Cyclogomphus ypsilon*, Fraser, *Fauna Brit. India, Odonata*, 2 : 180-182.

Material examined/Source : Fraser, 1934; Prasad, 1996.

Distribution : India : Maharashtra (Katraj lake, Pune), Central India.

Genus *Macrogomphus* Selys, 1857

46. *Macrogomphus annulatus* Selys

1854. *Heterogomphus annulatus* Selys, *Bull. Acad. Belg.*, 21 : 28.

1934. *Macrogomphus annulatus*, Fraser, *Fauna Brit. India, Odonata*, 2 : 342-344.

Material examined/Source : Fraser, 1934; Prasad, 1996.

Distribution : India : Maharashtra (Pune).

Genus *Microgomphus* Selys, 1857

47. *Microgomphus torquatus* (Selys)

1854. *Cyclogomphus torquatus* Selys, *Bull. Acad. Belg.*, 21 : 63.

1934. *Microgomphus torquatus* Fraser, *Fauna Brit. India, Odonata*, 2 : 353-355.

Material examined/Source : Fraser, 1934; Prasad, 1996.

Distribution : India : Maharashtra (Satara, Pune).

48. *Microgomphus verticalis* (Selys)

1873. *Cyclogomphus verticalis* Selys, *Bull. Acad. Belg.*, (2).

1934. *Microgomphus? verticalis*, Fraser, *Fauna Brit. India, Odonata*, 2 : 357.

1995. *Microgomphus verticalis*, Prasad & Varshney, *Oriental Ins.*, **29** : 400.

Material examined/Source : Fraser, 1934; Prasad, 1996.

Distribution : India.

Subfamily ONYCHOGOMPHINAE

Genus *Onychogomphus* Selys, 1854

49. *Onychogomphus grammicus* (Rambur)

1842. *Gomphus grammicus* Rambur, *Ins. Nevrop.*, P. 164.
 1854. *Onychogomphus grammicus*, Selys, *Bull. Acad. Belg.*, **21**(2) : 35.
 1936. *Onychogomphus grammicus*, Fraser, *Fauna Brit. India, Odonata*, **2** : 256-257.

Material examined/Source : Babu *et al.* (2009).

Distribution : India : Central India, Northern India and Maharashtra (Ahmednagar)

Genus *Paragomphus* Cowley, 1934

50. *Paragomphus lineatus* (Selys)

1850. *Gomphus lineatus* Selys, *Rev. Odon.*, : 386.
 1854. *Onychogomphus lineatus* Selys, *Bull. Acad. Belg.*, **21**(2) : 36.
 1924. *Mesogomphus lineatus*, Fraser, *Rec. Indian. Mus.*, **26** : 424, 477.
 1995. *Paragomphus lineatus*, Prasad & Varshney, *Oriental Ins.*, **29** : 402.

Diagnostic characters : Head : Labium, labrum, face & frons sandy yellow, vesicle and occiput yellow, separated by narrow, transverse dark brown streak. Prothorax blackish brown, thorax sandy yellow, legs yellow, marked with black, tarsi black, femora with two rows of spines. Abdomen black marked with yellow, anal appendages yellow. Females closely resemble males, much paler than males.

Material examined/Source : Prasad, 1996; Kulkarni, *et al.*, 2004; Kulkarni and Prasad, 2005; Kulkarni and Talmale, 2005 and Kulkarni, *et al.*, 2006.

Distribution : India : Karnataka, Maharashtra (Moshi, Dist. Pune; Kalyan River, Dist. Satara; Melghat Tiger Reserve, Dist. Amravati; Pench National park, Dist. Nagpur; Nathsagar Wetland,

Dist. Aurangabad & Ahmednagar; Tadoba Andhari Tiger Reserve, Dist. Chandrapur), Uttaranchal, Tamilnadu, West Bengal.

Remarks : Breeds both in still and running waters, camouflages with surroundings and a bit difficult to catch. Pale and dark forms are recorded in summer & monsoon.

Subfamily GOMPHOIDINAE

Genus *Gomphidia* Selys, 1854

51. *Gomphidia t-nigrum* Selys

1854. *Gomphidia T-nigrum* Selys, *Bull. Acad. Belg.*, **21** : 86.
 1934. *Gomphidia T-nigrum*, Fraser, *Fauna Brit. India, Odonata*, **2** : 383-384.

Material examined/Source : Fraser, 1934; Prasad, 1996.

Distribution : India : Maharashtra (Katraj lake, Pune).

Subfamily LINDENIINAE

Genus *Ictinogomphus* Cowley, 1934

52. *Ictinogomphus rapax* (Rambur)

1842. *Diastomma rapax* Rambur, *Ins. Neurop.*, : 169.
 1934. *Ictinus rapax*, Fraser, *Fauna Brit. India*, **2** : 373-376.
 1988. *Ictinogomphus rapax*, Prasad & Ghosh, *Rec. zool.Surv.India*, **85**(2) : 204.
 1995. *Ictinogomphus rapax*, Prasad & Varshney, *Oriental Ins.*, **29** : 403.

Diagnostic characters : Head : Labium yellow, bordered with brownish; labrum yellow, with heavy black border, face and frons greenish-yellow, ante clypeus yellow, post clypeus black. Thorax black, marked with yellow or greenish yellow, laterally yellowish green. Wings clear, slightly enfumed in the mature specimens. Pterostigma long, covering 5-6 cells, black. Legs black, coxae and trochanter yellow and a yellow stripe on the flexar surface of anterior femora. Abdomen black, marked with bright yellow. Anal appendages black. Female very similar to male.

Material examined/Source : Prasad, 1996; Kulkarni and Prasad, 2002; Kulkarni *et al.*, 2004;

Kulkarni and Talmale, 2005; Kulkarni, *et al.*, 2006 a & b and Kulkarni and Talmale, 2009.

Distribution : Throughout India: Maharashtra (Pench National park, Dist. Nagour; Nathsagar Wetland, Dist. Aurangabad & Ahmednagar; Ujani Wetland, Dist. Pune & Solapur, Tadoba Andhari Tiger Reserve, Dist. Chandrapur, Sanjay Gandhi National park, Borivali, Mumbai.).

Elsewhere : Mynamar, Sri Lanka and Malaysia except in desert area.

Family AESHNIDAE

Subfamily AESHNINAE

Genus *Anax* Leach, 1815

53. *Anax guttatus* (Burmeister)

- 1839 *Aeschna guttata* Burmeister, *Handb. Ent.*, 2 : 840
 1842. *Anax magnus*, Rambur, *Ins. Neurop.*, : 188.
 1867. *Anax guttatus*, Hagen, *Verh. zool.-bot. Ges. Wien.*, 16 : 39.
 1922. *Anax goliathus*, Fraser, *J. Bombay Nat. Hist. Soc.*, 28 : 900.
 1995. *Anax guttatus*, Prasad & Varshney, *Oriental Ins.*, 29 : 403.

Diagnostic characters : Labium and labrum bright ochreous, the later narrowly bordered with black. Face and frons golden yellow or sometimes bright greenish yellow, usually unmarked. Eyes blue during life. Occiput bright yellow, black behind Prothorax reddish brown, bordered with yellow and with anterior collar yellow. Thorax pale green, unmarked, save for sutures beneath, which are reddish brown. Wings hyaline, rarely enfumed, but a large part of amber-yellow on hind wing lying between discoidal cell and a point slightly distal to node,. Pterostigma ferruginous above, bright ochreous beneath, covering 2 cells. Membrane black, with a patch of white at extreme base. Abdomen with orange coloured markings Anal appendages reddish brown.

Material examined/Source : Prasad, 1996; Kulkarni *et al.*, 2004.

Distribution : Throughout India : Maharashtra (Sinhagad fort, Dist. Pune; Pench National Park, Dist. Nagpur).

Elsewhere : Myanmar, Thailand, Java and Sumatra.

54. *Anax immaculifrons* Rambur

1842. *Anax immaculifrons* Rambur, *Ins. Neurop.*, : 189.
 1936. *Anax immaculifrons*, Fraser, *Fauna Brit. India, Odon.*, 3 : 145-146.
 1995. *Anax immaculifrons*, Prasad & Varshney, *Oriental Ins.*, 29 : 403.

Diagnostic characters : Labium dirty or pale ochreous; labrum greenish yellow heavily bordered with blackish brown. Face and frons uniform pale brownish-green, with a very narrow black border at the base of frons above. Occiput palest blue. Prothorax dark reddish brown, paler laterally, posterior lobe with heavy fringe of long hairs, Thorax pale bluish-green on dorsum, turquoise-blue on sides broadly barred with jet black. Legs black. Wings hyaline, tinted with amber yellow from apex to base of discoidal cell, paler at apex, rather deeply towards the base of wing. Pterostigma ochreous to reddish brown, covering about 3 cells. Discoidal cell of forewing with 5-6 cells, 4-5 in the hind; 5-6 cubital nervures in fore wings, 4 in the hind; 12 cells in the anal loop. Abdomen : segment 1 entirely jet black, segment 2 turquoise-blue with black sutures.

Material examined/Source : Prasad, 1996; Kulkarni and Prasad, 2002; Kulkarni *et al.*, 2004; Kulkarni *et al.* 2006; Kulkarni and Talmale, 2009.

Distribution : India : Bihar, Chandigarh, Eastern Ghats, Maharashtra (Sinhagad fort, Ujani Wetland, Dist. Pune; Pench National Park, Dist. Nagpur; Sanjay Gandhi National Park, Borivali, Mumbai); Sikkim, West Bengal and Western Himalaya.

Elsewhere : Sri Lanka.

Genus *Hemianax* Selys, 1883

55. *Hemianax ephippiger* (Burmeister)

1839. *Aeschna ephippiger* Burmeister, *Handb. Ent. Band*, ii : 840.
 1936. *Hemianax ephippiger* Fraser, *Fauna Brit. India, Odonata*, 3 : 147-149.

Material examined/Source : Fraser, 1936; Prasad, 1996.

Distribution : India : Maharashtra : (Pune, Mumbai).

Genus *Gynacantha* Rambur, 1842

56. *Gynacantha bayadera* Selys

1891. *Gynacantha bayadera*, Selys *Ann. Mus. Civ. Stor (x) Nat. Giacomo Doria, Genova*, 30 : 47.

1920. *Gynacantha millardi*, Fraser, *J. Bombay Nat. Hist. Soc.*, 27 : 147.

1925. *Gynacantha lyttoni*, Fraser, *J. Darjeeling Nat. Hist. Soc.*, 9 : 31-33.

1995. *Gynacantha bayadera*, Prasad & Varshney, *Oriental Ins.*, 29 : 404.

Diagnostic characters : Large sized dragonfly with homogenous colour of dull brown and green. Wings long and broad, very closely reticulated and palely tinted at bases. Abdomen markedly constricted at segment 3, of even width and cylindrical from segment 4 to end of abdomen. Anal appendages bright ochreous changing to reddish brown at apices. Females indetical to males in colouration.

Material examined/Source : Prasad, 1996; Talmale and Kulkarni, 2003; Kulkarni *et al.*, 2004; Kulkarni and Prasad, 2005 and Kulkarni *et al.*, 2006.

Distribution : India : Karnataka, Maharashtra (Lakhani, Dist. Bhandara; Pench National Park, Dist. Nagpur; Melghat Tiger Reserve, Dist. Amravati; Tadoba-Andhari Tiger Reserve, Dist. Chandrapur); Meghalaya, Orissa, Sikkim, and West Bengal.

Elsewhere : Myanmar, Sikkim, Malaysia and Indo China.

Remarks : *Gynacantha millardi* Fraser synonymysed under *Gynacantha bayadera* Selys.

Superfamily LIBELLULOIDEA

Family CORDULIIDAE

Subfamily CORDULINAE

Genus *Hemicordulia* Selys, 1870

57. *Hemicordulia asiatica* Selys

1878. *Hemicordulia asiatica* Selys, *Bull. Acad. Belg.*, (2) Vol. xiv : 186.

1936. *Hemicordulia asiatica*, Fraser, *Fauna Brit. India, Odonata*, 3 : 213-215.

Material examined/Source : Fraser, 1936; Prasad and Varshney, 1995; Prasad, 1996.

Distribution : India : Assam; Maharashtra, Meghalaya and Western Ghats : (Ootacamund and Livadele, Nilgiris).

Subfamily MACROMIINAE

Genus *Epophthalmia* Burmeister, 1839

58. *Epophthalmia frontalis frontalis* Selys

1871. *Epophthalmia frontalis* Selys, *Bull. Acad. Belg.*, (2)31 : 530.

1936. *Epophthalmia frontalis frontalis*, Fraser, *Fauna Brit. India, Odonata*, 3 : 197-199.

Material examined/Source : Prasad, 1996.

Distribution : India : Assam, Maharashtra and Western Himalaya.

59. *Epophthalmia vittata vittata* Burmeister

1839. *Epophthalmia vittata* Burmeister, *Handb. Ent.*, 2 : 845.

1867. *Azuma cynocephala*, Hagen, *Verh. zool-bot. Ges. Wien.*, 17 : 59-60.

1936. *Epophthalmia vittata vittata*, Fraser, *Fauna Brit. India, Odon.*, 194-196.

Diagnostic characters : Dragonflies of very large size and robust build. Labium dark, ochreous labrum reddish brown, marked with two narrow bright yellow spots. Frons and vesicle dark, metallic blue. Frons with a rounded spot on each side in front and a crown shaped spot in the middle of the sulcus above. Eyes bluish green during life. Occiput black. Prothorax ochreous. Thorax dark, reddish brown, with the upper part of the dorsum and darker areas on the side with a bluish green metallic reflex and marked with citron yellow. Wings hyaline, with the extreme apices slightly enfumed and the tornal angle of the hind wing bearing a patch of bright amber colour; pterostigma short and narrow, dark blakish-brown, covering less than two cells. Abdomen dark reddish brown to dark ochreous marked with dark ochreous annules. Anal appendages pale ochreous to dark reddish-brown.

Material examined/Source : Kulkarni *et al.*, 2004.

Distribution : India : Maharashtra (Mahabaleshwar, Dist. Satara; Khandala, Dist. Pune; Pench National Park, Dist. Nagpur), Peninsular India, Uttar Pradesh, West Bengal.

Genus *Macromia* Rambur, 1842

60. *Macromia flavicincta* Selys

1874. *Macromia flavicincta* Selys, *M.H. Mus. Dresden.*, : 316.

1936. *Macromia flavicincta*, Fraser, *Fauna Brit. India, Odonata*, 3 : 171-174.

Material examined/Source : Fraser, 1936; Prasad, 1996.

Distribution : India : Maharashtra (Mahabaleshwar, Dist. Satara; Pune).

61. *Macromia cingulata* Rambur

1842. *Macromia cingulata* Rambur, *Ins. Neurop.*, : 137.

1936. *Macromia cingulata*, Fraser, *Fauna Brit. India, Odonata*, 3 : 179-182.

Material examined/ Source : Fraser, 1936.

Distribution : Peninsular India : Maharashtra (Khandala, Dist. Pune; Mahabaleshwar, Dist. Satara).

Family LIBELLULIDAE

Subfamily TETRATHEMISTINAE

Genus *Tetrathemis* Brauer, 1868

62. *Tetrathemis platyptera* Selys

1878. *Tetrathemis platyptera* Selys, *Mitt. Mus. Dresden.*, 316.

1936. *Tetrathemis platyptera*, Fraser, *Fauna Brit. India, Odonata*, 3 : 250-251.

Material examined/Source : Fraser, 1936; Prasad, 1996.

Distribution : Throughout India.

Elsewhere : Myanmar; Malacca; Java and Sumatra.

Subfamily BRACHYDIPLACTINAE

Genus *Brachydiplax* Brauer, 1868

63. *Brachydiplax sobrina* (Rambur)

1770 *Libellula sobrina* Rambur, *Ins. Neurop.*, : 114.

1936. *Brachydiplax sobrina*, Fraser, *Fauna Brit. India*, 3 : 325-327.

1988. *Brachydiplax sobrina*, Prasad & Ghosh, *Rec. zool. Surv. India*, 85(2) : 206-207.

Diagnostic characters : Head : Labium yellow to pale brown, very narrowly black at borders; labrum bright yellow, bordered with black, face and frons creamy white, occiput dark brown with a bright yellow geminate spot behind. Prothorax dark brown. Thorax olivaceous brown to greenish yellow, with black or metallic markings on dorsum. Legs black, anterior femora yellow, three stripes on inner side. Wings hyaline uncoloured, pterostigma pale yellow between black nervures. Abdomen black, pruinose blue in old adults, but marked with yellow in sub adults.

Anal appendages black. Female similar to teneral male but ground colour of the thorax brighter yellow and the metallic stripes broad. Wings similar to males.

Material examined/Source : Prasad, 1996; Kulkarni *et al.*, 2006.

Distribution : India : Assam, Himachal Pradesh, Maharashtra (Tadoba-Andhari Tiger Reserve, Dist. Chandrapur), Punjab, Uttar Pradesh, Travancore, Western coast of India, West Bengal.

Elsewhere : Myanmar, and Sri Lanka.

Remarks : Found along the water bodies and ponds, specimens resting on twigs.

This species is smaller than other species of the genus.

Subfamily LIBELLULINAE

Genus *Cratilla* Kirby, 1900

*64. *Cratilla lineata calverti* Foerster

1878. *Orthemis lineata* Brauer, *Sitzungsber. Acad. Wien*. Vol. IXXVii : 9.

1936. *Cratilla lineata*, Fraser, *Fauna Brit. India*, 3 : 286-288.

Material examined/Source : Prasad, 1996, Kulkarni and Talmale, 2009.

Distribution : India : Maharashtra: (Moshi, Dist. Nashik) Orissa, Uttar Pradesh, Western Ghats.

Elsewhere : Indonesia; Malaysia; Myanmar; New Guinea, Philippines; Sri Lanka and Sundaic Archipelago.

Genus *Lathrecista* Kirby, 1889

65. *Lathrecista asiatica asiatica* (Fabr.)

1798. *Lathrecista asiatica asiatica* Fabricius, *Ent. Syst. Suppl.*, : 283.
 1867. *Libellula pectoralis*, Brauer, *Verh. zoo., bot., Ges. Wien.*, 17 : 19.
 1878. *Agrionoptera pectoralis*, Selys, *Mitt. Mus. Dresden.*, : 294.
 1909. *Lathrecista asiatica asiatica*, Ris. *Cat. Coll. Selys fasc.*, 9 : 129-132.
 1995. *Lathrecista asiatica asiatica*, Prasad & Varshney, *Oriental Ins.*, 29 : 408.

Diagnostic characters : Head : Labrum pale ochreous, with borders narrowly black, face, lower border of frons and sides broadly creamy yellow, upper surface of frons, vesicle and occiput black. Prothorax blackish brown with anterior lobe yellowish, Thorax dark coppery brown, two yellow spots on the antealar sinus. Laterally two black Y shaped markings with a narrow black stripe between, the anterior Y forming the posterior border of humeral yellow stripe, the posterior Y situated on the lateral suture and metepimeron. Legs dark reddish brown to black. Wings hyaline with apices usually more or less enfumed. Abdomen, segments 1 and 2 with a broad lateral stripe and a fine mid-dorsal one which, apical to jugal suture is bisected by the black mid dorsal carina. All sutures on segment 2 finely black. Segments 3-8 bright crimson red, with apical sutures finely black. Segments 9 and 10 black. Anal appendages black. Female resembles male except the sexual details.

Material examined/Source : Kulkarni, *et al.*, 2006 a, b.

Distribution : India : Maharashtra : (Tadoba-Andhari Tiger Reserve, Dist. Chandrapur; Sanjay Gandhi National Park, Borivali, Mumbai), South Andaman Is., West Bengal, Eastern and Western India.

Elsewhere : Indonesia, New Guinea, Malabar, Philippines, Samoa and Sondaic Archipelago.

Genus *Orthetrum* Newman 1833

66. *Orthetrum anceps* (Schneider)

1845. *Libellula anceps* Schneider, *Stett. Ent. Zeit.*, Vol. VI, p. III
 1936. *Orthetrum anceps*, Fraser, *Fauna Brit. India*, 3 : 295-296.

Material examined/Source : Prasad, 1996.

Distribution : India : Himachal Pradesh, Maharashtra (Lonawala, Vadgaon, Dist. Pune).

Elsewhere : Asia Minor; North African Coast; Pakistan and Persia.

67. *Orthetrum chrysis* (Selys)

1891. *Libella testacea* race ? *chrysis* Selys, *Ann. Mus. Cir. Genova*, 30 : 462.
 1936. *Orthetrum chrysis*, Fraser, *Fauna Brit. India*, 3 : 310-311

Material examined/Source : Fraser, 1936; Prasad, 1996.

Distribution : India : Western Ghats. Nilgiris;

Elsewhere : Borneo; Celebes; Jawa; Myanmar; Sri Lanka.

68. *Orthetrum glaucum* (Brauer)

1865. *Libellula glauca* Brauer, *Verh. Zool-bot. Ges. Wien.*, 15 : 1012.
 1890. *Orthetrum glaucum*, Kirby, *Cat. Odon.*, 39.
 1936. *Orthetrum glaucum*, Fraser, *Fauna Brit. India*, 3 : 307-309.

Diagnostic characters : Medium sized dragonfly with face black, eyes, dark green during life. Prothorax bright yellow to dark brown, marked with yellow; thorax in old adults pruinose dark dull blue or black. Legs black, wings hyaline, with extreme base tinted with dark amber-yellow upto the cubital nervure and up to anal triangle in hind wing; discoidal cell of hind wing entire. In female abdomen reddish brown with a broad greenish yellow stripe on mid dorsum extending up to segment 7 as against in males, pale dirty blue up to apical end of segment 8 & black for the remainder.

Material examined and locality : Prasad, 1996;

Kulkarni *et al.*, 2004; Kulkarni and Prasad, 2005; Kulkarni and Talmale, 2009.

Distribution : India : Arunachal Pradesh, Maharashtra (Melghat Tiger Reserve, Dist. Amravati; Pench National Park, Dist. Nagpur; Sanjay Gandhi National Park, Borivali, Mumbai; Lonawala Dist. Pune), Manipur, Meghalaya, Mizoram, West Coast, Western Himalaya.

Elsewhere : Sri Lanka, Nepal, Philippines, and Java.

Remarks : This species is found at altitudes up to 4000 mt. and recorded only on West coast in plains. Its occurrence in Melghat Tiger Reserve confirms its dwelling in plains.

69. *Orthetrum japonicum internum* MacLachlan

1894. *Orthetrum japonicum internum* MacLachlan, *Ann. Mag. Nat. Hist.*, **13**(6) : 431.

1936. *Orthetrum japonicum internum*, Fraser, *Fauna Brit. India*, **3** : 304-305.

Material examined/Source : Babu *et al.* (2009)

Distribution : India : Arunachal Pradesh, Assam, Maharashtra (Nagpur), Meghalaya, Nagaland and Western Himalaya.

Elsewhere : China, Japan, Myanmar, Nepal, Pakistan, Taiwan, Thailand and Vietnam.

70. *Orthetrum luzonicum* (Brauer)

1868. *Libellula luzonica* BRAUER, *Verh. Zool.-bot. Ges. Wien.*, **18** : 169, 732.

1936. *Orthetrum chrysostigma luzonicum*, Fraser, *Fauna Brit. India*, **3** : 298-300.

1976. *Orthetrum chrysostigma luzonicum*, Singh & Prasad, *Rec. zool. Surv. India*, **70** : 21-38.

1995. *Orthetrum luzonicum*, Prasad & Varshney, *Oriental Ins.*, **29** : 409.

Diagnostic characters : Head : Labium and labrum palest yellow, vesicle and occiput black, eyes during life bluish-green capped with violet. prothorax blackish brown, thorax pale olivaceous green on mid dorsum, with some clouding of brownish along the length of mid-dorsal carina. Legs blackish brown, anterior pair of femora bright yellow on extensor surface. Wings hyaline,

pterostigma bright ochreous bordered with black, covering about two cells. Abdomen dorsoventrally dilated at base, then narrow and tapered, pruinose pale azure-blue except at sides of segment 1,2 and base of 3, which are bright yellow, all sutures finely black. Anal appendages blackish brown. Female similar to males in colour and markings but usually paler and the dark markings are less extensive.

Material examined/Source : Kulkarni *et al.*, 2006.

Distribution : Throughout India : Maharashtra (Tadoba-Andhari Tiger Reserve, Dist. Chandrapur).

71. *Orthetrum pruinoseum neglectum* (Rambur)

1842. *Libellula neglecta*, Rambur, *Ins. Neurop.*, 86.

1936. *Orthetrum pruinoseum neglectum*, Fraser, *Fauna Brit. India*, **3** : 311-313.

Diagnostic characters : Head, with reddish brown colour progressively dark from labium to frons and up to vesicle & occiput; eyes blue black above, bluish-gray below during life. Prothorax and thorax reddish brown, legs black, wings hyaline with enfumed pale brown towards apices and with a reddish-brown basal marking in hind wing. Abdomen bright vermilion red in sub adults, purplish red in adults. Anal appendages red. Females differ from males in frons similar to rest of face in colour, eyes yellowish capped with brown. Thorax reddish brown, abdomen dull ochreous with sutures and borders all finely black, anal appendages dark ochreous and basal markings in wings pale and almost obsolete.

Material examined/Source : Prasad, 1996; Kulkarni *et al.*, 2004; Kulkarni and Prasad, 2005; Kulkarni *et al.*, 2006a & b and Kulkarni and Talmale, 2009.

Distribution : India : Himachal Pradesh, Maharashtra (Melghat Tiger Reserve, Dist. Amravati; Tadoba – Andhari Tiger Reserve, Dist. Chandrapur; Pench National Park, Dist. Nagpur; Sanjay Gandhi National Park, Borivali, Mumbai), Uttar Pradesh, Bihar;

Elsewhere : Nepal; Myanmar; Sri Lanka; Hong Kong; Thailand and Malaya.

72. *Orthetrum sabina sabina* (Drury)

1770. *Libellula sabina*, Drury, *Ill. Exot. Int.*, 1 : 114.

1936. *Orthetrum sabina*, Fraser, *Fauna Brit. India*, 3 : 300-302.

1995. *Orthetrum sabina sabina*, Prasad and Varshney, *Oriental Ins.*, 409.

Diagnostic characters : Head : Labium yellow, middle lobe brownish to black; labrum face and frons yellowish, variably marked on anterior surface with black; frons very deeply notched so as to form two triangular facets in front. Prothorax bright yellow, thorax greenish yellow, legs black. Abdomen greenish yellow with very broad apical black rings on segments 4 to 5, narrow ring on segments 6; segments 7 to 9 and base of 10 black.

Segments 1 and 3 enormously swollen dorso ventrally as well as laterally; 4 to 6 narrow, cylindrical, 7 to 9 dilated but compressed laterally; 10th very small. Anal appendages as long as segment 9. Females exactly like males.

Material examined/Source : Prasad, 1996; Talmale and Kulkarni, 2003; Kulkarni *et al.*, 2004; Kulkarni and Prasad, 2005; Kulkarni and Talmale, 2005; Kulkarni *et al.*, 2006 a,b and Kulkarni and Talmale, 2009.

Distribution : India : Bihar, Bilaspur, Himachal Pradesh, Kangra, Maharashtra (Melghat Tiger Reserve, Dist. Amravati; Pench National Park, Dist. Nagpur; Lakhani, Dist. Bhandara; Nathsagar Wetland, Dist. Aurangbad and Ahmednagar, Sanjay Gandhi National Park, Borivali, Mumbai), Sirmour, Uttaranchal.

Elsewhere : Somalia (Somali Land); Iraq; Iran; Nepal; Sri Lanka; Myanmar; Thailand; Micronesia (Ocenia); Samoa Island (Pacific Ocean) Indonesia (Java, Sumba, Timor); Papua (New Guinea); Australia; Egypt; Angola and most of African continent.

73. *Orthetrum taeniolatum* (Schn.)

1842. *Libellula neglecta*, Rambur, *Ins. Neurop.*, 86.

1936. *Orthetrum taeniolatum*, Fraser, *Fauna Brit. India*, 3 : 296-298.

1996. *Orthetrum taeniolatum*, Prasad, *Rec. zool. Surv. India*, 95(3-4) : 315.

Diagnostic characters : Head : Labium, labrum, face, frons and vesicle palest brown; occiput dark brown, prothorax & thorax pulverulent blue; legs black, hinder surface yellow, wings hyaline not enfumed, pterostigma ochreous. Abdomen pulverulent blue, anal appendages black.

Material examined/Source : Prasad, 1996; Kulkarni *et al.*, 2004; Kulkarni and Prasad, 2005; Kulkarni *et al.*, 2006 and Kulkarni and Talmale, 2009.

Distribution : Throughout India, Maharashtra (Melghat Tiger Reserve, Dist. Amravati; Tadoba-Andhari Tiger Reserve, Dist. Chandrapur; Pench National Park, Dist. Nagpur);

Elsewhere : Nepal and countries bordering Mediterranean Sea.

74. *Orthetrum testaceum testaceum* (Burmeister)

1839. *Libellula testacea* Burmeister, *Handb. Ent.*, 2 : 859.

1890. *Orthetrum testaceum*, Kirby, *Cat. Odon.*, p. 39.

1936. *Orthetrum testaceum testaceum*, Fraser, *Fauna Brit. India*, 3 : 309-310.

Material examined/Source : Babu *et al.* (2009).

Distribution : India : Arunachal Pradesh, Maharashtra (Pune) and Orissa.

Elsewhere : Bangladesh, China, Hong Kong, Indonesia, Malaysia, Philippines, Singapore, Thailand and Vietnam.

Genus *Potamarcha* Karsch, 1890

75. *Potamarcha congener* (Rambur)

1842. *Libellula obscura* Rambur, *Ins. Neurop.*, : 64.

1842. *Libellula congener*, Rambur, *Ins. Neurop.*, : 70.

1890. *Potamarcha obscura*, Karsch, *Ent. Zeit.*, 33 : 371.

1891. *Potamarcha congener*, Selys, *Ann. Soc. Espan.*, 20 : 221.

1936. *Potamarcha obscura*, Fraser, *Fauna Brit. India*, 3 : 289-291.

1995. *Potamarcha congener*, Prasad & Varshney *Oriental Ins.*, 29 : 410.

Diagnostic characters : The only species of the genus. Can be distinguished by arc situated

between the first and second antenodal nervures; 2 rows of cells between I R iii and Rspl. and anal field of hindwing rather broad with cells arranged in straight rows. They are dragonflies of moderate size, coloured black brown, marked with yellow but never of metallic colour.

Material examined/Source : Prasad, 1996; Kulkarni and Prasad, 2002; Kulkarni and Talmale, 2003; Kulkarni *et al.*, 2004; Kulkarni and Prasad, 2005; Kulkarni *et al.*, 2006 and Kulkarni and Talmale, 2009.

Distribution : India : Andhra Pradesh, Bihar, Karnataka, Madhya Pradesh, Maharashtra (Melghat Tiger Reserve, Dist. Amravati; Lakhani, Dist. Bhandara; Tadoba-Andhari Tiger Reserve, Dist. Chandrapur; Pench National Park, Dist. Nagpur; Ujani Wetland, Dist. Pune; Sanjay Gandhi National Park, Borivali, Mumbai); West Bengal, Uttarakhand, Tamil Nadu.

Elsewhere : Nepal, Myanmar; Sri Lanka; Philippines, Taiwan; Malaya Archipelago; Indonesia (Java, Sumatra); Papua (New Guinea) and North Australia.

Remarks : Common Species in India.

Subfamily SYMPETRINAE

Genus *Acisoma* Rambur, 1842

76. *Acisoma panorpoides panorpoides* (Rambur)

1842. *Acisoma panorpoides* Rambur, *Ins. Neurop.*, : 28.

1936. *Acisoma panorpoides panorpoides*, Fraser, *Fauna Brit. India*, 3 : 330-331.

1996. *Acisoma panorpoides panorpoides*, Prasad, *Rec. zool. Surv. India*, 95(3-4) : 316.

Diagnostic characters : Head : Labium creamy white, labrum pale yellow, face and frons palest azure blue, the later bordered with black at base, vesicle and occiput black. Prothorax black, with the anterior border of anterior lobe, and posterior lobe, mid dorsum of middle lobe of posterior lobe pale yellow. Thorax azure blue marbled with black, which colour forms an intricate pattern of hieroglyphics on dorsum and sides, sutures all narrowly black. Abdomen azure blue, marked with black, segments 6 and 7 black with large spot of the ground colour on each side, segments 8 to 10

entirely black. Anal appendages ; superiors very long, acute at apex and spined beneath; inferiors very broadly triangular, white at middle, bordered with black. Female entirely similar to male.

Material examined/Source : Prasad, 1996; Kulkarni and Prasad, 2002, Kulkarni *et al.*, 2004, 2006.

Distribution : India : Arunachal Pradesh, Assam, Bihar, Himachal Pradesh, Karnataka, Kerala, Madhya Pradesh, Maharashtra (Ujani Wetland, Dist. Pune; Pench National Park, Dist. Nagpur; Tadoba-Andhari Tiger Reserve, Dist. Chandrapur), Manipur, Meghalaya, Orissa, Punjab, Rajasthan, South India, Uttar Pradesh and West Bengal.

Elsewhere : China; Indonesia; Japan; Malayan Archipelago; Myanmar; Nepal; Philippines; Singapore; Sri Lanka and Thailand.

Genus *Brachythemis* Brauer, 1868

77. *Brachythemis contaminata* (Fabr.)

1793. *Libellula contaminata*, Fabricius, *Ent. Syst.*, 2 : 382.

1936. *Brachythemis contaminata*, Fraser, *Fauna Brit. India*, 3 : 365-366.

1996. *Brachythemis contaminata*, Prasad, *Rec. zool. Surv. India*, 95(3-4) : 316.

Diagnostic characters : Head : Labium pale ochreous; labrum reddish; face frons and vesicle olivaceous or pale green yellow, eyes broadly contiguous; prothorax with dark reddish brown stripes traversing anterior and posterior borders of middle lobe, thorax with obscure brownish stripes, wings hyaline, reticulation reddish, with a broad bright orange fascia extending from base within 2-3 cells of pterostigma in fore wing and as far as that organ in the hind; pterostigma rust red. Abdomen reddish-ochreous, marked with obscure dorsal and sub dorsal brown stripes. Females differ in colour, with hind wings very palely tinted with yellow at extreme base without orange fascia seen in the males, pterostigma bright ochreous. Abdomen pale olivaceous brown, with narrow black stripe on mid dorsal carina from segment 2 to end. Anal appendages yellow.

Material examined/Source : Prasad, 1996; Kulkarni and Prasad, 2002; Kulkarni and Talmale,

2003; Kulkarni *et al.*, 2004; Kulkarni and Prasad, 2005; Kulkarni and Talmale, 2005; Kulkarni *et al.*, 2006; Kulkarni and Talmale, 2009.

Distribution : India : Himachal Pradesh, Madhya Pradesh, Maharashtra, Bihar, Uttaranchal, West Bengal and East Himalaya.

Elsewhere : China; Indonesia; Malaysia; Myanmar; Nepal; Philippines; Singapore; Sri Lanka Taiwan and Thailand.

Remarks : It is common species in India and found in large numbers. Seen flying over water surface throughout year and recorded to undergo three generations annually.

Genus *Bradinopyga* Kirby, 1893

78. *Bradinopyga geminata* (Rambur)

1842. *Libellula geminata* Rambur, *Ins. Neurop.* : 90.

1936. *Bradinopyga geminata*, Fraser, *Fauna Brit. India*, 3 : 349-350.

1996. *Bradinopyga geminata*, Prasad, *Rec. zool. Surv. India*, 95(3-4) : 316-317.

Diagnostic characters : Head : Labium, labrum pale yellow or dark brown; rest of face & frons olivaceous, vesicle & occiput brown, prothorax and thorax cinereous or dirty pale yellow marbled with black. Wings hyaline, pterostigma black at center, pure white at distal and proximal ends, discoidal cell in forewing traversed only once, but in hind wing entire. Anal triangle 3 celled, abdomen coloured very similar to thorax. Anal appendages pale-creamy white. Female exactly similar to males.

Material examined/Source : Prasad, 1996; Kulkarni *et al.*, 2004; Kulkarni and Prasad, 2005; Kulkarni *et al.*, 2006 and Kulkarni and Talmale, 2009.

Distribution : India : Delhi, Madhya Pradesh, Bihar, Uttar Pradesh, West Bengal, Eastern Himalaya, Maharashtra; Peninsular India.

Elsewhere : Sri Lanka.

Remarks : This species is found in open and cultivated areas, near wells, small and cemented walls, and exhibits protective, cryptic colours. It is common in tanks, plastered March to October.

Genus *Crocothemis* Brauer, 1868

79. *Crocothemis servilia servilia* (Drury)

1770. *Libellula servilia*, Drury, *Ill. Ex. Ins.*, 1 : 16.

1936. *Crocothemis servilia servilia*, Fraser, *Fauna Brit. India*, 3 : 345-347.

1999. *Crocothemis servilia servilia*, Prasad, *Rec. zool. Surv. India*, 95(3-4) : 316-317.

Diagnostic characters : Head : Labium ferruginous; labrum blood red, anteclypeus pale red, rest of face and frons bright blood red; eyes during life blood red above, purple laterally. Prothorax and thorax ferruginous, often blood red on dorsum during life, legs ochreous, Wings, hyaline bases of all wings marked with rich amber yellow up to cubital nervure in forewing and to first antenodal nervure nearly to arc; apices of wings lined narrowly with pale brown in old specimens.

Females differ widely in colouration from the males. Labium pale yellow; labrum, face, frons and vesicle olivaceous; prothorax and thorax olivaceous brown. Wings similar to males but markings paler, abdomen ochreous, segments 8 & 9 blackish along mid dorsal carina.

Material examined/Source : Prasad, 1996; Talmale and Kulkarni, 2003; Kulkarni *et al.*, 2004; Kulkarni and Prasad, 2005; Kulkarni and Talmale, 2005; Kulkarni *et al.*, 2006 and Kulkarni and Talmale, 2009.

Distribution : India : Himachal Pradesh Uttaranchal; Madhya Pradesh, Bihar, West Bengal, Maharashtra.

Elsewhere : Iraq; Nepal; Myanmar; Sri Lanka; Philippines; Indonesia (Sumba); Australia; Sundaic Archipelago and Japan.

Remarks : Common species in India. Adults are seen throughout the year on wing. Teneral males and females are similar in colour, pale straw-yellow, differ from mature males, may confuse identity of the species.

Genus *Diplacodes* Kirby, 1889

80. *Diplacodes lefebvrei* (Rambur)

1842. *Libellula lefebvrei* Rambur, *Ins. Neurop.*, : 112.

1936. *Diplacodes lefebvrei*, Fraser, *Fauna Brit. India, Odonata*, 3 : 333.

Material examined/Source : Prasad, 1996.

Distribution : India; Chandigarh, Maharashtra, Rajasthan and South India.

Elsewhere : Africa and Mesopotamia.

81. *Diplacodes nebulosa* (Fabr.)

1793. *Libellula nebulosa* Fabricius, *Ent. Syst.*, 2 : 379.

1933. *Diplocodes nebulosa*, Fraser, *Fauna Brit., India*, 3 : 335-336.

2006. *Diplocodes nebulosa*, Kulkarni, *et al.*, *Conservation Area Series, Zool. Surv. India*, 25 : 217.

Diagnostic characters : Head : Labium blackish brown, labrum and face brown, marked with a yellow spot on each side of post clypeus and also on base of mandibles, frons and vesicle and upper surface of clypeus and also on base of mandibles. Prothorax, thorax, abdomen and legs entirely black. Sub adults and females with yellow markings on sides of thorax and abdomen. Wings with all apices blackish brown up to the proximal end of pterostigma.

Material examined/Source : Kulkarni *et al.*, 2006a.

Distribution : Assam, Bihar, Himachal Pradesh, Maharashtra (Tadoba-Andhari Tiger Reserve, Dist. Chandrapur), Madhya Pradesh, Punjab, Rajasthan, Uttar Pradesh, West Bengal.

Elsewhere : Myanmar; Sri Lanka; East of China; Java; Formosa; Philippines and Sumatra.

Remarks : Common species and occurs throughout the year.

82. *Diplacodes trivialis* (Rambur)

1842. *Libellula trivialis*, Rambur, *Ins. Neurop.*, : 115.

1935. *Diplacodes trivialis*, Fraser, *Fauna Brit. India*, 3 : 336-338.

1996. *Diplacodes trivialis*, Kulkarni, *et al.*, *Conservation Area Series, Zool. Surv. India*, 25 : 217-218.

Diagnostic characters : Head : Labium, labrum and bases of mandibles creamy yellow; face, frons, and vesicle palest azure blue with fine black line at the base of frons; Prothorax pale brown to black;

thorax greenish yellow with sutures finely black; the area between mid dorsal carina and humeral sutures olivaceous brown speckled with minute dots, colouration darkens with age. Legs greenish yellow, marked with black in subadults; wings hyaline with a minute yellow point in cubital space of hind wings; abdomen with segments 1 to 3 greenish yellow; remaining segments black with sub dorsal yellow stripes on segments 4-7. Females : Similar to subadult males, abdominal markings broader on segments 8 to 10.

Material examined/Source : Prasad, 1996; Kulkarni and Prasad, 2002; Kulkarni and Talmale, 2003; Kulkarni *et al.*, 2004; Kulkarni and Prasad, 2005; Kulkarni and Talmale, 2005; Kulkarni *et al.*, 2006 and Kulkarni and Talmale, 2009.

Distribution : Throughout India.

Elsewhere : Nepal; Myanmar; Sri Lanka; Thailand; W. Malaysia (Malacca) and Indonesia (Sumatra).

Remarks : Common species found throughout the year near water bodies. Also found in grassy vegetation & agricultural fields.

Genus *Indothemis* Ris, 1909

83. *Indothemis limbata limbata* (Selys)

1891. *Trithemis limbata* Selys, *Ann. Mus. Civ. Genova*, 30 : 463.

1911. *Indothemis limbata*, Ris, *Cat. Coll. Selys fasc.*, 13 : 530-531.

1936. *Indothemis limbata limbata*, Fraser, *Fauna Brit. India, Odonata*, 3 : 341-342.

Material examined/Source : Babu *et al.* (2009).

Distribution : India : Arunachal Pradesh, Assam, Maharashtra (Pune), Mizoram, Orissa, Karnataka and West Bengal.

Elsewhere : Malaysia; Myanmar; Singapore and Thailand.

Genus *Neurothemis* Brauer, 1867

84. *Neurothemis fulvia* (Drury)

1773. *Libellula fulvia* Drury, *Ill. Exot. Ins. li*, pl. xlvii, fig. 2, pp. 84, 85.

1936. *Neurothemis fulvia*, Fraser, *Fauna Brit. India*, 3 : 353-354.

1996. *Neurothemis fulvia*, Prasad, *Rec. zool. Surv. India*, **95**(3-4) : 318.

Material examined/Source : Fraser, 1936, Prasad, 1996.

Distribution : Throughout India.

Elsewhere : Australia; China; Hong Kong; Indonesia; Iraq; Kampuchea; Laos; Malaysia; Myanmar; Nepal; Philippines; Seychelles; Sri Lanka; Taiwan and Thailand.

85. *Neurothemis intermedia intermedia* (Rambur)

1842. *Libellula intermedia*, Rambur, *Ins. Neurop.*, : 91.

1936. *Neurothemis intermedia intermedia*, Fraser, *Fauna Brit. India*, **3** : 357-358.

2006. *Neurothemis intermedia intermedia* Kulkarni, *et al.*, *Conservation Area Series, Zool. Surv. India*, **25** : 217-218.

Diagnostic characters : Head : Labium, bases of mandible, labrum, face, frons pale yellow; occiput and upper surface of eyes reddish-brown; eyes below golden yellow. Thorax with a distinct humeral reddish brown stripe, wings hyaline, palely tinted with yellow and with broad basal amber-yellow marking at the base of all wings. Abdomen bright reddish-ochreous with sutures on segment 2 & 3 finely darker, ventro-lateral brownish strip on segment 3-8. Females resemble males but with more defined ventro-lateral stripe.

Material examined/Source : Prasad, 1996; Talmale and Talmale, 2003; Kulkarni *et al.*, 2004; Kulkarni and Prasad, 2005; Kulkarni *et al.*, 2006.

Distribution : India : Himachal Pradesh, Maharashtra (Lakhani, Dist. Bhandara; Melghat Tiger Reserve, Dist. Amravati; Pench National Park, Dist. Nagpur; Tadoba-Andhari Tiger Reserve, Dist. Chandrapur), Madhya Pradesh, Bihar, Uttaranchal, West Bengal.

Elsewhere : Nepal; Myanmar; Sri Lanka; W. Malaysia (Malacca) and China.

Remarks : Pattern of marking on wings differentiates this species from all others within the genus.

86. *Neurothemis tullia tullia* (Drury)

1773 *Libellula tullia* Drury, *III Exot. Ins.*, **2** : 85.

1936 *Neurothemis tullia tullia*, Fraser, *Fauna Brit. India*, **3** : 360-362.

1996. *Neurothemis tullia tullia*, Prasad & Ghosh, *Rec. zool. Surv. India*, **85**(2) : 209.

1995 *Neurothemis tullia tullia*, Prasad & Varshney, *Oriental Ins.*, **29** : 411.

Diagnostic characters : Head : Labium blackish brown, middle lobe and borders of lateral lobes paler brown, labrum, face, frons, vesicle and occiput black; eyes blackish-brown above, violaceous below. Prothorax, thorax and abdomen black. White stripe on segments 1 to 8, broad at base of segments and tapering to apical end. Legs black, tibiae yellow on exterior surface. Wings hyaline for apical half, opaque steely blue black for basal half, this area runs in a convex curve up to one cell distal to node in fore wing and two or three cells distal to node in hind wings, this area followed by the broad white band in both the wings, broad at costal border and narrow to the posterior border. Pterostigma dull, ochreous, bordered with black. Female differs markedly from the male in both body colour and marking of wings.

Material examined/Source : Prasad, 1996; Kulkarni and Praad, 2002; Kulkarni *et al.*, 2004 and 2006.

Distribution : India : Bihar, Himachal Pradesh, Maharashtra (Ujani Wetland, Dist. Pune and Solapur; Tadoba-Andhari Tiger Reserve, Dist. Chandrapur), Madhya Pradesh, Penisular India, Punjab, Uttar Pradesh, West Cost of India, West Bengal.

Elsewhere : Myanmar, Sri Lanka, Hongkong, Indo-China and Malacca.

Remarks : Andromorphic females of this species are known to occur (Kulkarni *et al.*, 2000).

Genus *Rhodothemis* Ris, 1911

87. *Rhodothemis rufa* Rambur

1842. *Libellula rufa* Rambur, *Ins. Neurop.*, P. 71.

1936. *Rhodothemis rufa*, Fraser, *Fauna Brit. India*, **3** : 368-369.

Material examined/ Source : Fraser, 1936.

Distribution : India : Maharashtra, (Mumbai), West Coast of India.

Genus *Sympetrum* Newman, 1833

88. *Sympetrum hypomelas* (Selys)

1884. *Diplax hypomelas* Selys, *Ann. Soc. Ent. Belg.*, 28 : 37.

1936. *Sympetrum hypomelas*, Fraser, *Fauna Brit. India*, 3 : 373-375.

Material examined/Source : Kulkarni and Talmale (in press).

Distribution : Arunachal Pradesh, Himachal Pradesh, Maharashtra (Bhimashankar Wildlife Sanctuary, Dist. Pune), Sikkim, Uttar Pradesh, West Bengal and Western Ghats.

Subfamily TRITHEMISTINAE

Genus *Trithemis* Brauer, 1868

89. *Trithemis aurora* (Burmeister)

1839. *Libellula aurora* Burmeister, *Handb. Ent.*, 2 : 859.

1936. *Trithemis aurora*, Fraser, *Fauna Brit. India*, 3 : 383-385.

1995. *Tithemis aurora*, Prasad and Varshney, *Oriental Ins.*, 29 : 411.

Diagnostic characters : Head : Labium dark ochreous, labrum dark brown, face and front of frons ochreous, changing to reddish above; eyes crimson above, brown laterally changing to liliaceous beneath. Prothorax reddish brown; thorax dull purple with obscure superior humeral brown stripe and narrow black stripe on posterior-lateral suture; a short lower black line at the levels of spiracle; beneath olivaceous, marked with a black square with an angular black line crossing it. Legs black; wings hyaline with crimson reticulation and a broad amber-yellow fascia at base of wings with darker brown rays in subcostal and cubital spaces. Abdomen swollen dorso ventrally at base; then constricted at segment 3 and again dilated fusiformly depressed and broad. Anal appendages red.

Female : Differs from male in colour and shape, with wings often broadly tipped with brown up to pterostigma; reticulation bright yellow to brown, basal markings similar to males. Abdomen subcylindrical & anal appendages black.

Material examined/Source : Prasad, 1996; Kulkarni and Praasad, 2002; Talmale and

Kulkarni, 2003; Kulkarni *et al.*, 2004; Kulkarni and Prasad, 2005; Kulkarni *et al.*, 2006 and Kulkarni and Talmale, 2009.

Distribution : Throughout India.

Elsewhere : Pakistan; Nepal; Sri Lanka; Myanmar; West Malaysia : (Penang); Indonesia: (Borneo, Sulawesi, Java, Moluccas, Sumba, Sumatra, Timor) and Philippines.

Remarks : It is common species near hill streams, also recorded from plains in Maharashtra.

90. *Trithemis festiva* (Rambur)

1842. *Libellula festiva*, Rambur, *Ins. Neurop.*, 92.

1936. *Trithemis festiva*, Fraser, *Fauna Bri. India*, 3 : 387-389.

1995. *Tithemis festiva*, Prasad and Varshney, *Oriental Ins.*, 29 : 412.

Diagnostic characters : Head : Labium blackish brown, labrum, dark olivaceous; frons, dark brown in front; metallic violet above; prothorax dark blue; thorax black; legs black; wings hyaline with a dark brown mark at base of hind wings; abdomen black and appendages black. Females differ from adult males in labium face & frons dirty yellow, thorax greenish yellow, wings similar to males but in adults broadly dark reddish brown at apices, abdomen with a narrow mid dorsal stripe.

Material examined/Source : Prasad, 1996; Talmale and Kulkarni, 2003; Kulkarni *et al.*, 2004; Kulkarni and Prasad, 2005; Kulkarni *et al.*, 2006 and Kulkarni and Talmale, 2009.

Distribution : India: Assam; Himachal Pradesh, Maharashtra, Uttaranchal, West Bengal.

Elsewhere : Nepal; Sri Lanka; Myanmar; West Malaysia: (Penang); Singapore; Indonesia : (Sulawesi, Java, Lesser Sunda, Sumatra); Philippines; Taiwan and Papua (new Guinea).

Remarks : It is a common species near hill streams. Adults breed in still waters or streams with sluggish current.

91. *Triathemis pallidinervis* (Kirby)

1889. *Sympetrum pallidinervis* Kirby *Trans. zool. Soc. India*, 12 : 327.

1937. *Trithemis pallidinervis* Fraser, *Fauna Brit. India*, 3 : 389-391.

1985. *Trithemis pallidinervis* Prasad & Ghosh, *Rec. zool. Surv. India*, 85(2) : 209.

Diagnostic characters : Head : Labium pale yellow, labrum black, with two large basal yellow spots; clypeus and front of frons yellow, upper surface of frons and vesicle metallic purple. Prothorax dull brown or black, with the anterior border yellow and a large medial and lateral spot on middle lobe. Thorax olivaceous brown on dorsum and upper parts of sides, dorsum thickly coated with grayish hairs. Legs black, anterior pair of femora bright yellow on basal half. Wings hyaline, with reddish reticulation and a bright amber yellow basal marking at extreme base in the forewing. Abdomen long slender, black, marked with bright yellow. Anal appendages yellow at base, black for apical half, superiors with a row of robust spines on ventral border. Female resembles male in most particulars.

Material examined/Source : Prasad, 1996; Kulkarni and Prasad, 2002; Kulkarni *et al.*, 2004; Kulkarni and Talmale, 2005 and Kulkarni *et al.*, 2006.

Distribution : India : Assam, Bihar, Himachal Pradesh, Maharashtra, Punjab, Uttar Pradesh, West Bengal.

Elsewhere : Myanmar, Sri Lanka, Formosa and Philippines.

Remarks : A Common species along stagnant water, some times observed near sea shore either on wings or resting on twigs.

Subfamily PALPOPLEURINAE

Genus *Palpopleura* Rambur, 1842

92. *Palpopleura sexmaculata sexmaculata* (Fabr.)

1787. *Libellula sexmaculata* Fabricius, *Mant. Ins.*, I : 338.

1936. *Palpopleura sexmaculata sexmaculata*, Fraser, *Fauna Brit. India*, 3 : 318-320.

Material examined/Source : Fraser, 1936, Prasad, 1996.

Distribution : India : Coorg, Maharashtra

(Mahabaleshwar), Nilgiri Hills, Tibet Western India.

Elsewhere : Malaysia; Indo-China to China; Sri Lanka.

Subfamily TRAMEINAE

Genus *Rhyothemis* Hagen, 1867

93. *Rhyothemis variegata variegata* (Linneus)

1763. *Libellula variegata* Linnaeus, *Amoenitates, Acad.*, 6 : 412.

1936. *Rhyothemis variegata variegata*, Fraser, *Fauna Brit. India*, 3 : 423-424.

1995. *Rhyothemis variegata variegata*, Prasad and Varshney, *Oriental Ins.*, 29 : 412.

1996. *Rhyothemis variegata variegata*, Prasad, *Rec. zool. Surv. India*, 95(3-4) : 325.

Diagnostic characters : Head : Labium pale, whitish yellow, middle lobe black, labrum black; clypeus and lower border of frons creamy yellow. Prothorax black, thorax dark metallic green, legs and abdomen entirely black. Wings with apices blackish brown, nodal spot black but narrow, often extending posteriorly to as far as R_{4+5} , wings palely tinted yellow throughout, with black spots at the discoidal cell, and distal ends of cubital cell involving its base, with occasionally small spots at proximal end of subcostal space and at origin of sectors of arc. Hind wings with basal fassiae more extensive, extending beyond discoidal cell and well beyond the anal loop to the level of Cu_{1+2} , with a large spot at the middle of I_{r+2} . All the markings are subject to variation. Female resembles male except in particulars of markings in the wings.

Material examined/Source : Prasad, 1996; Kulkarni and Prasad, 2002 and Kulkarni *et al.*, 2006.

Distribution : India : Assam, Bihar, Himachal Pradesh, Maharashtra (Ujani wetland, Dist. Pune and Solapur; Tadoba-Andhari Tiger Reserve, Dist. Chandrapur), West Bengal.

Elsewhere : Myanmar, Sri Lanka, Malaysia and Philippines.

Remarks : Andromorphic females of this species are recorded (Fraser 1936), which are frequently observed.

Genus *Hydrobasileus* Kirby, 188994. *Hydrobasileus croceus* (Brauer)

1867. *Tramea croceus* Brauer, *Verh. Zool.-bot. Ges. Wien.*, 17 : 813.

1936. *Hydrobasileus croceus*, Fraser, *Fauna Brit. India, Odonata*, 3 : 429-430.

Material examined/Source : Fraser, 1936; Prasad and Varshney, 1995; Prasad, 1996.

Distribution : India : Assam, Karnataka Kerala, Madhya Pradesh, Maharashtra (Khandala, Dist. Pune), Meghalaya and Rajasthan.

Genus *Pantala* Hagen 186195. *Pantala flavescens* (Fabr.)

1798. *Libellula flavescens*, Fabricius, *Ent. Syst. Suppl.*, 285.

1861. *Pantala flavescens*, Hagen, *Syn. Neur N. Amer.*, : 142.

1936. *Pantala flavescens*, Fraser, *Fauna Brit. India*, 3 : 414-416.

1995. *Pantala flavescens*, Prasad and Varshney, *Oriental Ins.*, 29 : 413.

Diagnostic Characters : Rather large sized and robust built dragonfly coloured ochreous or reddish and with uncoloured wings. Head large; eyes broadly contiguous; labium pale brown with borders dark brown, anteclypeus pale brown, post clypeus & frons bright golden yellow; eyes reddish brown above, lilaceous or bluish laterally and beneath; prothorax rich ochreous, bluish laterally a beneath; thorax olivaceous, coated thickly with yellowish downy hairs; legs black, bases & exterior of femora yellowish; wings hyaline, with base of hind wing pale golden yellow upto anal loop and with narrow apical brown spot limited to posterior border of wing. Abdomen bright ochreous, sides of segments 1-4 pale yellow, 8-10 with sharply defined black mid dorsal pyriform spots with narrow end of them at bases of segments. Anal appendages ochreous, changing black towards apex. Females similar to males, with eyes olivaceous brown above; face vivid cream yellow; wings often evenly and deputy enfumed and always without the brown spot. Abdomen more stout and robust.

Material examined/Source : Prasad, 1996; Talmale and Kulkarni, 2003; Kulkarni *et al.*, 2004; Kulkarni and Prasad, 2005; Kulkarni and Talmale,

2005; Kulkarni *et al.*, 2006 and Kulkarni and Talmale, 2009.

Distribution : Circumtropical and subtropical in distribution (Throughout India).

Elsewhere : China; Indonesia; Malaysia; Micronesia; Morocco; Myanmar; Sri Lanka and Thailand.

Remarks : Common species, breeds in marshes and weedy tanks, especially in submontane areas and among the foothills. Large number of specimens emerge out and take to swarming from September to November/December.

Genus *Tramea* Hagen, 186196. *Tramea basilaris burmeisteri* Kirby

1889. *Tramea burmeisteri* Kirby *Trans. zool. Soc. Lond.*, 12 : 316.

1936. *Tramea basilaris burmeisteri*, Fraser, *Fauna Brit. India*, : 432-434.

1995. *Tramea basilaris burmeisteri*, Prasad and Varshney, *Oriental Ins.*, 29 : 413.

Diagnostic characters : Head : Labium bright yellow, middle lobe black; labrum reddish brown, very broadly bordered black, anteclypeus and sides of post clypeus olivaceous yellow; post clypeus and frons bright vermilion red. Prothorax yellowish; thorax olivaceous, with a reddish ting on dorsum and a bluish tinge laterally. Legs black; coxae, trochanters and anterior pair of femora on inner side and at base olivaceous. Wings hyaline, hind wing with dark reddish brown markings at the base, usually limited to the cubital space, base of discoidal cell and hyper trigone, extreme base of anal loop and anal area adjoining cubital space. Venation in this dark area bright yellow. Membrane pure white, pterostigma bright ochreous, short, even shorter in hind wings. Abdomen bright brick red, marked with black. Anal appendages very long, dark reddish to black, nearly as long as last three segments of abdomen. Female resembles males except minor details in colouration.

Material examined/Source : Prasad, 1996; Talmale and Kulkarni, 2003; Kulkarni *et al.*, 2004; Kulkarni and Talmale, 2005; Kulkarni *et al.*, 2006.

Distribution : India : Himachal Pradesh,

Maharashtra, Punjab, Rajasthan, Uttaranachal, West Bengal.

Elsewhere : Myanmar, Sri Lanka and Malaysia.

97. *Tramea limbata similata* (Rambur)

1842. *Libellula similata* Rambur, *Ins. Neruop.*, p. 36.

1995. *Tramea limbata similata*, Prasad and Varshney, *Oriental Ins.*, **29** : 413.

Material examined/Source : Prasad, 1996.

Distribution : India : Maharashtra (Pune), South India.

Elsewhere : Nepal; Sri Lanka.

98. *Tramea virginia* (Rambur)

1773. *Libellula chinensis*, De Geer, *Mem. Ins.*, **3** : 556.

1842. *Libellula virginia*, Rambur, *Ins. Neurop.*, : 33.

1889. *Tramea virginia*, Kirby, *Cat. Odon.*, : 3.

1936. *Tramea virginia*, Fraser, *Fauna Brit. India, Odon.*, **3** : 435-436.

1995. *Tramea virginia*, Prasad and Varshney, *Oriental Ins.*, **29** : 413.

Diagnostic Characters : Labium dark chrome-yellow, middle lobe and adjacent parts of lateral lobes black; labrum ochreous, broadly bordered with blackish-brown; face and frons olivaceous, the latter suffused with bright vermilion or rose red and with a very broad black border at base above which has a metallic blue or violaceous reflux; vesicle black in front, olivaceous behind, tipped with two small red points; occiput dark olivaceous; eyes reddish brown above liliaceous below. Prothorax dark ochreous, with a black stripe between anterior and middle lobes. Thorax dark oilvaceous green. Wings hyaline, spot in hind wing dark reddish brown, very large extending distally to distal end of discoidal cell and involving nearly whole of anal loop. Membrane blackish-brown, paler along free border; pterostigma dark ochreous, that of hind wing slightly more than half the length of that of forewing. Abdomen bright brick red, marked with black on last three segments.

Female differs only in sexual characters and the markings on the forewing, which has a large indentation on the basal sides of wings nearly cutting it in to two spots and approaching the

condition seen in *Trama bassilaris burmeisteri* Kirby.

Material Examined/Source : Kulkarni *et al.*, 2004.

Distribution : India : Bihar, Himachal Pradesh, Jammu and Kashmir, Maharashtra (Matheran, Dist. Raigad; Pench National Park, Dist. Nagpur), Tamil Nadu and Uttar Pradesh.

Elsewhere : China; Indonesia, Micronesia, Myanmar; South Japan; Taiwan and Thailand.

Remarks : The very dark, sharply-defined basal marking in the hind wing, not surrounded by a golden-yellow areola serves to distinguish from the other two Indian species of *Tramea* [*T. basilaris burmeisteri* Kirby and *T. limbata* (Desjardins)].

Genus *Tholymis* Hagen, 1867

99. *Tholymis tillarga* (Fab.)

1798. *Libellula tillarga* Fabricius, *Ent. Syst. Suppl.*, : 285.

1936. *Tholymis tillarga*, Fraser *Fauna Brit. India*, **3** : 411-413.

1988. *Tholymis tillarga*, Prasad & Ghosh, *Rec. zool. Surv. India*, **85**(2) : 210.

1995. *Tholymis tillarga*, Prasad & Varshney, *Oriental Ins.*, **29** : 413.

Diagnostic characters : Head : Labium, labrum and face oilvaceous or pale yellowish-brown; frons and vesicle ochreous, eyes brown, capped with reddish, olivaceous below. Prothorax and thorax golden yellow, with a bright reddish suffusion on dorsum. Legs ochareous. Wings hyaline, with a broad smoky fan shaped golden brown fascia extending from node to base of hind wing. Dep in colour at node and somewhat longitudinally striated. This fascia bordered distally by a broad oval opalescent white spot, 4 cells deep. Pterostigma reddish brown, between dark nervures. membrane blackish brown. Abdomen bright rust red, specially on dorsum, paler at sides. Anal appendages reddish. Female, similar to male, with wings without opalescent spot and the golden brown fascia very pale and obscure.

Material examined/Source : Talmale and Kulkarni, 2003; Kulkarni *et al.*, 2004, 2006a, b and Kulkarni and Talmale, 2009.

Distribution : India : Himachal Pradesh, Madhya Pradesh, Maharashtra (Sanjay Gandhi National Park, Borivali, Mumbai; Lakhani, Dist. Bhandara; Pench National Park, Dist. Nagpur; Tadoba-Andhari Tiger Reserve, Dist. Chandrapur), Punjab, Uttar Pradesh, West Bengal.

Elsewhere : Australia, Myanmar, Sri Lanka, Madagascar and Tropical Africa.

Remarks : Dragonflies of rather large size and robust built, appearing on wing before dusk. The brown fascia and opalescent white spot of hind wings distinguish this species easily.

Genus *Zyxomma* Rambur, 1842

100. *Zyxomma petiolatum* Rambur

1842. *Zyxomma petiolatum* Rambur *Ins. Neurop.*, : 30.

1936. *Zyxomma petiolatum*, Fraser, *Fauna Brit. India*, 3 : 409-410.

1995. *Zyxomma petiolatum*, Prasad & Varshney, *Oriental Ins.*, 29 : 413.

Diagnostic characters : Head : Labium pale yellow; labrum pale ochreous; face and frons pale oilvaceous, darkening above but variable, vesicle dark reddish brown. Prothorax and thorax chocolate-brown, paling at sides. Legs pale reddish-brown. Wings hyaline, in adult becoming enfumed with brown and apices dark brown, base of the wings variably dark reddish-brown. Abdomen reddish-brown, with variable shades, darkening to black at the apices. Anal appendages reddish-brown, superiors black at apices, long and slender, as long as segments 9 and 10 taken together. Female similar to male, anal appendages rather long and slim.

Material examined/Source : Talmale and Kulkarni, 2003; Kulkarni *et al.*, 2006.

Distribution : Throughout India : Maharashtra (Lakhani, Dist. Bhandara; Tadoba-Andhari Tiger Reserve, Dist. Chandrapur).

Elsewhere : Myanmar and Philippines.

Remarks : The only species of the genus occurring in India. The dragonfly is crepuscular in habits, emerging shortly before dusk and flying till darkness.

Subfamily UROTHEMISTINAE

Genus *Urothemis* Brauer, 1868

101. *Urothemis signata signata* (Rambur)

1839. *Libellula sanguinea* Burmeister, *Handb. Ent.*, II : 858.

1842. *Libellula signata*, Rambur, *Ins. Neurop.*, : 117.

1936. *Urothemis signata signata*, Fraser, *Fauna Brit. India. Odonata*, 3 : 442-444.

Material examined/Source : Fraser, 1936; Prasad, 1996; 1 damaged specimen, Paud Road, Pune, 26.v.1999, Coll. R.M. Sharma.

Distribution : Throughout Peninsular India : Maharashtra (Mumbai, Pune).

Elsewhere : Sri Lanka and Myanmar.

SUMMARY

An account of Odonata known from Maharashtra state is presented here. Earlier, Prasad (1996) studied Odonata from this state. 46 species were examined by him. He also presented a list of all the 83 species known from Maharashtra state till then. Later, from the collections made by the Western regional Centre, ZSI, Pune, 18 species were added to the list. Now the number has risen to a total of 101 species. Details of the collection localities from Maharashtra state for all the species are also given.

ACKNOWLEDGEMENTS

The authors are grateful to the Director and Dr. J.R.B. Alfred, Director (Retired), Zoological Survey of India, Kolkata for their encouragement. Thanks are due to Dr. M.S. Pradhan and Dr. Anil S. Mahabal, officers in charge of Western Regional Station, Zoological Survey of India, Pune for providing all facilities to workout the collection. Most of the collection of Odonata is made during the surveys of the Conservation areas in Maharashtra State. Thanks are also due to the Chief Conservator of Forests and The Chief Wildlife Warden who had kindly made available necessary permissions during the tenure of the projects surveying the conservation areas mainly during 1992 to 2007.

REFERENCES

- Babu, R., Sinha, C., and Prasad, M. 2009. New records of Odonata (Anisoptera) from Maharashtra. *Rec. zool. Surv. India*, **108**(4) : 113-117).
- Fraser, F.C. 1933. The fauna of British India, including Ceylon and Burma, Odonata Vol. I, *Taylor and Francis Ltd., London* : 1-423.
- Fraser, F.C. 1934. The fauna of British India including Ceylon and Burma. Odonata Vol. II, *Taylor and Francis Ltd., London* : 1-398.
- Fraser, F.C. 1936. The fauna of British India including Ceylon and Burma, Odonata Vol. III, *Taylor and Francis Ltd., London* : 1-461.
- Kulkarni, P.P., Bastawade, D.B. and Talmale, S.S. 1999. Predation of dragonflies *Ictinogomphus rapax* (Rambur) and *Pantala flavescens* (Fabr.) (Odonata : Anisoptera) by the giant wood spider, *Nephila maculata* (Fabr.) *Bionotes*, **1**(4) : 84.
- Kulkarni, P.P., Prasad, M. and Talmale, S.S. 2002. New record of damselfly *Pseudagrion microcephalum* (Rambur) from Maharashtra (Odonata : Coenagrionidae) *Bionotes*, **4**(3) : 58.
- Kulkarni, P.P. & Prasad, M. 2002. Odonata. In : *Fauna of Ujani Wetland, Maharashtra, Wetland Ecosystem Series* (Ed. Director, Zool. Surv. India, Kolkata), **3** : 91-104.
- Kulkarni, P.P., Prasad, M. and Talmale, S.S. 2004. Insecta : Odonata. In : *Fauna of Pench National Park, Conservation Area Series* (Ed. Director, Zool. Surv. India, Kolkata), **20** : 175-206.
- Kulkarni, P.P. and Prasad, M. 2005. Insecta : Odonata in Fauna of Melghat Tiger Reserve *Conservation Area Series* (Ed. Director, Zool. Surv. India, Kolkata), **24** : 297-316.
- Kulkarni, P.P. and Mahabal, Anil. 2005. Highlights of the Faunal Diversity on Tadoba–Andhari Tiger Reserve. *Compendium : Golden Jubilee of Tadoba National Park and One decade of Tadoba–Andhari Tiger Reserve*, : 5-9.
- Kulkarni, P.P. and Talmale, S.S. 2005. Insecta : Odonata in Fauna of Nathsagar Wetland Dist. *Aurangabad Wetland Ecosystem Series* (Ed. Director, Zool. Surv. India, Kolkata), **7** : 115-127.
- Kulkarni, P.P. and Talmale, S.S. 2006. An Account of Odonata in five Conservation areas and two Wetlands from Maharashtra : *VII South Asian Conference on Odonatology, Nagpur, India*, (Abs.) : 10.
- Kulkarni, P.P. and Talmale, S.S. 2009. Insecta : Odonata. In : *Fauna of Bhimashanka Wildlife Sanctuary, Conservation Area Series*, **42** : 231-250. (Published by the Director, Zool. Surv. India, Kolkata).
- Kulkarni, P.P., Prasad, M. and Talmale, S.S. 2006. a Insecta : Odonata in Fauna of Tadoba–Andhari Tiger reserve (Maharashtra) *Conservation Area Series* (Ed. Director, Zool. Surv. India, Kolkata), **25** : 197-226.
- Kulkarni, P.P., Talmale, S.S. and Prasad, M. 2006 b. Insecta : Odonata in Fauna of Sanjay Gandhi National Park, (Invertebrata), *Conservation Area Series*, **26** : 19-40.
- Kulkarni, P.P. and Talmale, S.S. 2008. Inseta : Odonata in Fauna of Goa *State Fauna Series*, (Ed. Director, Zool. Surv. India, Kolkata), **16** : 173-194.
- Kulkarni, P.P. and Talmale, S.S. (2008) Insecta : Odonata in Fauna of Lonar Wildlife Sanctuary, Dist. Buldhana, Maharashtra *Conservation Area Series*, **37** : 159-167 (Publ : Director, Zool. Surv. India, Kolkata).

- Prasad, M., Ram, R. and Ghosh, S.K. 1987 Notes on the Indian species of the Genus *Pseudagrion* Selys (Coenagrionidae : Odonata); *Bull. zool. Surv. India*, **8**(1-3) : 313-321.
- Prasad, M. 1988. The Odonata of Bihar, India; *Rec. zool. Surv. India. Occ. Pap.*, **110** : 1-42 + 2 pl.
- Prasad, M and Ghosh, S.K. 1988. A contribution on the Estuarine Odonata of East India. *Rec. zool. Surv. India*, **85**(2) : 197-216.
- Prasad, M. and Varshney, R.K. 1995. A check list of the Odonata of India including data on larval studies. *Oriental Ins.*, **29** : 385-428.
- Prasad, M. 1996 An account of the Odonata of Maharashtra State, India. *Rec. zool. Surv. India*, **95**(3-4) : 305-327.
- Prasad, M., Kulkarni, P.P. and Talmale, S.S. 2000. New records of Andromorphic females in two species of *Neurothemis* dragonflies (Odonata : Libellulidae) from Central India, *Bionotes*, **2**(3) : 54.
- Prasad, M., Kulkarni, P.P. 2001. Insecta : Odonata in Fauna of Nilgiri Biosphere Reserve, *Fauna of Conservation Area Series (Ed. Director, Zool. Surv. India, Kolkata)*, **11** : 73-83.
- Prasad, M. and Kulkarni, P.P. 2002. Insecta : Odonata. In : *Fauna of Erivakulum National Park, Fauna of Conservation Area Series (Ed. Director, Zool. Surv. India, Kolkata)*, **13** : 7-9.
- Sharma, R.M., Talmale, S.S. and Kulkarni, P.P. 2000. Odonates attracted to light at Tadoba –Andhari Tiger Reserve, Maharashtra, *Bionotes*, **2**(1) : 13.
- Talmale, D.A. and Kulkarni, P.P. 2006. Odonata of Pravaranagar, Dist. Ahmednagar, Maharashtra, *Bionotes*, **8**(3) : 75.
- Talmale, S.S. and Kulkarni, P.P. 2003. Odonata in the paddy fields of Bhandara District, Maharashtra, *Bionotes*, **5**(3) : 67.

INSECTA : ORTHOPTERA

KAILASH CHANDRA and S.K. GUPTA

Central Regional Station, Zoological Survey of India, Jabalpur-482 002

INTRODUCTION

The major work on Orthopteran fauna of India is published by Kirby (1914) and Chopard (1969). Some scattered information on record of Orthoptera fauna of Maharashtra has been published by Vasanth (1980, 1988), Shishodia (1991a), Sharma *et al.* (1999), Kulkarni & Sharma (2004) and Kulkarni & Shishodia (2004, 2005).

While working on Orthoptera fauna of other states, the distribution of some species occurring in Maharashtra were also included by Bhowmik (1985a, b, 1986), Shishodia & Hazra (1986), Mandal *et al.* (1999, 2007), Shishodia (1991b, 1997a,b, 2000a, b), Hazra *et al.* (1993, 1995), Vasanth (1993), Barman (1993, 1995, 2000, 2003), Shishodia & Tandon (2000, 2004), Dey & Hazra (2003), Shishodia *et al.* (2003), Mandal & Yadav (2007), Gupta *et al.* (2008).

This paper presents the comprehensive checklist of Orthoptera species known from Maharashtra along with their known distribution in the state. Altogether, 143 species / subspecies of Orthoptera belonging to 98 genera and 8 families are included.

Sl. No.	Families	Number of genera	Number of species
1.	Acrididae	42	55
2.	Pyrgomorphidae	5	7
3.	Tetrigidae	12	22
4.	Tridactylidae	1	4
5.	Gryllidae	21	33
6.	Trigonidiidae	1	2

7.	Gryllacrididae	2	2
8.	Tettigoniidae	14	18
Total		98	143

Order ORTHOPTERA

Suborder CAELIFERA

Infraorder ACRIDIDEA

Superfamily ACRIDOIDEA

Family ACRIDIDAE

Subfamily ACRIDINAE

Genus *Acrida* Linnaeus, 1758

1. *Acrida exaltata* (Walker, 1859) : Amravati and Nagpur.
2. *Acrida indica* Dirsh, 1954 : Amravati and Nagpur.

Genus *Ceracris* Walker, 1870

3. *Ceracris nigricornis nigricornis* Walker, 1870 : Amravati.

Genus *Gonista* Bolivar, 1898

4. *Gonista* sp. : Amravati, Nagpur.

Genus *Orthochtha* Karsch, 1891

5. *Orthochtha indica* Uvarov, 1942 : Nagpur.

Genus *Truxalis* Fabricius, 1775

6. *Truxalis indica* (Bolivar, 1902) : Nagpur.

Subfamily CATANTOPINAE

Genus *Diabolocatantops* Jago, 1984

7. *Diabolocatantops innotabilis* (Walker, 1870 : 629) : Amravati and Nagpur.

Genus *Gerenia* Stål, 1878

8. *Gerenia pustulipennis* (Walker, 1871) : Mumbai.

Genus *Stenocatantops* Dirsh & Uvarov, 1953

9. *Stenocatantops splendens* (Thunberg, 1915) : Amravati.

Genus *Xenocatantops* Dirsh & Uvarov, 1953

10. *Xenocatantops humilis* (Serville, 1839) : Mumbai.
 11. *Xenocatantops henryi* (Bolivar, 1918) : Maharashtra.
 12. *Xenocatantops karnyi* (Kirby, 1910) : Amravati.

Subfamily CALLIPTAMINAE

Genus *Acorypha* Krauss, 1877

Caloptenopsis Bolivar, 1889

13. *Acorypha glaucopsis* (Walker, 1870) : Amravati.
 14. *Acorypha insignis* (Walker, 1870) : Maharashtra.

Subfamily COPTACRIDINAE

Genus *Eucoptacra* Bolivar, 1902

15. *Eucoptacra praemorsa* (Stål, 1860) : Nagpur.

Eucoptacra saturata (Walker, 1870)

Subfamily CYRTACANTHACRIDINAE

Genus *Anacridium* Uvarov, 1923

16. *Anacridium flavescens* (Fabricius, 1773) : Maharashtra.

Genus *Cyrtacanthacris* Walker, 1870

17. *Cyrtacanthacris tatarica* (Linnaeus, 1758) : Nagpur.

Genus *Pachyacris* Uvarov, 1923

18. *Pachyacris vinosa* (Walker, 1870) : Amravati.

Genus *Patanga* Uvarov, 1923

19. *Patanga succincta* (Johansson, 1763) : Maharashtra.

Genus *Schistocerca* Stål, 1873

20. *Schistocerca gregaria* (Forskål, 1775) : Maharashtra.

Subfamily EYEPREPOCNEMIDINAE

Genus *Choroedocus* Bolivar, 1914

21. *Choroedocus illustris* (Walker, 1870) : Amravati.

Genus *Eyprepocnemis* Fieber, 1853

22. *Eyprepocnemis alacris alacris* (Serville, 1839) : Maharashtra.

Genus *Tylotropidius* Stål, 1860

23. *Tylotropidius varicornis* (Walker, 1870) : Amravati, Nagpur.

Subfamily GOMPHOCERINAE

Genus *Aulacobothrus* Bolivar, 1902

24. *Aulacobothrus luteipes luteipes* (Walker, 1871) : Mumbai.
 25. *Aulacobothrus luteipes inferrus* (Bolivar, 1902) : Maharashtra.
 26. *Aulacobothrus socius* (Bolivar, 1902) : Mumbai.

Genus *Dociostaurus* Fieber, 1853

27. *Dociostaurus apicalis* (Walker, 1871) : Mumbai.

Genus *Gelastorhinus* Brunner, 1893

Subsequent misspelling (Correct spelling is *Gelastorhinus*)

28. *Gelastorhinus laticornis* (Serville, 1839) : Mumbai.

Genus *Stenohippus* Uvarov, 1926

29. *Stenohippus mundus* (Walker, 1871) : Mumbai.

Subfamily HEMIACRIDINAE

Genus *Hieroglyphus* Krauss, 1877

30. *Hieroglyphus banian* (Fabricius, 1798) : Mumbai : Kaphot.
 31. *Hieroglyphus concolor* (Walker, 1870) : Amravati, Mumbai.
 32. *Hieroglyphus indicus* Mason, 1973 : Amravati, Nagpur.
 33. *Hieroglyphus nigrorepletus* Bolivar, 1912 : Maharashtra.
 34. *Hieroglyphus oryzivorus* Carl, 1916 : Maharashtra.
 Genus *Parahieroglyphus* Carl, 1916
 35. *Parahieroglyphus bilineatus* (Bolivar, 1912) : Amravati.

Subfamily OEDIPODINAE

Genus *Acrotylus* Fieber, 1853

36. *Acrotylus humbertianus* Saussure, 1884 :
Mumbai : Bulsar.

Genus *Aiolopus* Fieber, 1853

37. *Aiolopus thalassinus tamulus* (Fabricius, 1798) : Nagpur.

Genus *Chloebora* Saussure, 1884

38. *Chloebora crassa* (Walker, 1870): Gokal,
Nasik and Pune.

Genus *Chondronotulus* Uvarov, 1956

39. *Chondronotulus bengalensis* (Saussure, 1888) : Pune.

Genus *Eremopeza* Saussure, 1888

40. *Eremopeza granulose* Walker, 1871 :
Mumbai.

Genus *Gastrimargus* Saussure, 1884

41. *Gastrimargus africanus africanus* (Saussure, 1888) : Nagpur.
42. *Gastrimargus marmoratus* (Thunberg, 1815)
: Maharashtra.

Genus *Morphacris* Walker, 1870

43. *Morphacris fasciata sulcata* (Thunberg, 1815) : Mumbai.

Genus *Oedaleus* Fieber, 1853

44. *Oedaleus abruptus* (Thunberg, 1815) :
Amravati, Nagpur.

Genus *Scintharista* Saussure, 1884

45. *Scintharista notabilis blanchardiana* (Saussure, 1888) : Mumbai.

Genus *Sphingonotus* Fieber, 1852

46. *Sphingonotus balteatus balteatus* (Serville, 1839) : Mumbai.

Genus *Trilophidia* Stål, 1873

47. *Trilophidia annulata* (Thunberg, 1815) :
Amravati, Nagpur.

Subfamily OXYINAE

Genus *Gesonula* Uvarov, 1940

48. *Gesonula punctifrons* (Stål, 1861) :
Maharashtra.

Genus *Oxya* Serville, 1831

49. *Oxya hyla hyla* Serville, 1831 : Maharashtra.
50. *Oxya japonica japonica* (Thunberg, 1824) :
Maharashtra.
51. *Oxya velox* (Fabricius, 1787) : Mumbai.

Subfamily TERATODINAE

Genus *Teratodes* Brullè, 1835

52. *Teratodes monticollis* (Gray, 1832) :
Mumbai.

Subfamily SPATHOSTERNINAE

Genus *Spathosternum* Krauss, 1877

53. *Spathosternum prasiniferum prasiniferum* (Walker, 1871) : Mumbai.

Subfamily TROPIDOPOLINAE

Genus *Tristria* Stål, 1873

54. *Tristria pulvinata* (Uvarov, 1921) :
Maharashtra.

Genus *Tropidopola* Stål, 1873

55. *Tropidopola longicornis indica*, Uvarov, 1937 : Mumbai.

Superfamily PYRGOMORPHOIDEA

Family PYRGOMORPHIDAE

Subfamily ORTHACRIDINAE

Genus *Colemania* Bolivar, 1910

56. *Colemania sphenarioides* Bolivar, 1910 :
Maharashtra.

Subfamily PYRGOMORPHINAE

Genus *Atractomorpha* Saussure, 1862

57. *Atractomorpha crenulata* (Fabricius, 1793)
: Amravati, Nagpur.

Genus *Chrotogonus* Serville, 1838

58. *Chrotogonus (Chrotogonus) trachypterus trachypterus* (Blanchard, 1836) : Mumbai.
59. *Chrotogonus (Chrotogonus) oxypterus* (Blanchard, 1836) : Maharashtra.

Genus *Feacris* Kevan, 1969*Chlorizeina* Kevan, 1953

60. *Feacris malabarensis* (Kevan, 1953) :
Maharashtra.
61. *Feacris reducta* Kevan, 1969 : Pune and
Sirur.

Genus *Poecilocerus* Serville, 1831

62. *Poecilocerus pictus* (Fabricius, 1775) :
Maharashtra.

Superfamily TETRIGOIDEA

Family TETRIGIDAE

Subfamily CLADONOTINAE

Genus *Potua* Bolivar, 1887

63. *Potua sabulosa* Hancock, 1915 : Yenna
Valley and Satara.

Subfamily SCELIMENINAE

Genus *Euscelimena* Günther, 1938

64. *Euscelimena harpago* (Serville, 1839) :
Amravati, Mumbai, Nagpur and Pune.

Genus *Criotettix* Bolivar, 1887

65. *Criotettix curticornis* (Hancock, 1915) :
Medha, Satara and Yenna Valley.

66. *Criotettix latifrons* Hebard, 1929 : Nasik.

67. *Criotettix orientalis* Hancock, 1913 :
Maharashtra.

68. *Criotettix tricarinatus* Bolivar, 1887 :
Ahmednagar.

Genus *Eucriotettix* Hebard, 1929

69. *Eucriotettix flavopictus* (Bolivar, 1902) :
Satara.

Genus *Thoradonta* Hancock, 1909

70. *Thoradonta lativertex* Günther, 1938 :
Jalgaon.

71. *Thoradonta nodulosa* (Stål, 1860) :
Maharashtra.

72. *Thoradonta pruthii* Günther, 1938 : Pune.

73. *Thoradonta sinuata* Hancock, 1915 :
Moleshhwar, West of Yenna Valley : Satara.

Subfamily METRODORINAE

Genus *Pseudoparatettix* Günther, 1937

74. *Pseudoparatettix histricus* (Stål, 1861) :
Amravati, Nagpur.

Subfamily TETRIGINAE

Genus *Coptotettix* Bolivar, 1887

75. *Coptotettix indicus* Hancock, 1912 : Kalyan,
Koyna Valley, Satara and Vela.

Genus *Euparatettix* Hancock, 1904

76. *Euparatettix variabilis* (Bolivar, 1887) :
Maharashtra.

Genus *Paratettix* Bolivar, 1887

77. *Paratettix cingalensis* (Walker, 1871) :
Maharashtra.

Genus *Hedotettix* Bolivar, 1887

78. *Hedotettix cristitergus* Hancock, 1915 :
Amravati, Nagpur.

79. *Hedotettix gracilis* (De Haan, 1843) : Pune.

80. *Hedotettix punctatus* Hancock, 1909 :
Maharashtra.

Genus *Tetrix* Latreille, 1802

81. *Tetrix mundus* (Walker, 1871) : Mumbai.

Genus *Ergatettix* Kirby, 1914

82. *Ergatettix dorsiferus* (Walker, 1871) :
Amravati.

83. *Ergatettix guentheri* Steinmann, 1970 :
Maharashtra.

Infraorder TRIDACTYLIDEA

Superfamily TRIDACTYLOIDEA

Family TRIDACTYLIDAE

Subfamily TRIDACTYLINAE

Genus *Xya* Latreille, 1809

84. *Xya apicicornis* (Chopard, 1928) : Satara,
Medha, Yenna Valley.

85. *Xya frontomaculata* (Günther, 1974) :
Maharashtra (Tapti River, Shirpur and
Godavari River).

86. *Xya japonica* Haan, 1842 : Maharashtra.

87. *Xya variegata* Latreille, 1809 : Maharashtra.

Suborder ENSIFERA

Infraorder OEDISCHIOIDEA

Superfamily GRYLLOIDEA

Family GRYLLIDAE

Subfamily GRYLLINAE

Genus *Acheta* Fabricius, 1775

88. *Acheta domesticus* Linnaeus, 1758 :
Maharashtra.

Genus *Gryllus* Linnaeus, 1758

89. *Gryllus bimaculatus* De Geer, 1773 :
Mumbai.

Genus *Gryllodes* Saussre, 1874

- 90.
- Gryllodes sigillatus*
- (Walker, 1869) : Pune.

Genus *Gryllopsis* Chopard, 1928

- 91.
- Gryllopsis falconneti*
- (Saussure, 1877) : Igatpuri.

Genus *Itaropsis* Chopard, 1925

- 92.
- Itaropsis tenella*
- (Walker, 1869) : Mumbai, Satara.

Genus *Loxoblemmus* Saussure, 1877

- 93.
- Loxoblemmus latifrons*
- Chopard, 1928 : Mumbai and Ratanagiri.

Genus *Modicogryllus* Chopard, 1961Subgenus *Modicogryllus* Chopard, 1961

- 94.
- Modicogryllus*
- (
- Modicogryllus*
-)
- angustulus*
- (Walker, 1871) : Mumbai.

- 95.
- Modicogryllus*
- (
- Modicogryllus*
-)
- castaneus*
- (Chopard, 1928) : Mumbai.

- 96.
- Modicogryllus*
- (
- Modicogryllus*
-)
- confirmatus*
- (Walker, 1859) : Mumbai.

- 97.
- Modicogryllus*
- (
- Modicogryllus*
-)
- consobrinus*
- (Saussure, 1877) : Mumbai.

- 98.
- Modicogryllus*
- (
- Modicogryllus*
-)
- facialis*
- (Walker, 1871) : Mumbai.

- 99.
- Modicogryllus*
- (
- Modicogryllus*
-)
- signipes*
- (Walker, 1871) : Mumbai.

Genus *Phonarellus* Gorochoy, 1983Subgenus *Phonarellus* Gorochoy, 1983

- 100.
- Phonarellus*
- (
- Phonarellus*
-)
- humeralis*
- (Walker, 1871 : 5) : Mumbai : Salsette Island, Andheri.

- 101.
- Phonarellus*
- (
- Phonarellus*
-)
- minor*
- Chopard, 1969 : Mumbai : Salsette Island.

Genus *Plebeiogryllus* Randell, 1964

- 102.
- Plebeiogryllus guttiventris*
- (Walker, 1871) : Mumbai, Kolhapur, Pune and Solapur.

Genus *Tarbinskiellus* Gorochoy, 1983

- 103.
- Tarbinskiellus orientalis*
- (Burmeister, 1832) : Maharashtra.

- 104.
- Tarbinskiellus portentosus*
- (Lichtenstein, 1796) : Maharashtra.

Genus *Teleogryllus* Chopard, 1961

- 105.
- Teleogryllus occipitalis*
- (Serville, 1838) : Maharashtra.

- 106.
- Teleogryllus longipennis*
- (Saussure, 1877) : Mumbai.

Genus *Turanogryllus* Tarbinskii 1940

- 107.
- Turanogryllus aurangabadensis*
- Vasanth, 1980 : Aurangabad : Nala at Fordapur, Gevrai Ganesh Temple.

- 108.
- Turanogryllus ghoshi*
- Vasanth, 1980 : Pune : Manjari village, Wagholi.

Genus *Velarifictorus* Randell, 1964Subgenus *Velarifictorus* Randell, 1964

- 109.
- Velarifictorus*
- (
- Velarifictorus*
-)
- aspersus*
- (Walker, 1869) : Mumbai : Salsette Island.

Subfamily CACHOPLISTINAE

Genus *Meloimorpha* Walker, 1870

- 110.
- Meloimorpha cincticornis*
- (Walker, 1870 : 469) : Mumbai and Pune.

Subfamily NEMOBIINAE

Genus *Dianemobius* Vickery, 1973

- 111.
- Dianemobius fascipes*
- (Walker, 1869) : Mumbai.

Genus *Paranemobius* Saussure, 1877

- 112.
- Paranemobius pictus*
- (Saussure, 1877) : Mumbai, Nagpur and Satara.

- 113.
- Paranemobius vicinus*
- Chopard, 1928 : Mumbai : Dudh Sagar.

Genus *Pteronemobius* Jacobson and Bianchi, 1905Subgenus *Pteronemobius* Jacobson, 1904

- 114.
- Pteronemobius*
- (
- Pteronemobius*
-)
- heydenii concolor*
- (Walker, 1871) : Maharashtra.

- 115.
- Pteronemobius*
- (
- Pteronemobius*
-)
- indicus*
- (Walker, 1869) : Mumbai.

Genus *Polionemobius* Gorochoy, 1983

- 116.
- Polionemobius taprobanensis*
- (Walker, 1869) : Maharashtra.

Subfamily PODOSCIRTINAE

Genus *Prozvenella* Gorochoy, 2002

- 117.
- Prozvenella soror*
- Chopard, 1969 : Maharashtra.

Subfamily OECANTHINAE

Genus *Oecanthus* Serville, 1831

118. *Oecanthus indicus* Saussure, 1878 :
Amravati and Mumbai.
119. *Oecanthus rufescence* Serville, 1839 :
Mumbai.

Subfamily ITARINAE

Genus *Itara* Walker, 1869

120. *Itara minor* Chopard, 1925 : Maharashtra.

Family TRIGONIDIIDAE

Genus *Trigonidium* Rambur, 1839Subgenus *Trigonidium* Rambur, 1839

121. *Trigonidium (Trigonidium) cicindeloides*
Rambur, 1839 : Maharashtra.
122. *Trigonidium humbertianum* (Saussure, 1878)
: Mumbai.

Superfamily STENOPELMATOIDEA

Family GRYLLACRIDIDAE

Subfamily GRYLLACRIDINAE

Genus *Hadrogryllacris* Karny, 1929

123. *Hadrogryllacris signigeva* Walker, 1871 :
Mumbai.

Genus *Haplogryllacris* Karny, 1937

124. *Haplogryllacris simplex* (Walker, 1871) :
Maharashtra.

Superfamily TETTIGONIOIDEA

Family TETTIGONIIDAE

Subfamily CONOCEPHALINAE

Genus *Anelytra* Redtenbacher, 1891Subgenus *Anelytra* Redtenbacher, 1891

125. *Anelytra (Anelytra) concolor* Redtenbacher,
1891 : Mumbai.

Genus *Conocephalus* Thunberg, 1815Subgenus *Anisoptera* Latreille, 1829

126. *Conocephalus (Anisoptera) maculatus* (Le
Guillou, 1841) : Amravati and Nagpur.

Genus *Euhexacentrus* Hebard, 1922

127. *Euhexacentrus annulicornis* (Stål, 1877) :
Amravati.

Genus *Xiphidiopsis* Redtenbacher, 1891

128. *Xiphidiopsis straminula* (Walker, 1871) :
Mumbai.

Subfamily MECOPODINAE

Genus *Mecopoda* Serville, 1831

129. *Mecopoda elongata* (Linnaeus, 1758) :
Amravati, Nagpur and Pune.

Subfamily PHANEROPTERINAE

Genus *Elimaea* Stål, 1874Subgenus *Orthelimaea* Karny, 1926

130. *Elimaea (Orthelimaea) securigera* Brunner,
1878 : Amravati and Nagpur.

Genus *Ducetia* Stål, 1874

132. *Ducetia japonica* (Thunberg, 1815) :
Amravati, Nagpur.

Genus *Himertula* Uvarov, 1940

133. *Himertula kinneari* (Uvarov, 1923) :
Amravati and Nagpur.

Genus *Isopsera* Brunner, 1878

134. *Isopsera pedunculata* Brunner, 1878 :
Amravati and Nagpur.

Genus *Letana* Walker, 1869

135. *Letana atomifera* (Brunner, 1878) : Nagpur.
136. *Letana intermedia* Ingrisch, 1990 : Amravati
and Nagpur.
137. *Letana megastridula* Ingrisch, 1990 :
Maharashtra.

138. *Letana nigrosparsa* (Walker, 1871) :
Mumbai, Chikalda, Berar, 3664 ft.

139. *Letana rufonotata* (Serville, 1839) : Mumbai.

Subfamily PSEUDOPHYLLINAE

Genus *Callimenellus* Walker, 1871

140. *Callimenellus apterus* Beier, 1944 : Sangli.

Genus *Pseudophyllus* Serville, 1831

141. *Pseudophyllus titan* White, 1846 :
Maharashtra.

Genus *Paramorsimus* Beier, 1954

142. *Paramorsimus oleifolius* (Fabricius, 1793)
: Maharashtra.

Genus *Sathrophyllia* Stål, 1874

143. *Sathrophyllia femorata* (Fabricius, 1787) :
Amravati and Nagpur.

SUMMARY

The paper presents the checklist of Orthoptera of Maharashtra along with their known distribution

only from the state, which includes 143 species / subspecies of belonging to 98 genera representing 8 families.

REFERENCES

- Barman, R.S. 1993. *Insecta : Orthoptera : Tettigoniidae. State Fauna Series 3, Fauna of West Bengal, Zool. Surv. India, (4) : 355-367.*
- Barman, R.S. 1995. *Tettigoniidae : Orthoptera. State Fauna Series 4 : Fauna of Meghalaya, Zool. Surv. India, (3) : 279-290.*
- Barman, R.S. 2000. *Insecta : Orthoptera : Tettigoniidae. State Fauna Series 7 : Fauna of Tripura, Zool. Surv. India, (2) : 263-267.*
- Barman, R.S. 2003. *Insecta : Orthoptera : Tettigoniidae. State Fauna Series 9 : Fauna of Sikkim, Zool. Surv. India, (2) : 193-201.*
- Bhowmik, H.K. 1985a. Contribution to the gryllid fauna of the Western Himalaya (Orthoptera: Grylloidea). *Rec. zool. Surv. India, Occ. Pap. No., 73 : 1-85.*
- Bhowmik, H.K. 1985b. Out line of distribution with an index-catalogue of Indian grasshoppers (Orthoptera : Acrididae). *Rec. zool. Surv. India, Occ. Pap. No., 78 : 1-51.*
- Bhowmick, H.K. 1986. Grasshopper fauna of West Bengal, India (Orthoptera : Acrididae). *Zool. Surv. India, Tech. Mongr., No., 14 : 1-180.*
- Chopard, L. 1969. The Fauna of India and adjacent countries. : Orthoptera, 2 Grylloidea. Pub : Zool. Surv. India, Kolkata, 2 : 1-421.
- Dey, A. and Hazra, A.K. 2003. Diversity and distribution of grasshopper fauna of Greater Kolkata with notes on their ecology. *Memoirs, zool. Surv. India, 19(3): 1-118.*
- Eades, D.C. & Otte, D. 2010. Orthoptera Species File Online. Version 2.0/3.5. <<http://Orthoptera.SpeciesFile.org>>. [retrieval date, 15th January, 2010].
- Gupta, S.K., Dube, K.K. and Chandra, K. 2008. On a collection of Orthoptera from Achanakmar Wildlife Sanctuary, Chhattisgarh. *Natl. J. Life Sci., 5(1) : 117-126.*
- Hazra, A.K., Tandon, S.K., Shishodia, M.S., Dey, A. and Mandal, S.K. 1993. *Insecta : Orthoptera : Acridoidea. State Fauna Series 3, Fauna of West Bengal Part 4, Zool. Surv. India, : 287-354.*
- Hazra, A.K., Tandon, S.K., Shishodia, M.S., Mandal, S.K. and Dey, A. 1995. *Insecta : Orthoptera : Acridoidea. State Fauna Series 4, Fauna of Meghalaya Part 3, Zool. Surv. India, : 209-277.*
- Kirby, W.F. 1914. *The fauna of British India, including Ceylon and Burma, I. Orthoptera (Acrididae) : IX + 276pp.* London.
- Kulkarni, P.P. and Sharma, R.M. 2004. Unusual observation of mass immobilization of a grasshopper population in Maharashtra. *Bionotes, 6(2) : 55.*
- Kulkarni, P.P. and Shishodia, M.S. 2004. *Insecta : Orthoptera. Conservation area series 20, Fauna of Pench National Park, Zool. Surv. India, : 207-225.*
- Kulkarni, P.P. and Shishodia, M.S. 2005. *Insecta : Orthoptera. Conservation area series 24, Fauna of Melghat Tiger Reserve, Zool. Surv. India, : 317-340.*

- Mandal, S.K. & Yadav, K. 2007. Insecta : Orthoptera : Acridoidea. *State Fauna Series 5, Fauna of Andhra Pradesh*, Part 3. *Zool. Surv. India*, : 183-222.
- Mandal, S.K., Hazra, A.K. and Tandon, S.K. 1999. Studies on taxonomy, biology and ecology of grasshoppers. *Rec. zool. Surv. India. Occ. Pap. No.*, **173** : i- iv, 1-167.
- Mandal, S.K., Dey, A. and Hazra, A.K. 2007. *Pictorial handbook on Indian short-horned grasshopper pests* (Acridoidea : Orthoptera) : 1-57. (Published by the Director, *Zool. Surv. India*, Kolkata).
- Sharma, R.M., Kulkarni, P.P. and Kamble, R.H. 1999. Population outburst of *Mecopoda elongata* Linn. (Orthoptera : Tettigoniidae) around Pune, Maharashtra. *Zoos' Print Journal*. **1-14**(3-12) : 174.
- Shishodia, M.S. 1991a. On a collection of Grouse-Locusts (Orthoptera : Tetrigidae) from Maharashtra, India, with some new distributional records. *Rec. zool. Surv. India*, **88**(1) : 29-36.
- Shishodia, M.S. 1991b. Taxonomy and Zoogeography of the Tetrigidae (Orthoptera : Tetrigoidea) of North Eastern India. *Rec. zool. Surv. India, Occ. Pap. No.*, **140** : vi + 1-203.
- Shishodia, M.S. 1997a. Orthoptera. *State Fauna Series 6, Fauna of Delhi*, *Zool. Surv. India*, : 173-196.
- Shishodia, M.S. 1997b. Orthoptera. *Fauna of Conservation Areas 9, Fauna of Nanda Devi Biosphere Reserve*, *Zool. Surv. India*, : 49-53.
- Shishodia, M.S. 2000a. Short and long horned grasshoppers and crickets of Bastar district, Madhya Pradesh, India. *Rec. zool. Surv. India*, **98**(1) : 27-80.
- Shishodia, M.S. 2000b. Insecta : Orthoptera : Grylloidea and Tridactyloidea. *State Fauna Series 7, Fauna of Tripura*, *Zool. Surv. India*, (2) : 247-262.
- Shishodia, M.S. and Hazra, A.K. 1986. Orthopteran Fauna of Silent Valley, Kerala. *Rec. zool. Surv. India*, **84**(1&4) : 191-228.
- Shishodia, M.S. and Tandon, S.K. 2000. Insecta : Orthoptera : Acridoidea and Eumastacoidea. *State Fauna Series 7, Fauna of Tripura*, Part 2, *Zool. Surv. India*, : 197-230.
- Shishodia, M.S., Dey, A. and Tandon, S.K. 2003. Insecta : Orthoptera : Acridoidea and Eumastacoidea. *State Fauna Series 9, Fauna of Sikkim*, *Zool. Surv. India*, (2) : 165-192.
- Vasanth, M. 1980. Two new species of crickets of the genus *Turanogryllus* Tarbinskii (Orthoptera : Gryllidae) from Maharashtra. *Biovigyanam*, **6** : 115-119.
- Vasanth, M. 1988. Observations on the mating behaviour of *Gryllodes sigillatus* (Walker) (Insecta : Orthoptera : Gryllidae). *Rec. zool. Surv. India*, **85**(3) : 411-418.
- Vasanth, M. 1993. Studies on crickets (Insecta : Orthoptera : Gryllidae) of North-east India. *Rec. zool. Surv. India, Occ. Pap. No.*, **132** : i-vi, 1-178.

INSECTA : DERMAPTERA

M.J. JADHAV, S.S. JADHAV and R.M. SHARMA

Zoological Survey of India, Western Regional Centre, Pune-411044

INTRODUCTION

Earwigs are elongate, flattened insects that may be light red-brown to black in color, $\frac{1}{4}$ inch to 1 inch in length. They are mainly characterized by the presence of three jointed tarsi, forceps-like appendages (cerci) on the end of the abdomen. The size and shape of the cerci vary between species and between males and females. The cerci are used by the earwig (pincher bug) as both defensive and offensive weapons, and occasionally are used to capture prey. These insects have soft body, chewing mouthparts and long, slender antennae and are either winged or wingless. If wings are present, the first pair is hard and very short, barely covering the first segments of the insect's abdomen.

They are abundant and can occur in a variety of habitats. Most earwigs are nocturnal and inhabit small crevices, living in small amounts of debris, in various forms such as bark and fallen logs. Species have been found to be blind and living in caves. Some species are capable of adapting above the timber line in Himalayas and elsewhere and crawl even on snow. During rainy season they may be collected from foliage and occasionally visit flowers as well. Earwigs feed on a wide array of living and dead plant and animal matter. Some earwigs are predators, feeding on aphids, while others feed on living plants and may become pests in greenhouses and on certain crops such as vegetables, fruits, ornamentals, forages and field plants.

Approximately 320 species are known from India. But Only 13 species are reported from the state of Maharashtra and appears to be unexplored for this group. Further exploration will certainly add to the number.

SYSTEMATIC LIST

Superfamily PYGIDICRANOIDEA

Family PYGIDICRANIDAE

Subfamily PYGIDICRANINAE

1. *Cranopygia bhallaie* Kapoor, 1966

Distribution : Maharashtra (Pune)

Subfamily DIPLATYINAE

2. *Paradiplatys gladiator* Burr, 1905

Distribution : Maharashtra (Nagpur), Tamil Nadu, Madhya Pradesh, Orissa, Bihar, West Bengal.

3. *Diplatys coelebs* Hincks, 1955

Distribution : Maharashtra (Mumbai), Tamil Nadu, Kerala, Karnataka.

4. *Diplatys dolens* Hincks, 1957

Distribution : Maharashtra (Pune)

5. *Diplatys menoni* Kapoor and Bhardwaj, 1968

Distribution : Maharashtra (Pune)

Superfamily ANISOLABOIDEA

Family ANISOLABIDIDAE

Subfamily ANISOLABIDINAE

6. *Euborellia annulipe* Lucas, 1847

Distribution : Maharashtra (Satara Dist.), Tamil Nadu, Madhya Pradesh, Orissa, West Bengal, Tripura, Manipur, Punjab, Rajasthan, Arunachal Pradesh, Uttar Pradesh, Himachal Pradesh, Andaman Isls.

7. *Euborellia annulata* (Fabricius, 1793)

Distribution : Maharashtra (Mumbai), Kerala, Tamil Nadu, Orissa, West Bengal, Karnataka, Manipur, Arunachal Pradesh, Lakshadweep Isls.

8. *Anisolabella dohrni* (Kirby, 1891)

Distribution : Maharashtra (Pune, Satara, Koyana Valley), Tamil Nadu, Andhra Pradesh, Assam.

9. *Gonolabis burri* (Srivastava, 1970)

Distribution : Maharashtra

Family LABIDURIDAE

Subfamily LABIDURINAE

10. *Forcipula quadrispinosa* (Dohrn, 1863)

Distribution : Extensively distributed all over India except beyond 3000 ft in Himalayas.

Superfamily FORFICULOIDEA

Family SPONGIPHORIDAE

Subfamily SPONGIPHORINAE

11. *Marava arachidis* (Yersin, 1860)

Distribution : Maharashtra, West Bengal, Bihar and Tamil Nadu.

Family CHELISOCHIDAE

Subfamily CHELISOCHINAE

12. *Proreus abdominalia* Ramamurthi, 1965

Distribution : Maharashtra, West Bengal, Assam and Tamil Nadu.

13. *Hamaxas melanocephalus* (Dohrn, 1865)

Distribution : Maharashtra, West Bengal, Bihar, Uttar Pradesh and Tamil Nadu.

REFERENCES

- Srivastava G.K. 1988. The Fauna of India and the adjacent countries-Dermaptera (Part-I) : (Superfamily : Pygidicranoidea), 1-261.
- Srivastava G.K. 1988. The Fauna of India and the adjacent countries- Dermaptera (Part-II) : (Superfamily : Anisolaboidea), 1-235.
- Srivastava G.K. 1993. Insecta : Dermaptera In : *Fauna of West Bengal, State Fauna Series*, 3(Part-4) : 369-459.

INSECTA : EMBIOPTERA (WEB SPINNERS)

R.M. SHARMA* and KAILASH CHANDRA

Zoological Survey of India, M-Block, New Alipore, Kolkata-700 053

INTRODUCTION

The order Embioptera includes primitive insects commonly known as web-spinners or embiids. Medium sized (5 to 25 mm) insects with body elongate and dorso-ventrally flattened. Their mouth parts are chewing type, antennae filiform and metatarsus of forelegs swollen containing glands and spinnerets. The winged members have two pairs of elongate, membranous similar wings. The wings remain folded over the back at rest. Males are generally winged and females are apterous. They have a unique ability in the world of insects to spin the silk threads with their feet. These webs serve for the protection against predacious insects, for regulating the humidity and for laying the eggs. The reproduction takes place by both sexual as well as parthenogenetic methods. The females exhibit parental care as they remain near the eggs and young ones. They inhabit the humid places like under stones, leaves, bark and other objects. They usually shun the light. Their food consists of almost anything of vegetable origin. Some species of genus *Oligotoma* also live in association with spiders, ants and termites. The studies on web-spinners and their association with termites and other arthropods will throw some light on evolution of commensalism and socialism in insects. They play an important role in the formation of the humus and improvement of the soil quality.

These insects are found in all continents but

their distribution is discontinuous. Represented worldwide by **317** extant and **one** fossil species belonging to **53** genera under **8** families (Ross, 1999). In India, the order is represented by **31** species belonging to **5** genera under **two** families (Chandra & Sharma, 2009).

The Maharashtra fauna of embiids is represented by 4 species of a single genus under one family.

Order EMBIOPTERA

Family OLIGOTOMIDAE

1. *Oligotoma asymmetrica* Menon & George, 1936; Maharashtra
2. *Oligotoma ceylonica indica* Davis, 1940; Maharashtra, Kerala
3. *Oligotoma humbertiana* (Saussure, 1896); Andaman Is. Bihar, Kerala, Tamil Nadu, Maharashtra, Orissa, Madhya Pradesh, West Bengal
4. *Oligotoma saundersii* (Westwood, 1837) = *O. bramina* Saussure, 1896; Andaman Is. Kerala, Madhya Pradesh, Maharashtra, West Bengal, Bihar, Orissa, Tamil Nadu, Western Ghats

SUMMARY

The embiid fauna of Maharashtra is represented by 4 species of a single genus under one family.

REFERENCES

- Kapur, A.P. and Kripalani, M.B.1957. Studies in Indian Embioptera, Part 1. The Oligotomidae of India. *Trans. R. Ent. Soc. London*, **109** : 111-134.
- Chandra, K. and Sharma, R.M. 2009. Checklist of Indian Embioptera (Embiidina) [http://www. zsi.gov.in /zoological survey of India/zsidata/checklist](http://www.zsi.gov.in/zoological_survey_of_India/zsidata/checklist)
- Ross, E.S. 1999. World list of extant and fossil Embiidina (=Embioptera). [http:// research.calacademy.org/research/entomology/Entomology Resources/embiiist/inde...](http://research.calacademy.org/research/entomology/Entomology_Resources/embiiist/inde...) (Updated January, 2009)

INSECTA : MANTODEA

H.V. GHATE, S.S. JADHAV* and R.M. SHARMA*

Dept. of Zoology, Modern College, Shivajinagar, Pune-411005

INTRODUCTION

The insects, commonly known as 'Praying Mantids', are peculiar in respect of their body structure, prey capture, and reproductive behaviour and are known to lay eggs in complex ootheca. They are predatory insects and occur in all types of habitats and are well camouflaged, known to engage in cannibalism. They remain motionless for hours, and only the head rotates about 180 degrees to watch any disturbances caused by flying insects. About 2300 species under 434 genera belonging to 15 families are known from the world (Ehrmann, 2002). According to Mukherjee *et al.* (1995), 162 species under 68 genera and 6 families are known from India. Some recent taxonomic studies on mantid fauna of various Indian regions are by Vyjayanti & Narendran (2003, 2005), Vyjayanti (2007), Ghate & Mukherjee (2004), Thulsi Rao *et al.* (2005), Vyjayanti *et al.* (2006, 2009, 2010), Jadhav (2008b), Sureshan (2009), Sureshan *et al.*, (2004c; 2006c) and Chandra *et al* (2011).

The mantid fauna of Maharashtra is fairly well studied as compared to other states. Earlier studies from Maharashtra were by Nadkerni (1965, 1974), Ghate *et al.* (2001), Ghate and Ranade (2002), Chaturvedi *et al.* (2000, 2005), Sureshan *et al.* (2004a,b, 2006a,b), Jadhav *et al.* (2006), Jadhav (2008a, 2009), Mukerjee and Ghate (2010).

Here an attempt has been made to inventories the mantid fauna of Maharashtra based upon the study of the collections available at Zoological

Survey of India, Western Regional Centre, Pune, Modern College, Shivajinagar, Pune and published literature. This resulted in the enumeration of 56 species belonging to 31 genera, 16 subfamilies and 8 families.

SYSTEMATIC ACCOUNT

(Classification after Ehrmann, 2002)

Family AMORPHOSCELIDAE

Subfamily AMORPHOSCELINAE

Genus *Amorphoscelis* Stal, 1871

1. *Amorphoscelis annulicornis* Stal

Family HYMENOPODIDAE

Subfamily ACROMANTINAE

Tribe Acromantini

Genus *Acromantis* Saussure, 1870

2. *Acromantis montana* Giglio-Tos

Genus *Ephestiasula* Giglio-Tos, 1915

3. *Ephestiasula pictipes* (Wood-Mason)

4. *Ephestiasula intermedia* Werner

Genus *Euantissa* Giglio-Tos, 1927

5. *Euantissa pulchra* (Fabricius)

Genus *Hestiasula* Saussure, 1871

6. *Hestiasula brunneriana* Saussure

Subfamily HYMENOPODINAE

Tribe Hymenopodini

Genus *Creobroter* Audinet-Serville, 1839

7. *Creobroter apicalis* Saussure

8. *Creobroter laevicollis* (Saussure)
9. *Creobroter gemmatus* (Stoll)
10. *Creobroter urbanus* (Fabricius)
Family LITURGUSIDAE
Subfamily LITURGUSINAE
Tribe Liturgusini
Genus *Humbertiella* Saussure, 1869
11. *H. affinis* Giglio-Tos
12. *H. ceylonica* Saussure
13. *H. indica* Saussure
14. *H. nigrospinosa* Sjostedt
Family TARACHODIDAE
Subfamily TARACHODINAE
Genus *Didymocorypha* Wood-Mason, 1877
15. *Didymocorypha lanceolata* (Fabricius)
Genus *Dysaules* Stal, 1877
16. *Dysaules longicollis* Stal
Family IRIDOPTERYGIDAE
Subfamily IRIDOPTERYGINAE
Tribe Iridopterygini
Genus *Hapalopeza* (*Hapalopeza*) Stal, 1877
17. *Hapalopeza nilgirica* Wood-Mason
Subfamily TROPIDOMANTINAE
Tribe Tropidomantini
Genus *Tropidomantis* (*Eomantis*) Giglio-Tos
18. *Tropidomantis* (*Eomantis*) *guttatipennis* Stal
Family MANTIDAE
Subfamily OXYOTHESPINAE
Tribe Oxyothespini
Genus *Heterochaetula* Wood-Mason, 1889
19. *Heterochaetula fissispinis* Wood-Mason
20. *H. tricolor* (Wood-Mason)
Subfamily SCHIZOCEPHALINAE
Genus *Schizocephala* Audinet-Serville, 1831
21. *Schizocephala bicornis* (Linnaeus)
Subfamily AMELINAE
Tribe Amelini
Genus *Amantis* Giglio-Tos, 1915
22. *Amantis biroi* Giglio-Tos
23. *Amantis saussurei* (Bolivar)
Genus *Elmantis* Giglio-Tos, 1915
24. *Elmantis nira* Mukherjee and Hazra
25. *Elmantis trincomaliae* (Saussure)
Subfamily MANTINAE
Tribe Polyspilotini
Genus *Tenodera* Burmeister, 1838
26. *Tenodera angustipennis* Saussure, 1869
Subfamily PARAMANTINAE
Tribe Paramantini
Genus *Hierodula* Burmeister, 1838
27. *Hierodula coarctata* Saussure
28. *H. doveri* Chopard
29. *H. patellifera* Serville
30. *H. tenuidentata* Saussure
31. *H. unimaculata* (Olivier)
Genus *Rhombodera* Burmeister, 1838
32. *Rhombodera butleri* Wood-Mason
33. *Rhombodera* c.f. *tectiformes* Saussure
34. *Rhombodera woodmasoni* Werner
Tribe Mantini
Genus *Mantis* Linnaeus, 1758
35. *M. religiosa inornata* Werner
36. *Mantis religiosa religiosa* Linnaeus
Genus *Statilia* Stal, 1877
37. *Statilia apicalis* (Saussure)
38. *Statilia maculata* (Thunberg)
39. *S. nemoralis* (Saussure)
Subfamily MIOMANTINAE
Tribe Rivetinini
Genus *Deiphobe* Stal, 1877
40. *Deiphobe indica* Giglio-Tos
41. *D. incisa* Werner
42. *D. infuscata* (Saussure)
43. *D. mesomelas* (Olivier)
Genus *Deiphobella* Giglio-Tos, 1916
44. *Deiphobella laticeps* (Wood-Mason)

Subfamily VATINAE

Tribe Danuriini

Genus *Ambivia* Stal, 1877

- 45.
- Ambivia undata*
- (Fabricius)

Genus *Toxodanuria* Uvarov 1940

- 46.
- Toxodanuria orientalis*
- (Wood-Mason)

Subfamily PHYLLOTHELIINAE

Genus *Phyllothelys* Wood-Mason, 1877

- 47.
- Phyllothelys westwoodi*
- (Wood-Mason)

Family TOXODERIDAE

Subfamily TOXODERINAE

Tribe Toxoderopsini

Genus *Euthyphleps* Wood-Mason, 1889

- 48.
- Euthyphleps curtipes*
- (Westwood)

Genus *Toxoderopsis* Wood-Mason, 1889

- 49.
- Toxoderopsis spinigera*
- Wood-Mason

- 50.
- Toxoderopsis taurus*
- Wood-Mason

Tribe Aethalochroaini

Genus *Aethalochroa* Wood-Mason, 1877

- 51.
- Aethalochroa ashmoliana*
- (Westwood)

- 52.
- Aethalochroa insignis*
- Wood-Mason

Tribe Toxoderini

Genus *Cheddikulama* Henry, 1932

- 53.
- Cheddikulama straminea*
- Henry

Family EMPUSIDAE

Subfamily EMPUSINAE

Tribe Empusini

Genus *Empusa* Illiger, 1798

- 54.
- Empusa guttula*
- (Thunberg)

- 55.
- Empusa pauperata*
- (Fabricius)

Genus *Gongylus* Thunberg, 1815

- 56.
- Gongylus gongylodes*
- (Linnaeus)

SUMMARY

The present study reveals the occurrence of 56 species of mantids belonging to 31 genera, 16 subfamilies and 8 families in Maharashtra state. Species like *Humbertiella affinis*, *Hierodula coarctata*, *Schizocephala bicornis*, *Statilia maculata*, *Creobroter apicalis*, *Euantissa pulchra*, *Hierodula tenuidentata*, *Hierodula coarctata* etc. occur commonly whereas *Cheddikulama straminea*, *Toxoderopsis spinigera*, *Paradanuria orientalis*, *Rhombodera tectiformes*, *Elmantis nira*, have very limited distribution and known rarely from Maharashtra. Maximum representation is from the family Mantidae (29 species) followed by Hymenopodidae (9 species), Toxoderidae (6 species), Liturgusidae (4 species), Empusidae (3 species), Tarachodidae (2 species), Iridopterygidae (2) and Amorphoscelidae (1). Most of the studies on Mantodea are restricted to Western Maharashtra only and rest of the state remains still unexplored. Further serious attempts of field exploration will hopefully increase the distribution status of some species. Records of *Statilia apicalis*, *Ambivia undata* and *Empusa pauperata* are perhaps doubtful which needs verification.

ACKNOWLEDGEMENTS

The authors are thankful to Dr. K. Venkataraman, Director, Zoological Survey of India, Kolkata and the authorities of Modern College, Pune 5, for facilities and encouragement.

REFERENCES

- Chaturvedi, N & Hedge V. 2000. Mantid fauna of Sanjay Gandhi National Park, Mumbai, with some new records for Maharashtra State. *J. Bombay Nat. Hist. Soc.*, **97** : 295-297.
- Chaturvedi, N., Mukherjee, T.K. and Varad Giri 2005. Addition to the Mantid fauna of Sanjay Gandhi National Park, Mumbai and some new records from Maharashtra. *J. Bombay Nat. Hist. Soc.*, **102**(2) : 242-245.
- Chandra, K., R.M. Sharma and D.K. Harshey. 2011. *Gongylus gongylodes* (Linn.) (Insecta : Mantodea) : A new record for Madhya Pradesh. *Bugs R All* No., **17** : 21.

- Ehrmann, R. 2002. Mantodea : Gottesanbeterinnen der Welt. Natur und Tier-Verlag GmbH (NTV), Munster, Germany, 519 pp. (in German).
- Ghate, H.V. and Mukherjee, T.K. 2004. First report of the praying mantis genus *Euchomenella* Giglio-Tos from India and description of *Euchomenella* n.sp. from South India, *Genus*, **15**(3) : 329-337.
- Ghate, H.V., and Ranade, S.P. 2002. Biodiversity of Mantids, Insects: Mantodea, in Pune (Western Ghats) with notes on other regions of Maharashtra. *J. Bombay Nat. Hist. Soc.*, **99**(2) : 348-352.
- Ghate, H.V., Ranade, S., Kaur, R. & Marathe, R. 2001. On *Hestiasula brunneriana* Saussure (Insecta : Mantodea) from Pune, Maharashtra. *J. Bombay Nat. Hist. Soc.*, **98**(3) : 473-476.
- Jadhav S.S. 2008a. Some praying Mantids of Nasik district, Maharashtra State, *Bionotes*, Vol., **10**(1) : 27-28.
- Jadhav S.S. 2009. 'Insecta : Mantodea' *Fauna of Bhimashankar Wildlife Sanctuary, Conservation Area Series*, **42** : 251-256. (Ed. by DZSI, Kolkata).
- Jadhav S.S., Sureshan P.M. and Ghate H.V. 2006. Additions to the Mantid Fauna (Insecta : Mantodea) of Pench National Park, Fauna of Protected Areas-28. *Zoos Print Journal*, **21**(5) : 2261-2262.
- Jadhav, S.S. 2008b. (Insecta : Mantodea). *Fauna of Goa State, State Fauna series*, **16** : 195-198 (Ed. by DZSI, Kolkata).
- Mukherjee T.K. and Ghate H.V. 2010. Redescription of *Hierodula coarctata* Saussure (Mantodea : Mantidae) from Maharashtra, India. *Threatened taxa*, **2**(9) : 1167-1171.
- Mukherjee, T.K., Hazra, A.K. and Ghosh, A.K. 1995. The mantid fauna of India (Insecta : Mantodea) *Oriental Ins.*, **29** : 185-358.
- Nadkerny, N.T. 1965. A note on the Mantids and Tettigonids in the collection of Bombay Natural History Society. *J. Bombay Nat. Hist. Soc.*, **62**(1) : 76-83.
- Nadkerny, N.T. 1974. Insects. In : Maharashtra State Gazetteers: General Series : Fauna (Ed: Kunte, B.G.). Government of Maharashtra, Bombay, pp.127.
- Sureshan, P.M., Ghate, H.V. and C. Radhakrishnan, 2004a. Insecta : Mantodea. *Fauna of Pench National Park, Conservation Area Series*, **20** : 207-210. (Ed. by DZSI, Kolkata).
- Sureshan, P.M., Ghate, H.V. and C. Radhakrishnan, 2004b. *Statilia nemoralis* (Saussure) (Insecta : Mantodea) from Maharashtra, *Zoo's Print Journal*, **19**(7) : 1550.
- Sureshan, P.M., Md. Jafer Palot and C. Radhakrishnan 2004c. New additions to the mantid fauna (Insecta : Mantodea) of Andaman & Nicobar Islands, India. *Zoo's print journal*, **19**(7) : 1544.
- Sureshan, P.M., Ghate, H.V. and C. Radhakrishnan, 2006a. Insecta : Mantodea. *Fauna of Tadoba Andhari Tiger Reserve, Conservation Area Series*, **25** : 227-232. (Ed. by DZSI, Kolkata).
- Sureshan, P.M., Ghate, H.V. and C. Radhakrishnan 2006b. Insecta : Mantodea. *Fauna of Sanjay Gandhi National Park* (Invertebrates). Zool. Surv. India. *Conservation Area Series*, **26** : 41-50. (Ed. by DZSI, Kolkata).
- Sureshan, P.M., Samanta, T. and C. Radhakrishnan 2006c. Mantid (Insecta : Mantodea) fauna of Orissa with some new records for the state. *Zoo's print journal*, **22**(1) : 2539-2543.
- Sureshan, P.M. 2009. A preliminary study on the Mantid Fauna (Insecta : Mantodea) of Orissa, India. *Occ. Paper No.*, **305** : 1-56. (Ed. by DZSI, Kolkata).

- Thulsi Rao, K., Ghate, H.V., Sudhakar, M., Maqsood Javed, S.M. and Siva Rama Krishna 2005. Updated checklist of praying mantid species (Insecta: Mantodea) from Nagarjunasagar-Srisailem Tiger Reserve, Andhra Pradesh. *Zoos' print Journal*, **20**(6) : 1905-1907.
- Vyjayanti, M.C. and Narendran, T.C. 2003. A new species and a key to Indian species of *Hierodula* Burmeister (Mantodea : Mantinae). *Entomon*, **28**(4) : 315-320.
- Vyjayanti, M.C. and Narendran, T.C. 2005. A new species of Praying mantis from India. *Zoos' print Journal*, **20**(3) : 1807-1808.
- Vyjayanti, M.C., Narendra, T.C. and Mukherjee, T.K. 2006. A new species of Praying mantis (Insecta : Mantodea) from Kerala, India. *Oriental Insects*, **40** : 285-290.
- Vyjayanti, M.C. 2007. Mantid fauna of Kerala, Zoological Survey of India, *Occ. Paper* No. **267** : 1-169. (Ed. by DZSI, Kolkata).
- Vyjayanti M.C., Rajeesh, R.S., Sajin John P., M.M. Dhanasree and Ehrmann R. 2009. A new genus of praying mantis *Cotigaonopsis* from Goa, India (Insecta : Mantodea), *Genus*, Vol. **20**(3) : 485-492.
- Vyjayanti M.C. R.S. Rajeesh, P. Sajin John and M.M. Dhanasree 2010. On a collection of Praying mantids (Insecta : Mantodea) from Goa, India, with new distribution records. *Journal of Threatened taxa*, **2**(12) : 1325-1329.
- Werner, F. 1935. Further communication on Indian Mantids or Praying insects. *Proceedings of the Zoological Society of London*, **105** : 495-498.

INSECTA : BLATTODEA

S.S. JADHAV and R.M. SHARMA

Zoological Survey of India, Western Regional Centre, Akurdi, Pune-411044

INTRODUCTION

These insects are commonly known as 'cockroaches'. They are small to medium sized, cursorial, omnivorous insects and rarely resort to flight. The majorities are nocturnal, but the tree and bush species are diurnal in habit. Their body is strongly depressed, bilaterally symmetrical and dorso-ventrally flattened. These insects are medically important as they mechanically transmit food, garbage or water borne diseases.

The knowledge on Indian Blattodea is mainly based on the valuable contributions of Kirby (1904), Shelford (1906), Hanitsch (1915), Bruüning (1948), Rehn (1951), Princis (1966, 1971), Mukherjee (1989, 1993), Roth (1996), Mandal (1995, 2006, 2007), Mandal *et al.* (2000) and Prabakaran *et al.* (2009).

Of the 4000 species and 445 genera under 6 families known from the world, Indian diversity accounts for 156 species belonging to 57 genera under 5 families (Prabakaran *et al.*, 2009) which is approximately 3.75% of world diversity. The present study enumerates 12 species under 10 genera spread over 4 families. This group of insects appears to be under explored from the state and the inventory presented here is based on the scattered information in scientific literature and the identified holdings of Western Regional Centre, Pune.

SYSTEMATIC ACCOUNT

Superorder DICTYOPTERA

Order BLATTODEA

Family BLABERIDAE

Subfamily EPILAMPRINAE

1. *Stictolampra plicata* (Navas, 1904)

Subfamily PYCNOSCELINAE

2. *Pycnoscelus surinamensis* (Linnaeus, 1758)

Subfamily PERISPHAERINAE

3. *Trichoblatta sericea* (Saussure, 1863)

Family POLYPHAGIDAE

4. *Polyphaga indica* (Walker, 1886)

Family BLATTIDAE

Subfamily BLATTINAE

5. *Periplaneta americana* (Linnaeus, 1758)

6. *Blatta orientalis* Linnaeus, 1758

7. *Neostylopyga rhambifolia* (Stoll, 1813)

8. *Neostylopyga sexpustulata* (Walker, 1871)

Family BLATTELLIDAE

Subfamily BLATTELLINAE

9. *Blattella germanica* (Linnaeus, 1767)

10. *Blattella humbertiana* (Saussure, 1863)

11. *Malaccina pallidula* (Boliver, 1897)

12. *Symploce biligata* (Walker, 1868)

SUMMARY

The paper presents the inventory of Blattodea of Maharashtra, which includes 12 species, belonging to 10 genera representing 4 families.

REFERENCES

- Bruijning, C.F.A. 1948. Studies on Malayan Blattidae. *Zool. Meded. R. Mus. Nat. Hist. Leiden*, **29** : 1-174.
- Hanitsch, R. 1915. Malayan Blattidae, *J. Straits. Br. R. Asiat. Soc.*, **69** : 1.
- Kirby, W.F. 1904. A synonymic catalogus of Orthoptera, *Brit. Mus. Nat. Hist.*, **1** : 1-501
- Mandal, S.K. 1995. Insecta : Blattariae. In: *Fauna of Meghalaya, State Fauna Series*, **4**(Part-3) : 353-384.
- Mandal, S.K., Shishodia, M.S. and Bhatta, K.L. 2000. Insecta : Dictyoptera : Blattariae. In : *Fauna of Tripura, State Fauna Series*, **7**(Part-2) : 285-294.
- Mandal, S.K. 2006. Dictyoptera : Blattaria. In : *Fauna of Arunachal Pradesh, State Fauna Series*, **13**(Part-2) : 175-190.
- Mukherjee, K.P. 1989. Insecta : Blattaria. In: *Fauna of Orissa, State Fauna Series*, **1**(Part-2) : 171-179.
- Mukherjee, K.P. 1993. Dictyoptera : Blattaria. In : *Fauna of West Bengal, State Fauna Series*, **3**(Part-4) : 461-473.
- Mandal, S.K. 2007. Insecta : Dictyoptera : Blattaria. In : *Fauna of Andhra Pradesh, State Fauna Series*, **5**(Part-3) : 235-247.
- Prabhakaran, S., Mandal, S.K. and Yadav, K. 2009. Insecta : Dictyoptera : Blattodea. In : *Fauna of Tamil Nadu, State Fauna Series*, **17** : 57-59.
- Princis, K. 1966. Pars 8 : Blattariae. Subordo Blattoidea. In : Beier (ed.), *Orthopterorum Catalogus*: 402-614.
- Princis, K. 1971. Part 13 : Blattariae. Subordo Blattoidea. In: Beier (ed.), *Orthopterorum Catalogus* : 711-1038.
- Roth, L.M. 1996. The Cockroach genera Anaplecta, Anaplectella and Malaccina (Blattaria : Blattellidae : Anaplectinae and Blattellinae). *Oriental Insects*, **30** : 301-372.
- Rehn, J.W.H. 1951. Classification of the Blattaria as indicated by their wings. *Mem. Amer. Soc. Philad.*, No., **69** : 1-201.
- Shelford, R. 1906. Studies of the Blattidae. *Trans. Ent. Soc. London*, : 231-280.

INSECTA : HEMIPTERA : APHIDIDAE

B.C. DAS and P.P. KULKARNI*

Zoological Survey of India, M Block, New Alipore, Kolkata-700 053

INTRODUCTION

Aphids are soft bodied, small, homopteran insects infesting large number of plants. They are important because of their polymorphic forms, heterocious behaviour, reproductive habit, wide range of polyphagism and also being largest group of insect vectors of plant viruses. They are more abundant in temperate climate.

Though Maharashtra state does not have a temperate climate, it has a good number of aphid species recorded from a wide area covering Western Ghat Hills to dry Central peninsular portion.

Not much work on aphids of this state was reported except the works of Kulkarni *et al.*, (1971, '75, '77, '80, '96). So this is a first consolidated work of aphids from this state. So far 44 species under 26 genera have been reported. Among these 4 species are new records for the state.

MORPHOLOGY

Body of an aphid is divisible into 3 parts, head, thorax and abdomen. Sometimes head is fused with the thorax. Head bears flat or concave frons, with frontal horns in some cases, may be smooth, rugose, spinulose and with or without lateral frontal tubercles. Eyes are compound but in some cases represented by triomatidia. Antennae have two basal segments and a flagellum of 1-4 segments, penultimate one bears primary

rhinarium at distal end and the last segment consists of a base and slender processus terminalis. Secondary rhinaria present variably in alatae on segment III, IV & V and in apterae on III. Last segment of rostrum is called ultimate rostral segment with variable number of secondary hairs along with 3 pairs of primary hairs at apex. Thorax is composed of pro, meso and meta thorax. Mesothorax in aptera with mid thoracic furca. Legs consists of 5 segments, sometimes coxae and trochanter may be fused. Trarsi two segmented, first tarsal joint with 2-7 ventral hairs, second tarsal segment with claws. Abdomen with 9 segments, 1-7 segments with spiracles and 1-7 segments with lateral abdominal tubercles, those on 2-6 variably present, abdominal segment 5 or 6 usually with a pair of siphuncula of various shape and size in some cases it may be absent. Cauda may be of various shape with many hairs. Fore wing with stigma, radial sector once or twice forked, hind wing smaller than fore wing and with 2 oblique veins, which may be one or absent.

Males are usually alate, smaller, with secondary rhinaria on flagellum, oviparous females are usually apterous and possess pseudosensoria on hind tibiae which is swollen than in apterous viviparous female.

MATERIAL AND METHODS

Habitat-Aphids usually feed on succulent leaves, stems, foliages, fruits and may occasionally

*Scientist 'D' (Retd.) Western Regional Station, ZSI, Pune.

Present address : 31 Pannalal Nagar, Aurangabad (M.S), Pin-431 005

form galls. Aphids are sometimes found in under ground stems and roots. Association of ants with aphids is frequently met with.

Collection—Aphids are generally collected from host plant with a soft brush soaked in alcohol and preserved in 70% alcohol.

Yellow pan trap method—By this method winged aphids are collected by putting water on a yellow coloured tray kept in open air.

Mounting—Insects are boiled in 15% KOH solution for 10-15 minutes till specimens become transparent. The KOH solution is decanted off and the specimens again boiled in saturated solution of chloral-phenol for a few minutes.

The specimens are then mounted on a glass slide in gum-chloral medium. Slides are properly labelled after study.

Abbreviations used

- F.T.C. – First tarsal chaetotaxy
h.t.2 – Second segment of hind tarsus
P.T. – Processus terminalis
u.r.s. – ultimate rostral segment.

SYSTEMATIC ACCOUNT

Key to the subfamilies

1. First tarsal segment always with more than 7 ventral hairs. Head with a median suture ...
..... LACHNINAE
- First tarsal segment with less than 7 ventral hairs. Head may or may not have a median suture2
2. Siphunculi elongated, hairy GREENIDEINAE
- Siphunculi of various shapes, if elongate then usually without hairs3
3. Empodial hair flattened or fine, subanal plate usually indented or bilobed4
- Empodial hair always fine, subanal plate never indented or bilobed APHIDINAE
4. Head in apterae free from pronotum cauda

rounded. First tarsal segment with 2-7 hairs
..... PEMPHIGINAE

- Head in apterae fused with pronotum, usually eyes 3 faceted5
- 5. Head usually with a pair of frontal horns. Antennae 2-5 segmented, dorsoapical hair of second tarsal segment capitate
..... HORMOPHIDINAE
- Head without a pair of frontal hairs. Eyes sometimes 3 faceted. Cauda knobbed
..... DREPANOSIPHINAE

SYSTEMATIC ACCOUNT

Subfamily APHIDINAE

Tribe Aphidini

Genus 1. *Aphis* Linn.

1. *Aphis citricola* Van der Goot
2. *Aphis craccivora* Koch
3. *Aphis gossypii* Glover
4. *Aphis nasturtii* Kaltentbach
5. *Aphis nerri* B. d. F.

Genus 2. *Toxoptera* Koch

6. *Toxoptera aurantii* (B.d.F.)
7. *Toxoptera citricidus* (Kirkaldy)

Genus 3. *Rhopalosiphum* Koch

8. *Rhopalosiphum maidis* (Fitch)
9. *Rhopalosiphum nymphae* (Linn.)
10. *Rhopalosiphum padi* (Linn.)
11. *Rhopalosiphum rufiabdominalis* (Sasaki)

Genus 4. *Melanaphis* V.d. Goot

12. *Melanaphis donacis* (Passerini)

Genus 5. *Hysteroneura* Davis

13. *Hysteroneura setariae* (Thomas)

Genus 6. *Schizaphis* Börner

14. *Schizaphis graminum* (Rondoni)
15. *Schizaphis rotundiventris* (Signoret)

Tribe Macrosiphini

Genus 7. *Acyrtosiphon* Mordvilko

16. *Acyrtosiphon pisum* (Harris)

Genus 8. *Brachycaudus* V.d. Goot17. *Brachycaudus helicrysi* (Kaltenbach)Genus 9. *Bravicoryne* V.d. Goot18. *Bravicoryne brassicae* Linn.Genus 10. *Coloradoa* Wilson19. *Coloradoa rufomaculata* (Wilson)Genus 11. *Hyadaphis* Kirkaldy20. *Hyadaphis coriandri* (Das)Genus 12 *Lipaphis* Mordvilko21. *Lipaphis erysimi* (Kaltenbach)Genus 13. *Macrosiphoniella* del Guercio22. *Macrosiphoniella estopi* Kulkarni23. *Macrosiphoniella sanborni* (Gillette)Genus 14. *Macrosiphum* Passerini24. *Macrosiphum rosae* (Linn.)25. *Macrosiphum raoi* KulkarniGenus 15. *Myzus* Passerini26. *Myzus persicae* (Sulzer)Genus 16. *Pentalonia* Coquerel27. *Pentalonia nigronervosa* CoquerelGenus 17. *Rhodobium* H.R. Lambers28. *Rhodobium porosum* (Sanderson)Genus 18. *Uroleucon* Mordvilko29. *Uroleucon (Uroleucon) kumaoni* Bangerjee, Ghosh & Raychaudhuri30. *Uroleucon (Uromelan) compositae* (Theobald)31. *Uroleucon (Uroleucon) sonchi* (Linn.)32. *Uroleucon (Uromelan) gobonis* (Matsumura)33. *Uroleucon (Uromelan) lactucicola* (Strand)34. *Uroleucon (Uromelan) orientalis* (Kulkarni)35. *Uroleucon (Uromelan) echinatus* (Kulkarni)

Subfamily DREPANOSIPHINAE

Genus 19. *Theriaphis* Walker36. *Theriaphis trifolii* (Monell)

Subfamily GREENIDEINAE

Tribe **Cervaphidinae**Genus 20. *Schoutedenia* Rubsaamen37. *Schoutedenia emblica* Patel & KulkarniTribe **Greenideini**Genus 21. *Greenidea* Schouteden38. *Greenidea (Trichosiphum) formosana* Maki39. *Greenidea ficicola* Takahashi

Subfamily HORMAPHIDINAE

Genus 22. *Ceratovacuna* Zehntner40. *Ceratovacuna lanigera* Zehntner

Subfamily PHEMPHIGINAE

Tribe **Fordini**Genus 23. *Geoica* Hart41. *Geoica luciphaga* (Zehntner)Tribe **Erisomatini**Genus 24. *Tetraneura* Hartig42. *Tetraneura (Tetraneurella) nigriabdominalis* (Sasaki)

Subfamily LACHNINAE

Tribe **Cinarini**Genus 25. *Cinara* Curtis43. *Cinara thujaefilina* (del Guercio)Tribe **Lachnini**Genus 26. *Tuberolachnus* Mordvilko44. *Tuberolachnus salignus* (Gmelin)**Key to the genera of Tribe Aphidini**

1. Hind tibiae with row of peg like projections. Rows of spinules forming interconnecting stinae on lateroventral areas of abdominal segments **Toxoptera** Koch
- Hind tibiae without such projections. 2
2. Abdominal dorsum with distinct polygonal spinules **Rhopaloriphum** Koch
- Abdominal dorsum without polygonal spinules 3
3. Siphunculi short and thick, secondary rhinaria in alatae protuberant **Melanaphis** V.d. Goot
- Siphunculi rather long; secondary rhinaria in alatae normal 4
4. Alate viviparae with M in forewing once branched **Selizaphis** Börner

- Alate viviparae with M in forewing twice branched5
- 5. Hind wing with one oblique vein. Femora and tibiae dark at apex, cauda pale with basal constriction *Hysteroneura* Davis
- Hind wing with both oblique veins6
- 6. Head without any projection, siphunculi never too short *Aphis* Linnaeus

Key to the Species of *Aphis* Linnaeus

Apterae

1. Longest hair on femora as long as to longer than basal diameter of femora
..... *citricola* V.d.G.
- Longest hair on femora shorter than basal diameter of femora2
2. Secondary hair on u.r.s. as long as to longer than primary hairs *craccivora* Koch
- Secondary hair on u.r.s. shorter than primary hairs3
3. Second tarsal segment with only three pairs of primary hairs *nasturtii* Kaltenbach
- Second tarsal segment with secondary hairs in addition to primary hairs4
4. Second tarsal segment with both dorsal and ventral secondary hairs, siphunculi stout, dark about 1.25 x segment III *nerii* B.d.F.
- Second tarsal segment with secondary hairs only ventrally. Siphunculi subequal to or just longer than segment III *gossypii* Glover

Family APHIDIDAE

Subfamily APHIDINAE

Tribe Aphidini

Genus *Aphis* Linnaeus

1758. *Aphis* Linnaeus, *Syst. Nat.* (10th ed.), 1 : 451.

1. *Aphis citricola* Van der Goot

1912. *Aphis citricola* Van der Goot, *Rec. Indian Mus.*, 13 : 175.

1990. *Aphis citricola* : Ghosh, L.K., *Mem. Zool. Surv. India*, 17(3) : 16.

Distribution : India : Maharashtra and all over.

Elsewhere : Widely distributed.

2. *Aphis craccivora* Koch

1854. *Aphis craccivora* Koch, *Die Pfl. Aphiden*, 1 : 124.

1980. *Aphis craccivora* Koch, Raychaudhuri, D.N.(ed.), *Aphids of North East India & Bhutan*, *Zool. Soc. Kol.* : 52.

Material examined : 2 apterae + 1 alata, *Dolichos lablab*, Paud, Pune, 17.1.03, coll. B.C. Das : 4 apterae, *Dolichos lablab*, Sayed Pimpri, Nasik, 12.12.03, coll. B.C. Das.

Diagnostic characters : Apterae. Body oval, blackish, about 2.01 mm long with 1.30 mm as width. Antennae 6 segmented, pt. about 3.0 x base; Rostrum reaches upto hind coxae, u.r.s. about 0.90 x h.t.2. Abdominal dorsum dark with polygonal reticulations, hairs on dorsum with acuminate apices. Siphunculi cylindrical, imbricated about 1.50 x cauda. Cauda elongate, black, somewhat constricted at base bearing 5-9 hairs. F.T.C. 3.3.2.

Distribution : India : Maharashtra and all over.

Elsewhere : Virtually cosmopolitan.

3. *Aphis gossypii* Glover

1877. *Aphis gossypii* Glover, *Rep. comm. agxig. Oper. Dept.*, 36.

1980. *Aphis gossypii* Glover, Raychaudhuri, D.N.(ed.), *Aphids of North East India and Bhutan*, *Zool. Soc. Kol.*, 52.

Material examined : 2 apterae, *Rosa* sp. Matheran, 20.1.03, 2 apterae, *Hibiscus* sp. Matheran, 20.1.03, coll. B.C. Das.

Diagnostic character : Aptera–Body pale, 1.40 mm 1.50 mm long 0.80-0.85 mm width, antennae 6 segmented, p.t. about 2.20 x base of antennal segment VI. Rostrum reaching beyond mid coxae, u.r.s. about 1.2 times x h.t.2 Abdominal dorsum pale, dorsal hairs acuminate. Siphunculi cylindrical, about 1.35 x as long as cauda. Cauda thumb shaped and with 5-6 hairs, F.T.C., 3, 3, 2.

Distribution : India : Maharashtra and all over.

Elsewhere : Cosmopolitan.

4. *Aphis nasturtii* Kaltenbach

1843. *Aphis nasturtii* Kaltenbach, *Mon. Fam. pfl.*, 76.

1980. *Aphis nasturtii* Kaltenbach, Raychaudhuri, D.N. (ed.), *Aphids of North East India and Bhutan, Zool. Soc. Kol.*, : 56.

Distribution : India : Maharashtra, Arunachal Pradesh, Himachal Pradesh, Meghalaya, Nagaland, Sikkim, West Bengal.

Elsewhere : America, Europe, Middle East, Pakistan and Taiwan.

5. *Aphis nerii* B.d.F.

1841. *Aphis nerii* Boyer de Fonscolombe, *Ann. Soc. ent. Fr.*, 10 : 179.

1980. *Aphis nerii* B.d.F., Raychaudhuri, D. N. (ed.) *Aphids of North East India and Bhutan, Zool. Soc. Kol.*, 56.

Material examined : 2 apterae, *Calotropis gigantea*, Chowgaon, Dhule, 14.12.03, coll. B.C. Das; 1 Alata, *Calotropis gigantea*, Trimbakeswar, Nasik, coll. B.C. Das.

Diagnostic characters : Apteræ—Body pale, length about 2.15 mm, width 1.10 mm. Antennae 6 segmented, p.t. about 3.90 x base of antennal segment VI. Rostrum reaches beyond mid coxae, u.r.s. about 1.35 x h.t. 2. Abdominal dorsum pale, distal hairs fine, siphunculi cylindrical, imbricated about 0.20x cauda. Cauda with 9 hairs. F.T.C.—3, 3, 3.

Distribution : India : Maharashtra and all over.

Elsewhere : Africa, America, Japan, Korea, Phillipines and Taiwan.

2. Genus *Hysteroneura* (Davis)

1919. *Hysteroneura* Davis, *Canad. Ent.*, 51 : 263.

6. *Hysteronema setariae* (Thomas)

1878. *Siphonophora setariae* Thomas, *Bull. Ill. Sta. Lab. nat. Hist.*, 2 : 5.

1980. *Hysteroneura setariae* (Thomas), Raychaudhuri, D.N. (ed.) *Aphids of North East India and Bhutan, Zool. Soc. Kol.*, 61.

Material examined : 3 apterae + 1 alata, grass, Kolhapur, 27.1.03, Coll. B.C. Das.

Diagnostic characters : Apteræ—Body pale, frons with low lateral frontal tubercles. Antennae 6 segmented, imbricated, p.t. about 6.30 x base of segment VI. Rostrum reaches mid coxae, u.r.s. about 0.850 x h.t. 2. Abdominal dorsum pale, Siphunculi imbricated, brown, 2.0 x cauda which is pale and with 4 hairs. F.T.C. 3, 3, 2.

Distribution : India : Maharashtra and all over.

Elsewhere : Africa, America, Japan, Korea, Phillipines and Taiwan.

7. *Melanaphis donacis* (Passerini)

1860. *Longiunguis donacis* Passerini, *Gli Afidi*, 309.

1980. *Melanaphis donacis* (Passerini), Raychaudhuri, D.N. (ed.), *Aphids of North East India and Bhutan, Zool. Soc. Kol.*, 65.

Material examined : 1 aptera + 1 alata, *Phragmites karka*, Lingmal, Mahabaleshwar, 29.1.03, Coll. B.C. Das.

Diagnostic characters : Apteræ. Body pale, head with lateral frontal tubercles. Antennae imbricated, 6 segmented, p.t. about 1.50 x base of antennal segment VI. Rostrum reaches beyond fore coxae, u.r.s. about 0.60 x h.t. 2. Abdomen pale, siphunculi short, cylindrical, without flange about 0.64 x elongated cauda bearing 8 hairs F.T.C. 3, 3, 2.

Distribution : India : Maharashtra, Meghalaya, Tamil Nadu.

Elsewhere : Mediteranean region.

Remarks : This species is a new record for the state.

4. Genus *Rhopalosiphum* Koch

1854 *Rhopalosiphum* Koch, *Die pfl. Aphiden*, 1 : 23.

Key to the species of *Rhopalosiphum* Koch

1. Antennae 5 segmented,
..... *rufiabdominalis* (Sasaki)
- Antennae 6 segmented 2

2. P.t. about 1.8 to 2.5 x base of segment VI. Body about 10-15 x siphunculi*maidis* (Fitch.)
- Processus terminalis never less than 3 x base of segment IV3
3. Dorsal abdominal hairs with blunt apices. Siphunculi cylindrical*padi* (Linn.)
- Dorsal abdominal hairs, fine, siphunculi swollen distally*nymphaeae* (Linn.)

8. *Rhopalosiphum maidis* (Fitch)

1856. *Aphis maidis* Fitch, Trans. N.Y. Agric. Soc., 15 : 531.
1980. *Rhopalosiphum maidis* (Fitch), Raychaudhuri, D.N. (ed.), Aphids of North East India and Bhutan, Zool. Soc. Kol., 69.

Material examined : 3 apterae, *Zea mays*, Sayd Pimpri, Nasik, 12.12.03, Coll. B.C. Das.

Diagnostic character : Apteræ–Body pale, elongated, Antennae 6 segmented, p.t. about 2.30 x base of segment VI, Rostrum short, reaches mid coxae, u.r.s. about 0.80 x h.t.2. Abdomen with spinulose polygonal reticulations, siphunculi short, slightly longer than cauda. Cauda with 4 hairs, F.T.C. 3.3.2.

Distribution : Virtually cosmopolitan.

9. *Rhopalosiphum nymphaeae* (Linn.)

1761. *Aphis nymphaeae* Linnaeus, *Fauna suecica*, 2 : 260.
1980. *Rhopalosiphum nymphaeae* (Linn.), Raychaudhuri, D.N. (ed.), Aphids of North East India and Bhutan, Zool. Soc. Kol., 67.

Distribution : Virtually Cosmopolitan.

10. *Rhopalosiphum padi* (Linn.)

1758. *Aphis padi* Linnaeus, *Syst. Nat.* (10 ed.), 1 : 451.
1980. *Rhopalosiphum padi* (Linn.), Raychaudhuri, D.N. (ed.), Aphids of North East India and Bhutan, Zool. Soc. Kol., 70.

Material examined : 2 alatae, *Triticum vulgare*, Paud, (Pune), 17.1.03, Coll. B.C. Das.

Diagnostic characters : Alata Head smooth with weakly developed lateral frontal tubercles.

Antennae 6 segmented, p.t. about 5.60 x base of antennal segment VI. Segments III 23, IV 17 & V with 3 secondary rhinaria. Rostrum reaches mid coxae, u.r.s. about 0.75x h.t.2. Siphunculi cylindrical, scabrous, brownish, longer than cauda which is constricted at middle, pale, with 4 hairs. F.T.C. 3, 3, 2. Wing venation normal.

Distribution : Virtually cosmopolitan.

Remarks : This species is a new record for this state.

11. *Rhopalosiphum rufiabdominalis* (Sasaki)

1899. *Toxoptera rufiabdominalis* Sasaki, *Rep. Hokkaido natr. agric. Exp. Stn.*, 17 : 202.
1980. *Rhopalosiphum rufiabdominalis* (Sasaki), Raychaudhuri, D.N. (ed.), Aphids of North East India and Bhutan, Zool. Soc. Kol., 70.

Material examined : 1 alata, *Triticum vulgare*, Nagpur, 23.12.03, coll. B.C. Das.

Diagnostic characters : Alata–Head smooth, lateral frontal tubercles weakly developed. Antennae 5 segmented, p.t. about 4.50x base of segment VI, segment III with 27, segment IV with 8 secondary rhinaria. Rostrum extend upto mid coxae, u.r.s. about 1.50x h.t.2. Abdomen, with sclerotic pigmentation laterally and with spinular reticulation, dorsal hair fine, siphunculi cylindrical, imbricated, brownish, with a well developed flange. Cauda tapering and with 6 hairs. F.T.C. 3, 3, 2. Wing venation normal.

Distribution : Virtually cosmopolitan.

5. Genus *Schizaphis* Börner

1931. *Schizaphis* Börner, *Ans. Schadlingsk.*, 7 : 10.

Key to the species of *Schizaphis* Börner Apterous viviparous female

1. Cauda pale, siphunculi never more than 2 x cauda *graminum* (Rondoni)
- Cauda dark. Siphunculi never less than 2 x cauda *rotundiventris* (Signoret)

12. *Schizaphis graminum* (Rondani)

1852. *Aphis graminum* Rondani, *Nouv. Ann. Sci. Nat. Eologna*, 6(3) : 10.

1980. *Schizaphis graminum* (Rondani), Raychaudhuri, D.N. (ed.), *Aphids of North East India and Bhutan, Zool. Soc. Kol.*, 72.

Distribution : India : Maharashtra and widely distributed.

Elsewhere : Cosmopolitan.

13. *Schizaphis rotundiventris* (Signoret)

1860. *Schizonerua rotundiventris* Signoret, (Original citation could not be traced).

1980. *Schizaphis rotundiventris* (Signoret), Raychaudhuri, D.N. (ed.), *Aphid of North East India and Bhutan, Zool. Soc. Kol.*, 74.

Distribution : India-Maharashtra, Meghalaya, Sikkim, South India, Uttar Pradesh, West Bengal.

Elsewhere : Widely distributed.

6. Genus *Toxoptera* Koch

1887. *Toxoptera* Koch, *Die pfl. Aphiden*, 3 : 253.

**Key to the species of genus *Toxoptera* Koch
Apterous viviparous female**

1. Longest hair on antennal segment III shorter than b.d. III siphunculi sparsely imbricated, cauda with 9-17 hairs *aurantii* (B.d.F)
- Longest hair on antennal segment III equal to 1.5 times of b.d. III; siphunculi heavily imbricated, cauda with 25-36 hairs *citricidus* (Kirkaldy)

14. *Toxoptera aurantii* (B.d.F)

1841. *Aphis aurantii* B.d.F. *Anal. soc. Fr.*, 10 : 178.

1980. *Toxoptera aurantii* (B.d.F), Raychaudhuri, D.N. (ed.), *Aphids of North East India and Bhutan, Zool. Soc. Kol.*, 76.

Distribution : India : Maharashtra and all over.

Elsewhere : Virtually Cosmopolitan.

15. *Toxoptera citricidus* (Kirkaldy)

1907. *Myzus citricidus* Kirkaldy, *Proc. Hawii ent. Soc.*, 1 : 100.

1980. *Toxoptera citricidus* (Kirkaldy), Raychaudhuri, D.N. (ed.), *Aphids of North East India and Bhutan, Zool. Soc. Kol.*, 77.

Material examined : 2 apterous nymphs, money plant, Matheran, 19.1.03, coll. B.C. Das.

Diagnostic characters : (Apterous nymph)–
Body oval. Antennae 6 segmented, imbricated, p.t. about 4.80 x base of a.s. VI, Rostrum reaches hind coxae, u.r.s. about 1.60 x h.t. 2. Abdominal dorsum with reticulation, siphunculi brownish, imbricated, ventrolateral sides of 5th, 6th & 7th segments with striae. Cauda immature, F.T.C. 3, 3, 3.

Distribution : India : Maharashtra and all over.

Elsewhere : Widely distributed.

Key to the genera of Tribe Macrosiphini

1. Cauda not or hardly longer than width of base *Brachycaudus* V.d.G.
- Cauda distinctly longer than width at base 2
2. Some of secondary hairs on u.r.s. as long as or longer than primary hairs *Macrosiphoniella* del Guereio
- Secondary hairs on u.r.s. usually much shorter than primary hairs 3
3. Siphunculi reticulated with isodiametrical cells 4
- Siphunculi not reticulated 5
4. Secondary rhinaria protuberant. Abdominal dorsum with hairs bearing selerites. F.T.C. usually 5,5,5 *Uroleucon* Mordvilko
- Secondary rhinaria non protuberant. Hairs on abdominal dorsum without selerites. F.T.C. usually 3,3,3 or 4,4,4 *Macrosiphum* Passerini
5. Dorsal abdominal hairs with apices like a partly opened fan *Coloradoa* Wilson
- Dorsal abdominal hairs may be variously shaped but never as above 6
6. Abdominal dorsum in apterae with a reticulated pattern *Pentalonia* Coquerel

- Abdominal dorsum in apterae without such pattern 7
- 7. Apterae with secondary rhinaria 8
- Apterae without secondary rhinaria 9
- 8. Frontal sinus v shaped. Dorsal cephalic hairs short, with bluntish to incrassate apices
..... *Acyrtosiphon* Mordvilko
- Median frontal prominence distinct, dorsal cephalic hairs short and of myzine type
..... *Rhodobium* H.R.L.
- 9. Dorsum of head in apterae usually smooth or may be slightly uninked or spinulose 10
- Dorsum of head in apterae spinulose or warty
..... *Myrus* passerini
- 10. Siphunculi shorter than cauda 11
- Siphunculi longer than cauda
..... *Lipaphis* Mordvilko
- 11. Siphunculi barrel shaped, cauda triangular
..... *Brevicoryne* V.d.G.
- Siphunculi clavate, cauda elongated
..... *Hydaphis* Kirkaldy

7. Genus *Acyrtosiphon* Mordvilko

1914. *Acyrtosiphon* Mordvilko, *Faunae Russie*, 1 : 75.

16. *Acyrtosiphon pisum* (Harris)

1776. *Aphis pisum* Harris, *Exposit. English Insects*, London, 66.
1980. *Acyrtosiphon pisum* (Harris), Raychaudhuri, D.N. (ed.), *Aphids of North East India and Bhutan*, *Zool. Soc. Kol.*, : 91.

Material examined : 4 apterae & 1 alata, Loson Grass, Khultabad, Aurangabad, 17.12.03, coll. B.C. Das.

Diagnostic characters : Body elongated, frons V shaped, head smooth, frontal hairs short, length 4.20 mm, width–1.90 mm. Antennae 6 segmented, segment III with a few secondary rhinaria, p.t. long about 3.55 x base of segment VI. Rostrum short, reaches beyond mid coxae, u.r.s. about 0.66 x h.t.2. Abdomen pale, smooth, dorsal hairs like frontal hair. Siphunculi long narrowed, cylindrical, with a few preapical striae, about 1.55 x long, elongated, pointed cauda which bears 8 hairs. F.T.C., 3,3,3.

Distribution : Cosmopolitan.

8. Genus *Brachycaudus* Van der Goot

1913. *Brachycaudus* V.d.G. *Tijdschr. Ent.*, 56 : 97.

17. *Brachycaudus helicrysi* (Kaltenbach)

1843. *Aphis helicrysi* Kaltenbach, *Monogr. pflause*, : 102.
1980. *Brachycaudus helicrysi* (Kaltenbach), Raychaudhuri, D.N. (ed.), *Aphids of North East India and Bhutan*, *Zool. Soc. Kol.*, : 106.

Material examined : 1 aptera + 1 alata, Azaratum conizoides, Lingmal, Mahabaleshwar, 24.1.03, 1 alata, undet, Panchagani, Mahabaleshwar, 22.1.03, Coll. B.C. Das.

Diagnostic characters (Apterae)–Body oval, Antennae 6 segmented, imbricated, p.t. about 2.96 x base of antennal segment VI. Rostrum reaches upto mid coxae, u.r.s. about 1.30 x h.t. 2. Abdominal hairs bluntish, spiracular opening large, siphunculi short, flanged, slightly narrowed. Cauda subpentagonal with 4 hairs. F.T.C.–3,3,2.

Distribution : Virtually cosmopolitan.

Remarks : This species is a new record for the state.

9. Genus *Brevicoryne* Van der Goot

1915. *Brevicoryne* Van der Goot. *Beitr. kennt. Holland. Blattlause*, 245.

18. *Brevicoryne brassicae* (Linn.)

1758. *Aphis brassicae* Linn. *Syst. Nat.* (10 ed.), 1 : 452.
1980. *Brevicoryne brassicae* (Linn.), Raychaudhuri, D.N. (ed.), *Aphids of North East India and Bhutan*, *Zool. Soc. Kol.*, : 111.

Material examined : 1 aptera and 1 alata, *Brassica* sp. Lingmal, Mahabaleshwar, 23.1.03, Coll. B. C. Das.

Diagnostic characters : Aptera–Body oval. Antennae 6 segmented, imbricated, p.t. about 3.50 x base of segment VI. Rostrum reaches upto mid coxae, u.r.s. about 0.61 x h.t. 2. Abdomen with pigmented patches, dorsal hairs bluntish. Siphunculi winkled, shorter than cauda which is triangular and with 5 hairs. F.T.C. 3,3,3.

Distribution : India : Maharashtra and all over.

Elsewhere : Virtually cosmopolitan.

10. Genus *Coloradoa* Wilson

1910. *Coloradoa* Wilson, *Ann. ent. Soc. Am.*, 3 : 328.

19. *Coloradoa rufomaculata* (Wilson)

1908. *Aphis rufomaculata* Wilson, *Ent. News*, 19 : 261.

1980. *Coloradon rufomaculata* (Wilson), Raychaudhuri, D.N. (ed.), *Aphids of North East India and Bhutan*, *Zool. Soc. Kol.*, : 125.

Distribution : India : Maharashtra, Arunachal Pradesh, Assam, Meghalaya, Nagaland, West Bengal.

Elsewhere : Virtually cosmopolitan.

11. Genus *Hyadaphis* Kirkaldy

1904. *Hyadaphis* Kirkaldy, *Entomologist*, 37 : 279.

20. *Hyadaphis coriandri* (Das)

1918. *Brevicoryne coriandri* Das, *Mem. Indian Mus.*, 6(4) : 180.

1980. *Hyadaphis coriandri* (Das) Raychaudhuri, D.N. (ed.), *Aphids of North East India and Bhutan*, *Zool. Soc. Kol.*, 143.

Material examined : 4 apterae & 1 alata, *Foeniculum vulgaris*, Khultabad, Aurangabad, 17.12.09 Coll. B.C. Das.

Diagnostic characters : Apteran Body very pale, length 1.75 mm, width 1.00 mm. Head smooth. Antennae 6 segmented, shorter than body, imbricated apicad, p.t. about 1.70 x base of last antennal segment. Rostrum reaches mid coxae, u.r.s shorter, about 0.70 x h.t., with 2 secondary hairs. Abdomen pale, smooth. Siphunculi cylindrical, slightly conical, short, about 0.80 x elongated pale cauda with 6 hairs. F.T.C. 3,3,2.

Distribution : India : Maharashtra, Bihar, Himachal Pradesh, Manipur, Meghalaya, Sikkim, South India, Uttar Pradesh, West Bengal.

Elsewhere : Egypt, Nigeria, Pakistan and South Africa.

Remarks : Present specimen slightly differs from *H. coriandri* by its smoothness and no pigmentation on abdomen and siphunculi being slightly conical and not clavate.

Remark : This species is a new record for the state.

12. Genus *Lipaphis* Mordvilko

1928. *Lipaphis* Mordvilko, *keys to the Russian Insects*, 200.

21. *Lipaphis erysimi* Kalténbach

1943. *Aphis erysimi* Kalténbach, *Monogr. Faun. plfan zenl.*, 99.

1980. *Lipaphis erysimi* (Kalténbach), Raychaudhuri, D.N. (ed.), *Aphids of North East India and Bhutan*, *Zool. Surv. Kol.*, : 161.

Material examined : 2 aptera, *Brassica* sp. Paudi, Pune, 17.1.03, 1 alata, *Brassica* sp. Kolhapur 27.1.03, coll. B.C. Das.

Diagnostic characters : Apteran—Body oval. Antennae 6 segmented, imbricated, p.t. about 2.20 x base of last antennal segment. Rostrum reaching upto mid coxae, u.r.s. shorter than h.t.2, bears 4 secondary hairs. Abdomen pale, dorsal hairs incrassate, siphunculi cylindrical, imbricated, flanged, longer than cauda which is narrower and with 6 hairs. F.T.C. 3,3,3.

Distribution : Virtually cosmopolitan.

13. Genus *Macrosiphoniella* del Guercio

1911. *Macrosiphoniella* del Guercio, *Redia*, 7 : 331.

Key to the species of genus *Macrosiphoniella* del Guercio

1. Secondary rhinaria on segment III never less than 10 and may be upto 17. Abdominal hairs on sclerotic bases *sanborni* (Gillette)
- Secondary rhinaria on segment III 14-19 and also on segment V *estopi* Kulkarni

22. *Macrosiphoniella eastopi* Kulkarni

1980. *Macrosiphoniella eastopi* Kulkarni, *Marath. Univ. J. Sci.*, 19(12) : 19-31.

Distribution : India : Maharashtra.

23. *Macrosiphoniella sanborni* (Gillette)

1908. *Macrosiphum sanborni* Gillette, *Can. Ent.*, **49** : 65.
 1980. *Macrosiphoniella sanborni* (Gillette), Raychaudhuri, D.N. (ed.), *Aphids of North East India and Bhutan*, *Zool. Soc. Kol.*, 174.

Distribution : Virtually cosmopolitan.

14. Genus *Macrosiphum* Passerini

1860. *Macrosiphum* Passerini⁸, *Gli Afidi, Parma*, 27.

Key to the species of genus *Macrosiphum* Passerini

1. Processus terminalis shorter than antennal segment III. Secondary rhinaria scattered over a.s. III *rosae* (Linn.)
- Processus terminalis longer than antennal segment III. Secondary rhinaria near base of a.s. III *raoi* Kulkarni

24. *Macrosiphum rosae* (Linnaeus)

1758. *Aphis rosae* Linnaeus, *Syst. Nat.*, (10 ed.), **1** : 452.

Material examined : 2 alatae, *Rosa* sp. Matheran, 20.1.03, 2 apterae, *Rosa* sp., Lingmal, Mahabaleshwar, 24.1.03, Coll. B.C. Das.

Diagnostic characters : Aptera–Body elongate, Antennae 6 segmented, imbricated, p.t. about 5.4 x base of segment VI. Rostrum reaches upto mid coxae, u.r.s. 1.00 x h.t. 2. Abdomen pale. Siphunculi brown, cylindrical, apical portion reticulated with isodiametrical cells. Cauda elongate, pale, with 10 hairs. F.T.C. 3,3,3.

Distribution : India : Maharashtra, Arunachal Pradesh, Assam, Himachal Pradesh, Manipur, Meghalaya, Sikkim, South India, Uttaranchal, West Bengal.

Elsewhere : Virtually cosmopolitan.

25. *Macrosiphum (Siobion) raoi* Kulkarni

1980. *Macrosiphum raoi* Kulkarni, *Math. Univ. J. Sci.* **19**(12) : 25-28.
 1985. *Macrosiphum (Siobion) raoi* Kulkarni, Agarwala,

B.K. & Ghosh, A.K. *Mem. Zool. Surv. India*, **16**(3) : 1-117.

Distribution : India : Maharashtra.

15. Genus *Myzus* Passerini

1860. *Myzus* Passerini, *Gli Afidi Perma*, 27.

26. *Myzus persicae* (Sulzer)

1776. *Aphis persicae* Sulzer, *Abgekürzte Gesch. Insekten*, 105.
 1980. *Myzus persicae* (Sulzer), Raychaudhuri, D.N. (ed.), *Aphids of North East India and Bhutan*, *Zool. Soc. Kol.*, : 217.

Material examined : 2 alatae, Pimpri, Pune, 17.1.03, 1 alata, *Brassica* sp. Kolhapur, 27.1.03; coll. B.C. Das, 3 apterae, Cabbage, Trymbok, Nasik, 10.12.03, Coll. B.C. Das.

Diagnostic characters : Aptera–Body elongate. Head spinulose with lateral frontal tubercles. Antennae 6 segmented, imbricated, p.t. about 4.20 x base of last antennal segment. Rostrum reaches upto mid coxae, u.r.s. about 1.00 x h.t.2. Abdomen pale, dorsal hairs myzine type. Siphunculi cylindrical, distally clavate. Cauda elongate, conical, with 6 hairs. F.T.C. 3, 3, 3.

Distribution : Cosmopolitan.

16. Genus *Pentalonia* Coquerel

1859. *Pentalonia* Coquerel, *Ann. Soc. ent. Fr.*, **3** : 259.

27. *Pentalonia nigronervosa* Coquerel

1859. *Pentalonia nigronervosa* Coquerel, *Ann. Soc. ent. Fr.*, **3** : 260.
 1980. *Pentalonia nigronervosa* Coquerel, Raychaudhuri, D.N. (ed.), *Aphids of North East India and Bhutan*, *Zool. Soc. Kol.*, : 235

Material examined : 2 apterae, *Calocasia* sp. Matheran, 19.1.03, Coll. B.C. Das, 4 apterae, Banana, Trymbak, Nasik, 10.12.03, Coll. B.C. Das.

Diagnostic characters : Aptera–Head spinulose. Antennae 6 segmented, imbricated, p.t. about 8.00 x base of antennal segment VI. Rostrum reaches beyond hind coxae, u.r.s. 1.80 x h.t.

Abdomen with spinular striae, dorsal hairs with expanded apices, siphunculi spinulose, longer than cauda which is short with a bulbous base, bears 5 hairs. F.T.C. 3. 3. 2.

Distribution : India : Maharashtra and all over.

Elsewhere : Virtually cosmopolitan.

17. Genus *Rhodobium* Hille Ris Lambers

1947. *Rhodobium* Hille Ris Lambers, *Temminckia*, 7 : 300.

28. *Rhodobium porosum* (Sanderson)

1901. *Myzus porosum* Suanderson, *Rep. Del. Univ. agric. Exp. stn.*, 12 : 205.

1980. *Rhodobium porosum* (Sanderson) Raychaudhuri, D.N. (ed.), *Aphids of North East India and Bhutan*, *Zool. Soc. Kol.*, : 244.

Distribution : India : Maharashtra, Meghalaya, South India, West Bengal.

Elsewhere : Virtually cosmopolitan.

18. Genus *Uroleucon* Mordvilko

1914. *Uroleucon* Mordvilko, *Fauna de la Russie*, 1 : 64.

Key to the subgenera of the genus

Uroleucon Mordvilko

1. Cauda pale..... *Uroleucon* s.s.
- Cauda dark *Uroleucon* (Uromelan)

Key to the species of genus *Uroleucon*

Mordvilko Apterae

1. Cauda pale.....3
- Cauda dark4
3. Segment III shorter than segment IV & V taken together, with 16-32 secondary rhinaria, antennae, longer than body, cauda with 20-30 hairs *sanchi* (Linn.)
4. Ultimate rostral segment 1.0-1.15 x h.t.3....5
- Ultimate rostral segment 1.10-1.20 x h.t.2..6
5. Segment III with 33-45 secondary rhinaria,

u.r.s. with 4-5 secondary hairs, cauda with 10-12 hairs. *gobonis* (Matsumura)

- Segment III with 79-91 secondary rhinaria, u.r.s. with about 8 secondary hairs. Cauda with 16-17 hairs *compositae* Theobald
- 6. Secondary rhinaria 34-47 on segment III, siphunculi 0.33, reticulated apically *orientalis* Kulkarni
- Secondary rhinaria 65-70 on segment III, blunt to forked apices of body hairs. Longer processus terminalis (6.0-6.30 x base) *echinatus* Kulkarni

29. *Uroleucon* (*Uromelan*) *compositae* (Theobald)

1915. *Dactynotus composita* Theobald, *Bull. ent. Res.*, 6 : 123.

1994. *Uroleucon* (*Uromelan*) *compositae* (Theobald), Ghosh, L.K. & Basu, R.C., *State Fauna Series*, 3 (W.B.), *Zool. Surv. India*, pt. V : 231.

Material examined : 2 apterous viviparous females.

Distribution : India : Maharashtra, Meghalaya, South India, West Bengal.

Elsewhere : Africa, Mauritius and Taiwan.

30. *Uroleucon* (*Uromelan*) *kumaoni* (Banerjee, Ghosh and Raychaudhuri)

1969. *Dactynotus kumaoni* Banerjee, Ghosh and Raychaudhuri, *oriental Ins.*, 3(3) : 361-362.

Distribution : India, Maharashtra and Uttar Pradesh.

31. *Uroleucon* (*Uroleucon*) *gobonis* (Matsumura)

1917. *Macrosiphum gobonis* Matsumura, *J. Coll. Agric. Tohoku imp. Univ.*, 7(6) : 395.

1994. *Uroleucon* (*Uromelan*) *gobonis* (Matsumura), Ghosh, L. K. & Basu, R. C. *State Fauna Series* 3 (W.B.) pt. v. *Zool. Surv. India*, : 230.

Material examined : 2 alatae, *Aster* sp. Lingmal, Mahabaleshwar, 23.1.03, Coll. B.C. Das; 2 alate, *Compositae*, Mahabaleswar, 22.1.03, Coll. B.C. Das, 4 apterae, *Carthamus tinctorium*, Himayetbag, Aurangabad 19.12.03, Coll. B.C. Das.

Diagnostic characters : Alata—Body elongate, Antennae brownish, segment III with 37, segment IV with 16, p.t. about 6.30 x base of segment VI. Rostrum reaches upto hind coxae, u.r.s. about 1.10 x h.t.2. Abdomen pale, siphunculi cylindrical, brownish, apical portion reticulated, cauda elongated with 11 hairs. F.T.C. 5,5,5.

Distribution : India : Maharashtra, West Bengal.

Elsewhere : China, Japan, Korea and Taiwan.

32. *Uroleucon (Uromelan) echinatus* (Kulkarni)

1980. *Dactynotus echinatus* Kulkarni, *Bull. zool. Surv. India*, 2(2 & 3) : 177-181.

1985. *Uroleucon (Uromelan) echinatus* (Kulkarni), Agarwala, B.K. & Ghosh, A.K. *Mem. Zool. Surv. India*, 16(3) : 1-117.

Distribution : India : Maharashtra.

33. *Uroleucon (Uroleucon) lactucicola* (Strand)

1929. *Macrosiphum lactucicola* Strand, *Act. Univ. Latviensis*, 20 : 22.

1978. *Dactynotus lactucicola* (Strand), Kulkarni, P.P. & Rao, S.N., *J. Marth. Univ. net. Sci.*, 16(10) : 112.

Distribution : India : Maharashtra.

Elsewhere : China and Japan.

34. *Uroleucon (Uromelan) orientalis* (Kulkarni)

1980. *Dactynotus orientalis* Kulkarni, *Bull. zool. Surv. India*, 2(2 & 3) : 177-191.

Distribution : India : Maharashtra.

35. *Uroleucon (Uromelan) sonchi* (Linn.)

1767. *Aphis sonchi* Linnaeus, *Systema Naturae*, 12th ed., 735.

1994. *Uroleucon (Uromelan) sonchi* (Linn.), Ghosh, L.K. & Basu, *State Fauna Series 3*, (W.B.), *Zool. Surv. India*, pt. v, 230.

Material examined : 4 apterae, *Sonchus* sp. Lingmal, Mahabaleshwar, 24.1.03, coll. B.C. Das, 1 aptera & 1 alata, *Sonchus* sp. Paud, Pune, 17.1.03, Coll. B.C. Das.

Source : Rao and Kulkarni, 1980.

Diagnostic characters : Apterata : Body elongate head pale, antennae brownish, segment III with 27 protuberant secondary rhinaria, p.t. about 5.00 x base of antennal segment VI. Rostrum reaches hind coxae, u.r.s. about 0.73 x h.t.2. Abdomen pale, few hair bases with brownish patches. Siphunculi cylindrical, reticulated towards apex. Cauda pale, elongate, with 21 hairs, tapering.

Distribution : India : Maharashtra, Himachal Pradesh, Manipur, Meghalaya, Sikkim, South India, Uttar Pradesh, West Bengal.

Elsewhere : Africa, Australia, Egypt, Europe and South America.

19. Genus *Therioaphis* Walker

1870. *Therioaphis* Walker, *F., Zoologist*, (2) 5 : 1999.

36. *Therioaphis trifolii* (Monell)

1882. *Callipterous trifolii* Monell, *S. Can. Ent.*, 14 : 14.

1990. *Therioaphis trifolii* (Monell), Ghosh, A.K. & Quednau, F.W. *Fauna of India*, (Homoptera : Aphidoidea), pt. 5, *Zool. Surv. India*, : 254.

Distribution : India : Maharashtra, Punjab, Haryana, Delhi, Rajasthan, Karnataka.

Elsewhere : Asia, Europe, North America.

20. Genus *Schoutedenia* Rubsaamen

1905. *Schoutedenia* Rubsaamen, *Marceill*, 4 : 19.

37. *Schoutedenia embelica* (Patel & Kulkarni)

1952. *Cerciaphis emblica* Patel, G.S. & Kulkarni, H.L., *Curr. Sci.*, 21 : 350.

1993. *Schoutedenia emblica* (Patel & Kulkarni), Ghosh, A.K. & Agarwal, B.K., *Fauna of India* (Homoptera : Aphidoidea) pt. 6, *Zool. Surv. India*, : 46.

Distribution : India : Maharashtra, Andhra Pradesh.

Elsewhere : Asia, Europe, North America.

21. Genus *Greenidea* Schouteden

1905. *Greenidea* Schonteden, *spolia Zeylon*, 2 : 181.

38. *Greenidea (Trichosiphum) formosana formosana* (Maki)

1916. *Trichosiphum formosanum* Maki, M., *Coll. Essays for Nawa Gifu*, 13 (Partim).

1993. *Greenidea (Trichosiphum) formosana formosana* (Maki), Ghosh, A.K. & Agarwala, B.K. *Fauna of India*, (Homoptera : Aphidoidea), p.t. 6, *Zool. Surv. India*, 217.

Material examined : 1 aptera, *Psidium guajava*, Paud, Pune, 17.1.03; 2 apterae, *Psidium guajava*, Lingmal, Mahabaleswar, 24.1.03. 1 aptera, *Psidium guajava*, Kolhapur, 24.1.03, Coll. B.C. Das.

Diagnostic characters : Aptera Body oval. Antenna 6 segmented, p.t. about 2.20 x base of antennal segment VI. Rostrum reaches beyond hind coxae, u.r.s. about 2.30 x h.t.2. Abdomen pale, a dark brown patch on middle, few dorsal hairs furcated, siphunculi reticulated near base, barrel shaped, spinulose towards apex. Cauda rounded with a median stylus like process.

Distribution : India : Maharashtra, Manipur, Meghalaya, West Bengal.

Elsewhere : Bangla Desh, China, Indonesia, Japan, Nepal, Taiwan.

Remarks : This species is a new record for the state.

39. *Greenidea ficicola* Takahasi

1921. *Greenidea ficicola* Takahasi, *Aphididae of Formosa*, 1 : 66.

1980. *Greenidea (Greenidea) ficicola*, Takahasi, Raychaudhuri, D.N. (ed.), *Aphids of North East India and Bhutan* : 341.

Material examined : 2 apterae, *Ficus* sp. Panchagani, 22.1.03, Coll. B.C. Das.

Diagnostic characters : Aptera. Head smooth. Antennae 6 segmented, flagellum imbricated, p.t. about 3.10 x base of antennal segment VI. Rostrum reaches beyond hind coxae, u.r.s. about 1.40 x h.t.2. Dorsum of abdomen pale brown, spinules present laterally, some hairs furcated. Siphunculi reticulated near base, apically spinulose, cauda

rounded with median stylus. Femora and tibiae imbricated. F.T.C. 7, 7, 7.

Distribution : India : Maharashtra, Delhi, Himachal Pradesh, Sikkim, Tamil Nadu, Uttaranchal, West Bengal.

Elsewhere : Australia, Bangla Desh, East China, Indonesia, Malayasia, Nepal, Russia, Taiwan.

22. Genus *Ceratovacuna* Zehntner

1897. *Ceratovacuna* Zehntner, *Meded. Proefstn Oost-Java* (N.S.) 37 : 29.

40. *Ceratovacuna lanigera* Zehntner

1897. *Ceratovacuna lanigera* Zehntner, *Meded. proefstn Oost Java* (N.S.) 37 : 29.

1980. *Ceratovacuna lanigera* Zehntner, Raychaudhuri, D.N. (ed.), *Aphids of North East India and Bhutan*, *Zool. Soc. Kol.*, 371.

Material examined : 2 aptera, *Saccarum* sp., Paud, Pune, 17.1.03, 1 apterae + 2 alata, *Saccarum* sp. Kolhapur, 26.1.03, Coll. B.C. Das.

Diagnostic characters : Aptera. Body oval, Head and prothorax fused and with a pair of frontal horns. Antennae 4 segmented, imbricated, p.t. short, about 0.41 x base of last antennal segment. Eyes 3 faceted. Rostrum short, reaches upto mid coxae, u.r.s. about 0.46 x h.t.2 & without secondary hairs. Abdomen pale, siphunculi pore like, cauda knobbed. F.T.C. 3, 3, 2.

Distribution : India : Maharashtra, Assam, Sikkim, Uttar Pradesh, West Bengal.

Elsewhere : Indonesia, Japan, Philippines and Sri Lanka.

Remarks : Of late, this species is assuming the proportion of a serious pest of sugar cane in this area.

Subfamily PEMPHIGINAE

Tribe *Fordini*

23. Genus *Geoica* Hart

1884. *Geoica* Hart, *Rep. III. St. Ent.*, 18 : 101.

41. *Geoica lucifuga* (Zehntner)

1898. *Tetraneura lucifuga* Zehntner, Aref Suikind, *Ned. en. Ned. India*, 6 : 555.
1994. *Geoica lucifuga* (Zehntner) Ghosh, L.K. & Basu, R.C., *State Fauna Series*, 3 : W.B., *Zool. Surv. India* : 287.

Source : Rao and Kulkarni, 1975.

Distribution : India : Maharashtra, Assam, Manipur, Sikkim, West Bengal.

Elsewhere : Widely distributed.

Tribe Erisomatini

24. Genus *Tetraneura* Hartig

1841. *Tetraneura* Hartig, *Z. Ent. Garuer*, 3 : 366.

42. *Tetraneura* (*Tetraneurella*) *nigriabdominalis* (Sasaki)

1899. *Schizoneura nigriabdominalis* Sasaki, *Handb. insect pests of crops in Japan*, : 435.
1994. *Tetraneura* (*Tetraneurella*) *nigriabdominalis* (Sasaki), Ghosh, L.K., & Basu, R.C., *State Fauna Series*, 3, W. B., *Zool. Surv. India*, : 282.

Distribution : India : Maharashtra, Arunachal Pradesh, Assam, Manipur, Meghalaya, Nagaland, Sikkim.

Elsewhere : Widely distributed.

Subfamily LACHNINAE

Key to the genera of subfamily Lachninae

1. Abdominal dorsum with a large spinal tubercle on tergite 4; Rostrum blunt at apex, segments 4 and 5 not distinctly separated ..
..... *Tuberolachnus* Mordvilko
- No such tubercle on abdominal dorsum 4. Rostrum pointed at apex. segment 4 and 5 distinct *Cinara* Curtis

25. Genus *Tuberolachnus* Mordvilko

1908. *Tuberolachnus* Mordvilko, *Annle. Mus. Zool. Acad. Imp. Sci.*, 5(13) : 374.

43. *Tuberolachnus salignus* (Gmelin)

1790. *Aphis salignus* Gmelin, *Syst. Nat.* (13 ed.), 1 : 2209.
1994. *Tuberolachnus salignus* (Gmelin), Ghosh, L.K. & Basu, R.C., *State Fauna series*, 3, W. B., *Zool. Surv. India*, 279.

Distribution : India : Maharashtra, Meghalaya, West Bengal.

Elsewhere : Africa, America, Europe, Middle East and South East Asia.

26. Genus *Cinara* Curtis

1835. *Cinara* Curtis, *British Entomology*, 12 : 576.

44. *Cinara tujaefilina* (del Guercio)

1909. *Lachniella tujaefilina* Del Guercio, *Redia*, 5 : 288.
1982. *Cinara tujaefilina* (Del Guercio), Ghosh, A. K. *Fauna of India, Aphidoidea*, pt. 2, *Zool. Surv. India*, 55.

Distribution : India : Maharashtra, and North Western states.

Elsewhere : Widely distributed.

SUMMARY

Present work shows a total of 44 species of aphids belonging 26 genera distributed over 6 subfamilies of the family Aphididae. The subfamilies are Aphidinae, Drepanosiphinae, Greenideinae, Homaphidinae, Lachninae and Pemphiginae.

Distribution of aphid species in Maharashtra represents about 6% of Indian aphids, though Maharashtra is a vast area, arid, dry conditions deprive most of the aphids to thrive on. The present study shows quite a few are new records for the state. This shows extension of distribution of many species from hills to plains.

ACKNOWLEDGEMENT

The authors express their gratitude to the Director, Zoological Survey of India, Kolkata for encouragement and to Dr. L.K. Ghosh, Emeritus Scientist for manifold helps.

REFERENCES

- Agarwala, B.K. and Ghosh, A.K. 1985. Oriental Aphidoidea, Key to the genera and synoptic list. *Mem. Zool. Surv. India*, **16**(3) : 1-117.
- Ghosh, A.K. 1988. The Fauna of India and adjacent countries pt. IV. *Zool. Surv. India*, 1-429.
- Kulkarni, P.P. 1990. Two new species of Aphids from Maharashtra IV. *Bull. Zool. Surv. India*, **2**(2 & 3) : 177-181.
- Kulkarni, P.P. and Rao, S.N. 1980. Studies on Aphid fauna from Maharashtra (Maharashtra state) VI. *Marath. univ. J. Sci.*, **19**(12) : 19-31.
- Kulkarni, P.P. & Rao, S.N. 1980. Studies on aphid fauna from Maharashtra (Maharashtra state) IV. *Marth. Unit. J. Sci.*, **17**(10) : 114.
- Rao, S.N. Kulkarni, P.P. 1971. New records of aphids from Maharashtra (Maharashtra state) I. *Marath. Univ. J. Sci.*, **5**(1) : 287-288.
- Rao, S.N. and Kulkarni, P.P. 1975. Indian Root Aphids. *Marath. Univ. J. Sci.*, **14**(7) : 189-192.
- Rao, S.N. and Kulkarni, P.P. 1977. Studies on the Aphid fauna from Maharashtra (Maharashtra state). II. *Marath. Univ. J. Sci.*, **15**(9) : 141-150.
- Rao, S.N. and Kulkarni, P.P. 1977. Aphids of Sawflower. *Marath. Univ. J. Sci.*, **15**(9) : 171-174.
- Raychaudhuri, D.N. (ed). 1980. Aphids of North East India and Bhutan. *Zool. Sec. Kol.*, 1-521.

INSECTA : HOMOPTERA : MEMBRACIDAE

G. THIRUMALAI, S. PRABAKARAN and R.M. SHARMA*

Zoological Survey of India, Southern Regional Centre, Chennai-600 028

INTRODUCTION

The members of family Membracidae are commonly known as treehoppers or cow bugs. Their diagnostic characters include grey brown body colour; antennae short and bristle-like arising in front of or between the compound eyes; tarsi 3-segmented; middle coxae short and contiguous and absence of Y-vein in the anal area of the fore wing. Membracids are separated from closely related families by having thorn-like pronotum extending back over the abdomen. Many species also have the pronotum extending forward so that the insects may appear like thorns on their host plant and gives bizarre look. Their nymphs exude honey dew liquid which is used by ants. The Indian membracid diversity belongs to 233 species under 42 genera (Ananthasubramanian, 1996). A perusal of literature revealed that in the state of Maharashtra the membracid fauna is represented by 18 species of 9 genera.

Order HOMOPTERA

Suborder COLEORRHYNCHA

Superfamily MEMBRACOIDEA

Family MEMBRACIDAE Rafinesque

Subfamily OXYRHACINAE Haupt

Tribe Oxyrhacini Distant

1. Genus *Oxyrhachis* Germar

1. *Oxyrhachis haldari* Ananthasubramanian, 1980

Distribution : India : Maharashtra (Pune)

2. *Oxyrhachis rufescens* Walker, 1851

Distribution : India : All over.

3. *Oxyrhachis taranda* (Fabricius, 1798)

Distribution : India : All over

Subfamily CENTROTINAE

Amyot and Serville

Tribe Tricentrini Ahmad and Yasmeen

2. Genus *Tricentrus* Stål

4. *Tricentrus albomaculatus* Distant, 1908

Distribution : India : Assam; Maharashtra (Mumbai), Tamilnadu (Chennai).

Elsewhere : Brazil, Burma, Hawaii, Kwangtung, Myanmar, Penang, Singapore.

5. *Tricentrus bicolor* Distant, 1908

Distribution : India : Uttarakhand (Dehra Dun, Mussorree, Garhwal); Maharashtra (Mumbai).

Elsewhere : Bangladesh; Pakistan.

6. *Tricentrus hameedi*

Ananthasubramanian, 1996

Distribution : India : Maharashtra (Mumbai).

Elsewhere : Malaysia : Kuala Lumpur.

7. *Tricentrus minusculus*

Ananthasubramanian, 1980

Distribution : India : Maharashtra (Pune).

* Zoological Survey of India, Western Regional Centre, Pune-482002

Tribe **Leptocentrini** Distant3. Genus *Leptocentrus* Stål8. *Leptocentrus splendens*

Ananthasubramanian, 1980

Distribution : India : Maharashtra (Pune).4. Genus *Dograna* Distant9. *Dograna suffulta* Distant, 1908*Distribution* : India: Karnataka (Kodagu), Kerala (Palghat), Maharashtra (Mumbai).5. Genus *Otinotus* Buckton10. *Otinotus pallescens* Distant, 1908*Distribution* : India : Karnataka (Bangalore), Maharashtra (Mumbai), Punjab, Uttar Pradesh, West Bengal (Calcutta).6. Genus *Emphusis* Buckton11. *Emphusis malleus* (Walker, 1851)*Distribution* : India : Karnataka (Kodagu), Maharashtra (Mumbai).*Elsewhere* : Malaysia, North Borneo, Sri Lanka.7. Genus *Centrotypus* Stål12. *Centrotypus flexuosus* (Fabricius, 1794)*Distribution* : India : Assam (Silchar, Shillong); Maharashtra (Mumbai).*Elsewhere* : China, Myanmar.13. *Centrotypus securis* Buckton, 1903*Distribution* : India : Assam, Maharashtra (Mumbai); Tamilnadu (Nilgiris, Yercaud).*Elsewhere* : Borneo; Myanmar; Sumatra.Tribe **Centrotini** Distant8. Genus *Anchon* Buckton14. *Anchon pilosum* (Walker, 1851)*Distribution* : India : Karnataka (Mysore), Kerala (Thiruvananthapuram), Maharashtra (Mumbai); Tamilnadu (Coimbatore);*Elsewhere* : Sri Lanka.Tribe **Gargarini** Distant9. Genus *Gargara* Amyot and Serville15. *Gargara affinis* Distant, 1908*Distribution* : India : Karnataka (Kodagu, Mysore), Maharashtra (Mumbai), Uttarakhand (Dehra Dun).*Elsewhere*: Borneo; Myanmar; Philippine Islands.16. *Gargara extrema* Distant, 1916*Distribution* : India: All over.*Elsewhere* : Sri Lanka.17. *Gargara kandala* Ananthasubramanian, 1996*Distribution* : India : Maharashtra (Mumbai).18. *Gargara nigrofasciata* Stål, 1870*Distribution* : India : Maharashtra (Mumbai).**SUMMARY**

The family Membracidae is represented by 18 species of 9 genera under two subfamilies from Maharashtra.

REFERENCE

- Ananthasubramanian, K.S. 1996. *Fauna of India Homoptera : Membracidae*. Zoological Survey of India, Kolkata, 534 pp.

INSECTA : HEMIPTERA (AQUATIC AND SEMI AQUATIC)

G. THIRUMALAI and R.M. SHARMA*

Zoological Survey of India, Southern Regional Centre, Chennai-600 028

INTRODUCTION

Aquatic and semi aquatic bugs not only play a vital role but also form an important component in food chain of fresh water ecosystem. They are over all indicators of long term environmental conditions and constitute integral components of almost all freshwater communities (Jansson, 1977; Hynes, 1984; Patrick & Palavage, 1994; Ramakrishna, 2000). Due to their diverse habitats and poor dispersal capability these insects also serve as Zoogeographical indicators (Jordon, 1951; Hungerford & Matsuda, 1958; Polhemus & Polhemus, 2008). Their role in biological control of mosquitoes need hardly be emphasized. Some of the aquatic bugs are key stone predators, their abundance is essential to the existence of animal communities in an aquatic habitat (Murdoch, *et al*, 1984). Though, aquatic insects constitute less than 3% of global diversity (Cheng, 1976), they represent 95% of all macro-invertebrate species in fresh water habitats (Ward, 1992).

The aquatic and semi-aquatic fauna of India belonging to the infraorders Gerromorpha and Nepomorpha is represented by 79 genera and 284 species accommodated in 15 major families as against 292 genera and 4429 species in 19 recognized families globally (Thirumalai, 2002 & 2007; Polhemus & Polhemus, 2008). The study of this group from the State of Maharashtra dates back to Annandale (1919) and Paiva (1919). Much later, Tonapi (1959) studied the group at length by making collections from the tributaries of the

River Bhima. Recently, Thirumalai & Sharma (2002) and Thirumalai *et al* (2005) throw more light on the group from Ujani and Nathsagar Wetlands respectively situated in the State. Further, Thirumalai & Sharma (2005) and Thirumalai *et al* (2004, 2006) studied the group from some Conservation Areas of the State. As checklists of provincial areas are of immense value in diversity studies (Daniels, 1997), the present study provides the baseline data to the functional aspects of fresh water communities. Besides, inventorisation and assessment of aquatic insects would be a valuable tool for conservation purposes in the face of increasing pressure on freshwater ecosystems (Balian *et al.*, 2008). The aquatic and semi-aquatic fauna of the infraorders Gerromorpha and Nepomorpha of Maharashtra is represented by 70 species of 32 genera under 13 families which comes to 24.5% of Indian occurrence. The following table-1 shows the families their habitats and known species of Gerromorpha and Nepomorpha associated with water compared with World, India and the State.

SYSTEMATIC LIST

Order HEMIPTERA

Suborder HETEROPTERA

Infraorder GERROMORPHA

Superfamily GERROIDEA

Family GERRIDAE

Subfamily CYLINDROSTETHINAE

1. *Cylindrostethus productus* (Spinola, 1840)

* Zoological Survey of India, Western Regional Centre, Pune-482002

Table 1. Families, habitats, species of Gerromorpha & Nepomorpha associated with water

Family	Habitat	World	India	Maharashtra
Infraorder Gerromorpha				
Gerridae	→ (water striders) – surface of fresh & brackish waters (sea)	751	79	16
Hebridae	→ (velvet water bugs)–marshes & wet riparian mosses	221	15	1
Infraorder Nepomorpha				
Hydrometridae	→ (water measurers)–surface of calm waters	125	3	2
Mesoveliidae	→ (water treaders)–vegetated banks of ponds & lakes	46	3	1
Veliidae	→ (riffle bugs)–surface of ponds & streams, also brackish	896	31	3
Infraorder Nepomorpha				
Aphelocheiridae	→ (bottom bugs)–lentic & lotic	78	5	No report
Belostomatidae	→ (giant water bugs)–ponds, on vegetation	160	6	4
Corixoidea	→ (water boatmen)–fresh & brackish lentic waters	607	48	9
Gelastocoridae	→ (toad bugs)–shorelines, in mud & plant debris	111	4	No report
Helotrephidae	→ (beetle back-swimmers)–ponds & lakes on vegetation	180	13	1
Naucoridae	→ (creeping water bugs)–lentic & lotic stones & vegetation	391	17	7
Nepidae	→ (water scorpions)–ponds on vegetation	268	24	10
Notonectidae	→ (back-swimmers)–ponds and lakes	400	31	13
Ochteridae	→ (shore bugs)–stream margins, pond vegetation	68	1	1
Pleidae	→ (pygmy back-swimmers)–ponds & lakes, on vegetation	38	4	2

Subfamily EOTRECHINAE

2. *Onychotrechus rhexenor* Kirkaldy, 1903
3. *Oncyhotrechus spinifer* Andersen, 1980
4. *Amemboa (Amemboa)* sp.

Subfamily GERRINAE

5. *Aquarius adelaidis* (Dohrn, 1860)
6. *Neogerris parvula* (Stal, 1859)
7. *Limnogonus (Limnogonus) fossarum fossarum* (Fabricius, 1775)
8. *Limnogonus (Limnogonus) nitidus* (Mayr, 1865)
9. *Limnometra anadyomene* (Kirkaldy, 1901)
10. *Limnometra fluviorum* (Fabricius, 1798)

Subfamily HALOBATINAE

11. *Halobates elephanta* Andersen & Foster, 1992 (Arabian Sea)
12. *Halobates formidabilis* (Distant, 1910) (Arabian Sea)
13. *Metrocoris communis* (Distant, 1910)
14. *Metrocoris indicus* Chen & Nieser, 1993

Subfamily PTILOMERINAE

15. *Ptilomera (Ptilomera) agroides* Schmidt, 1926
16. *Stridulobates anderseni* Zettel & Thirumalai, 2001

Family VELIIDAE

Subfamily MICROVELIINAE

17. *Microvelia (Microvelia) diluta* Distant, 1909
18. *Microvelia (Picaultia) douglasi* Scott, 1874

Subfamily RHAGOVELIINAE

19. *Rhagovelia (Rhagovelia) ceylanica* Lundblad, 1936

Family HEBRIDAE

Subfamily HEBRINAE

20. *Hebrus (Hebrus) bombayensis* Paiva, 1919

Family MESOVELIIDAE

Subfamily MESOVELIINAE

21. *Mesovelia vittigera* Horvath, 1895

Family HYDROMETRIDAE

Subfamily HYDROMETRINAE

22. *Hydrometra butleri* Hungerford & Evans, 1934

23. *Hydrometra greeni* Kirkaldy, 1898

Infraorder NEPOMORPHA

Family NOTONECTIDAE Latreille, 1802

Subfamily ANISOPINAE Hutchinson, 1929

Tribe ANISOPINI Hutchinson, 1929

24. *Anisops barbatus* Brooks, 1951
25. *Anisops bouvieri* Kirkaldy, 1904
26. *Anisops campbelli* Brooks, 1951
27. *Anisops cavifrons* Brooks, 1951
28. *Anisops exiguus* Horvath, 1919
29. *Anisops extendofrons* Brooks, 1951
30. *Anisops nigrolineatus* Lundblad, 1934
31. *Anisops niveus* (Fabricius, 1775)
32. *Anisops paranigrolineatus* Brooks, 1951
33. *Anisops sardeus sardeus* Herrich-Shaffer, 1850

Subfamily NOTONECTINAE Latreille, 1802

Tribe Notonectini Latreille, 1802

34. *Enithares ciliata* (Fabricius, 1798)
35. *Enithares lineatipes* Horvath, 1889
36. *Enithares fusca* Brooks, 1948

Family NEPIDAE Latreille, 1802

Subfamily RANATRINAE Douglas & Scott, 1865

Tribe **Ranatrini** Douglas & Scott, 1865

37. *Cercotmetus asiaticus* Amyot & Serville, 1843
38. *Cercotmetus brevipes* Montandon, 1909
39. *Cercotmetus pilipes* (Dallas), 1850
40. *Ranatra elongata* Fabricius, 1790
41. *Ranatra filiformis* Fabricius, 1790
42. *Ranatra varipes varipes* Stål, 1861

Subfamily NEPINAE Latreille, 1802

Tribe **Nepini** Latreille, 1802

43. *Laccotrephes elongatus* Montandon, 1907
44. *Laccotrephes griseus* (Guerin-Meneville, 1844)
45. *Laccotrephes maculatus* (Fabricius, 1775)
46. *Laccotrephes ruber* (Linnaeus, 1764)

- Family BELOSTOMATIDAE Leach, 1815
 Subfamily BELOSTOMATINAE Leach, 1815
 47. *Diplonychus annulatus* (Fabricius, 1781)
 48. *Diplonychus molestus* (Dufour, 1863)
 49. *Diplonychus rusticus* (Fabricius, 1781)
 Subfamily LETHOCERINAE Lauck & Menke, 1961
 Genus *Lethocerus* Mayr, 1853
 Subgenus *Lethocerus* Mayr, 1853
 50. *Lethocerus indicus* (Lepeletier & Serville, 1825)
 Family HELOTREPHIDAE Esaki & China, 1927
 Subfamily HELOTREPHINAE Esaki & China, 1927
 51. *Tiphotrephes indicus* (Distant, 1910)
 Family OCHTERIDAE Kirkaldy, 1906
 Genus *Ochterus* Latreille, 1807
 Subgenus *Ochterus* Latreille, 1807
 52. *Ochterus marginatus marginatus* (Latreille, 1804)
 Family PLEIDAE Fieber, 1851
 53. *Paraplea frontalis* (Fieber, 1844)
 54. *Paraplea indistinguenda* (Matsumura, 1905)
 Superfamily NAUCOROIDEA Leach, 1815
 Family NAUCORIDAE Leach, 1815
 Subfamily LACCOCORINAE Stål, 1876
 Genus *Heleocoris* Stål, 1876
 Subgenus *Heleocoris* Stål, 1876
 55. *Heleocoris actus* (Spinola, 1837)
 56. *Heleocoris breviceps* Montandon, 1897
 57. *Heleocoris elongatus* Montandon, 1897
 58. *Heleocoris indicus* Montandon, 1897
 59. *Heleocoris obliquatus* (Spinola, 1837)
 60. *Heleocoris vicinus* Montandon, 1910
 Subfamily NAUCORINAE Leach, 1815
 Tribe *Naucorini* Leach, 1815
 61. *Naucoris scutellaris* Stål, 1859

- Family CORIXIDAE Leach, 1815
 Subfamily CORIXINAE Leach, 1815
 Tribe *Agraptocorixini* Hungerford, 1948
 62. *Agraptocorixa hyalinipennis hyalinipennis* (Fabricius, 1803)
 Tribe *Corixini* Leach, 1815
 Genus *Sigara* Fabricius, 1775
 Subgenus *Tropocorixa* Hutchinson, 1940
 63. *Sigara distorta* (Distant, 1910)
 64. *Sigara graveleyi* (Hutchinson, 1940)
 Subgenus *Vermicorixa* Walton, 1940
 65. *Sigara lateralis* (Leach, 1818)
 Subfamily CYMATINAE Walton, 1940
 66. *Cymatia apparens* (Distant, 1910)
 Family MICRONECTIDAE Jaczewski, 1924
 Subfamily MICRONECTINAE Jaczewski, 1924
 Genus *Micronecta* Kirkaldy, 1897
 Subgenus *Basilonecta* Hutchinson, 1940
 67. *Micronecta scutellaris scutellaris* (Stål, 1858)
 Subgenus *Dichaetonecta* Hutchinson, 1940
 68. *Micronecta desertana desertana* Distant, 1920
 69. *Micronecta sanctae-catherine* Hutchinson, 1940
 Subgenus *Sigmonecta* Wroblewski, 1962
 70. *Micronecta quadristrigata* Breddin, 1905

SUMMARY

A list of 70 species of 32 genera under 13 families of aquatic and semi-aquatic Hemiptera recorded from Maharashtra is provided.

ACKNOWLEDGEMENTS

The authors are thankful to the Director, Zoological Survey of India, Kolkata and the Officer-in-Charge, Zoological Survey of India, Pune for giving this opportunity to contribute this paper. Junior author thankfully acknowledges the facilities provided by the Officer-in-Charge, Zoological Survey of India, Jabalpur.

REFERENCES

- Andersen, N.M. and W.A. Foster. 1992. Sea skaters of India, Sri Lanka, and the Maldives, with a new species and a revised key to Indian Ocean species of *Halobates* and *Asclepios* (Hemiptera, Gerridae). *J. nat. Hist.*, **26** : 533-553.
- Annandale, N. 1919. The fauna of certain streams in the Bombay Presidency. *Rec. Indian Mus.*, **16**(1) : 109-161.
- Balian, E.V., Segers, C., Lévêque, C and Martens, K. 2008. An introduction to the Freshwater Animal Diversity Assessment (FADA) project. *Hydrobiologia*, **595**(1) : 3-8.
- Cheng, L., 1976. Insects in marine environments. In : Cheng, L.,(ed), *Marine Insects*. North Holland/American Elsevier, Amsterdam, pp. 1-4.
- Daniels, R.J.R. 1997. Taxonomic uncertainties and conservation assessment of the Western Ghats. *Curr. Sci.*, **73**(2) : 169-170.
- Hungerford, H.B. and R. Matsuda, 1958. Some interesting aspects of the world distribution and classification of aquatic and semi aquatic Hemiptera. *Proc. 10th International Cong. Ent.*, **1**(1956) : 337-348.
- Hynes, H.B.N. 1984. Aquatic insects and mankind In: The Ecology of Aquatic insects. Ed. V.H. Resh and D.M. Rosenberg Praeger, New York, p. 625.
- Jansson, A, 1997. Micronectidne (Heteroptera : Corixidae) as indicators of water quality in two lakes in southern Finland. *Annales Zoologici Fennici*, **14** : 118-124.
- Jordon, K.H.C. 1951. Zoogeographische Betrachtungen über ostliche sachsen dargestellte deutsche Neuf unter von Heteropteren *Zool. Anz.*, **147** : 79-84.
- Murdoch, W.W., Scott, M.A. and Ebsworth, P. 1984. Effects of the general predator Notonectidae (Hemiptera) upon a fresh water community. *J. anim. Ecol.*, **53** : 791-808.
- Patrick, R. and D.M. Palavage. 1994. The value of species as indicators of water quality. *Proc. Acad. Nat. Sci. Philadelphia*, **145** : 55-92.
- Paiva, C.A. 1919. Aquatic and Semi-aquatic Rhynchota from Satara and Poona districts. *Rec. Indian Mus.*, **16**(1) : 152-158.
- Polhemus, J.T. and Polhemus, D.A. 2008. Global diversity of true bugs (Heteroptera; Insecta) in freshwater. *Hydrobiologia*, **595**(1) : 379-391.
- Ramakrishna, 2000. Limnological investigation and distribution of micro and macro invertebrates and vertebrates of Fox Sagar Lake, Hyderabad. *Rec. zool. Surv. India*, **98**(1) : 169-196.
- Thirumalai, G. 2002. A check list of Gerromorpha (Hemiptera) from India. *Rec. zool. Surv. India*, **100**(1-2) : 55-97.
- Thirumalai, G. 2007. A Synoptic list of Nepomorpha (Hemiptera : Heteroptera) from India. *Rec. zool. Surv. India, Occ. Pap. No.* **273** : 1-84.
- Thirumalai, G and Sharma, R.M. 2002. Aquatic and Semi Aquatic Heteroptera (Insecta). *Zool. Surv. India, Wetland Ecosystem Series*, **3**, *Fauna of Ujani Wetland*, : 105-116.
- Thirumalai, G., Suresh Kumar and Sharma, R.M. 2004. Aquatic & Semi aquatic Hemiptera (Insecta).

Zool. Surv. India, Fauna of Pench National Park, (Maharashtra), Conservation Area Series, 20 : 233-250.

Thirumalai, G. and Sharma, R.M. 2005. Insecta: Hemiptera (Aquatic and Semi aquatic). *Zool. Surv. India, Fauna of Melghat Tiger Reserve, (Maharashtra), Conservation Area Series, 24 : 341-357.*

Thirumalai, G., Sharma, R.M. and K. Valarmathi. 2005. Aquatic and Semi aquatic Hemiptera (Insecta). *Zool. Surv. India, Fauna of Nath Sagar Wetland, Wetland Ecosystem Series, 7 : 129-136.*

Thirumalai, G., Sharma, R.M. and M.P. Sreedharan Namboodiri. 2006. Insecta : Aquatic and Semi aquatic Hemiptera. *Zool. Surv. India, Fauna of Tadoba Andhari Tiger Reserve, Conservation Area Series, 25 : 233-253.*

Tonapi, G.T. 1959. Studies on the aquatic insect fauna of Poona (Aquatic Heteroptera). *Proc. Nat. Inst. Sci. India, 25(6)B : 321-332.*

Ward, J.V., 1992. *Aquatic Insect Ecology, Biology and Habitat.* John Wiley & Sons, Inc. New York, 438 pp.

INSECTA : HEMIPTERA : PENTATOMIDAE (STINK BUGS)

GIRISH PATHAK, H.V. GHATE and R.M. SHARMA*

Modern College of arts Science and Commerce, Shivajinagar, Pune-411 005

INTRODUCTION

The Stink bugs are the members of family Pentatomidae characterized by 5-segmented antennae; 4-segmented beak; body somewhat shield-shaped in dorsal view and triangular scutellum about as long as the corium of the front wings.

In a series of volumes of Fauna of British India, Distant compiled, as well as described new species, of Heteroptera (Distant 1902-1918). At that time Family Pentatomidae included several sub-families like Scutellerinae, Cydninae, Tessaratominae, Dinidorinae, etc. Now in the recent classification given by Schuh and Slater (1995) many of the sub-families listed by Distant are treated as families under the Super- Family Pentatomoidea (for e.g. Tessaratomidae, Dinidoridae, etc). though this classification is not accepted by all, as clarified by Schuh and Slater.

The list of Stink bugs provided here is based on Distant (1902; 1908 and 1918), our personal collections and the identified collection present at Western Regional Centre of Zoological Survey of India Pune. Which resulted in the inventory of 58 species of 42 genera under two subfamilies.

In some cases Distant's nomenclature is modified on the basis of Pentatomoidea website (<http://www.ndsu.edu/ndsu/rider/Pentatomoidea/>) created by Prof. David Rider of North Dakota State University, U.S.A. Subfamily and tribal names have also been adopted from the same.

The list gives the current valid name of the bug along with the older name used by Distant.

Interestingly enough, many species of Pentatomidae recorded by Distant are from Bor Ghat region along Bombay-Poona Road (Maharashtra). Now this locality has undergone drastic change so it will be interesting to intensively survey this area to ascertain the occurrence of these bugs. The concerted efforts to collect bugs from unexplored areas will certainly raise the number of species existing in the state.

SYSTEMATIC LIST

Order HEMIPTERA

Suborder GYMNOCERATA

Superfamily PENTATOMOIDEA

Family PENTATOMIDAE

Subfamily ASOPINAE

1. *Andrallus spinidens* (Fabricius)
= *Audinetia spinidens* (Fabricius)
2. *Amyotea malabarica* (Fabricius)
= *Asopus malabaricus* (Fabricius)
3. *Eocanthecona furcellata* (Wolff)
= *Canthecona fuecellata* (Wolff)

Subfamily PENTATOMINAE

Tribe Agonoscelidini

4. *Agonoscelis nubilis* (Fabricius)
= *Agonoscelis nubila* (Fabricius)

Tribe Antestiini

5. *Antestia cruciata* (Fabricius)
6. *Plautia crossota* (Dallas)
= *Plautia fimbriata* (Fabricius)
7. *Plautia picturata* Distant

Tribe Bathycoeliini

8. *Bathycoelia indica* (Dallas)
= *Jurtina indica* (Dallas)

Tribe Cappaeini

9. *Cappaea taprobanensis* (Dallas)
10. *Halyomorpha picus* (Fabricius)
11. *Halyomorpha scutellata* Distant

Tribe Carpocorini

12. *Aeliomorpha lineatocollis* (Westwood)
= *Aeliomorpha lineaticollis* (Westwood)
13. *Bonacialis dixonii* Distant
= *Bonacialis dixonii* Distant
14. *Codophila maculicollis* (Dallas)
15. *Dolycoris indicus* (Stal)
16. *Gulielmus laterarius* Distant
17. *Gulielmus mormoratus* Distant

Tribe Catacanthini

18. *Catacanthus incarnatus* (Drury)

Tribe Caystrini

19. *Hippotiscus dorsalis* (Stal)
= *Hippota dorsalis* (Stal)

Tribe Degonetini

20. *Degonetus serratus* (Distant)

Tribe Eysarcorini

21. *Adria parvula* (Dallas)
22. *Carbula biguttata* (Fabricius)
23. *Carbula insocia* (Walker)
24. *Carbula scutellata* Distant
25. *Carbula socia* (Walker)
26. *Eysarcoris guttiger* (Thunberg)
= *Eusarcocoris guttiger* (Thunberg)
27. *Eysarcoris inconspicua* Horr. Sch.
= *Eusarcocoris inconspicua* Horr. Sch.
28. *Eysarcoris montivagus* Distant
= *Eusarcocoris montivagus* Distant

29. *Eysarcoris major* Distant
= *Eusarcocoris major* (Distant)
30. *Eysarcoris ventralis* (Westwood)
= *Eusarcocoris ventralis* (Westwood)

Tribe Halyini

31. *Dalpada neoclavata* Rider
32. *Dalpada nigricollis* (Westwood)
33. *Erthesina acuminata* Dallas
34. *Halys dentatus* (Fabricius)
35. *Halys nilgiriensis* Distant

Tribe Hoplistoderini

36. *Alcimocoris coronatus* (Stal)

Tribe Lestonocorini

37. *Gynenica affinis* Distant

Tribe Mecideini

38. *Mecidia indica* Dallas

Tribe Menidini

39. *Apines concinna* Dallas
40. *Cresphontes monsoni* (Westwood)
41. *Menida flavovaria* (Dallas)
42. *Menida formosa* (Westwood)
43. *Phavorinus* sp.

Tribe Myrocheini

44. *Laprius varicornis* (Dallas)

Tribe Nezarini

45. *Acrosternum graminea* (Fabricius)
= *Nezara graminea* (Fabricius)
46. *Nezara viridula* (Linn)
47. *Glaucias albomaculatus* (Distant)
= *Zangis albomaculata* Distant

Tribe Pentatomini

48. *Placosternum alces* Stal
49. *Placosternum taurus* (Fabricius)
50. *Sabaeus humeralis* (Dallas)

Tribe Piezodorini

51. *Piezodorus rubrofasciatus* (Fabricius)

Tribe Sciocorini

52. *Menedemus hieroglyphicus* Distant
53. *Menedemus vittatus* (Dallas)

54. *Sciocoris indicus* Dallas

Tribe **Sephelini**

55. *Niphe subferruginea* (Westwood)

56. *Niphe vittativentris* (Stal)

Tribe **Strachiini**

57. *Bagrada picta* (Fabricius)

58. *Stenozygum speciosum* (Dallas)

SUMMARY

An account of 58 species belonging to 42 genera under two subfamilies of family Pentatomidae reported from Maharashtra State is provided. This list is based on past records and collections made by the authors together with identified collections at Western Regional Centre, Pune.

REFERENCES

- Distant, W.L. 1902. The Fauna of British India including Ceylon and Burma. Rhynchota Volume 1 (Heteroptera), Taylor and Francis London. pp. 438 (Indian Reprint Today and Tomorrows Printers and Publishers New Delhi 1977).
- Distant, W.L. 1908. The Fauna of British India including Ceylon and Burma. Rhynchota Volume 4 (Heteroptera), Taylor and Francis London. pp 501 (Indian Reprint Today and Tomorrows Printers and Publishers New Delhi 1977).
- Distant, W.L. 1918. The Fauna of British India including Ceylon and Burma. Rhynchota Volume 7 (Heteroptera), Taylor and Francis London. pp 210 (Indian Reprint Today and Tomorrows Printers and Publishers New Delhi 1977).
- <http://www.ndsu.edu/ndsu/rider/Pentatomoidea/>
- Schuh, R.T., and Slater J.A. (1995). True Bugs of the World (Hemiptera : Heteroptera) Classification and Natural History. Cornell University Press, Ithaca, New York, U.S.A.

INSECTA : HEMIPTERA : REDUVIIDAE (ASSASSIN BUGS)

R.M. SHARMA and R. BANO

Zoological Survey of India, Western Regional Centre, Pune-411044

INTRODUCTION

Assassin or kissing bugs are predatory insects on spiders and other arthropods occupying microhabitats like under bark, boulders on shrubs and litter in forests, semiarid zones and scrub jungles. Adult bugs are black, brown or brightly colored and measure from 4-40 mm in length. They are distinguished from other bugs by their elongated head with a distinct narrowed neck, long legs and a prominent, segmented curved proboscis for feeding. The antennae are filiform, four to five segmented and as long as body. Legs are very long and covered with tiny hairs that serve to make them sticky to hold on to their prey while they feed. Worldwide the family is represented by 6250 species and subspecies in 913 genera and 25 subfamilies (Maldonado, 1990). Indian Assassin bugs are studied by Distant (1902 and 1910), Ambrose (2006), Sahayaraj (2004), Biswas *et al.*, (1994) and Biswas & Bal (2010). At present Indian Reduviid fauna is known by 465 species under 144 genera spread over 14 subfamilies (Biswas & Mitra, 2011). A perusal of literature revealed the report of 33 species belonging to 21 genera under seven subfamilies from Maharashtra State. The classification adopted here is after Ambrose (2006).

SYSTEMATIC ACCOUNT

Class INSECTA

Order HEMIPTERA

Suborder HETEROPTERA

Family REDUVIIDAE

Subfamily ECTRICHODIINAE

1. *Ectrychotes dispar* Reuter, 1881
2. *Quercetanus atromaculatus* Distant, 1902

Subfamily EMESINAE

Tribe Leistarchini

3. *Bagauda avidus* Bergroth, 1903

Subfamily HARPACTORINAE

4. *Coranus fuscipennis* Reuter, 1881
5. *Endochus umbrinus* Distant, 1902
6. *Euagoras plagiatus* (Burmeister, 1834)
7. *Isyndus heros heros* (Fabricius, 1803)
8. *Nagusta macroloba* Bergroth, 1907
9. *Polididus armatissimus* Stal, 1859
10. *Rhynocoris fuscipes* (Fabricius, 1787)

Subfamily PEIRATINAE

11. *Androclus granulatus* (Stal, 1863)
12. *Androclus pictus* (Herrich-Schaeffer, 1848)
13. *Catamiarus brevipennis* (Serville, 1831)
14. *Cleptocoris lepturoides* (Wolff, 1804)
15. *Ectomocoris cordiger* Stal, 1866
16. *Ectomocoris quadriguttatus* (Fabricius, 1781)
17. *Ectomocoris tibialis* Distant, 1902
18. *Ectomocoris vishnu* Distant, 1902
19. *Lestomerus affinis* (Serville, 1831)
20. *Peirates mundulus* Stal, 1874

Subfamily REDUVIINAE

21. *Acanthaspis angularis* Stal, 1859
22. *Acanthaspis apicata* Distant, 1903
23. *Acanthaspis bistillata* Stal, 1858

24. *Acanthaspis bombayensis* Distant, 1909
25. *Acanthaspis flavipes* Stal, 1855
26. *Acanthaspis lineatipes* Reuter, 1881
27. *Acanthaspis megaspila* Walker, 1873
28. *Acanthaspis quinquespinosa* (Fabricius, 1781)
29. *Acanthaspis rugulosa* Stal, 1863
30. *Gerbilius ornatus* Distant, 1903

Subfamily STENOPODAINAE

31. *Oncocephalus annulipes* Stal, 1855
32. *Thodelmus falleni* Stal, 1859

Subfamily TRIATOMINAE

Tribe **Triatomini**

33. *Triatoma rubrofasciata* (De Geer, 1773)

SUMMARY

An enumeration of 33 species of 21 genera of Assassin bugs (Reduviidae) from Maharashtra State is provided based on review of literature and the identified collection present in the Western Regional Centre, Pune.

ACKNOWLEDGEMENTS

The authors are thankful to Dr. K. Venketraman, Director, Zoological Survey of India, Kolkata for facilities and encouragement.

REFERENCES

- Biswas, B. and Bal, Animesh 2010. Insecta : Hemiptera : Heteroptera : Reduviidae). *Fauna of Uttarakhand, State Fauna Series*, 18(Part-2) : 255-268.
- Biswas, B., Sen, G.C. and Ghosh, L.K. 1994. (Insecta: Hemiptera: Reduviidae). *Fauna of West Bengal, State Fauna Series*, 3(Part 5) : 369-411.
- Biswas B. and Mitra, B. 2011. Checklist of Indian Assassin Bugs (Insecta : Hemiptera : Reduviidae). <http://www.zsi.gov.in/checklist/reduviidae.pdf>.
- Distant, W.L. 1902. *The fauna of British India including Ceylon & Burma, Rhynchota*. 2 Heteroptera pp. 503. Taylor & Francis, London.
- Distant, W.L. 1910. *The fauna of British India, Rhynchota including Ceylon & Burma*. 5 Heteroptera-5xii. pp 362. Taylor & Francis, London.
- Ambrose, D.P. 2006. A checklist of Indian assassin bugs (Insecta : Hemiptera : Reduviidae) with taxonomic status, distribution and diagnostic morphological characteristics. *Zoos' Print Journal* 21(9) : 2388-2406.
- Maldonado, C. 1990. *Systematic catalogue of the Reduviidae of the world (Insecta: Heteroptera)* Caribbean Journal of Science edition, University of Puerto Rico, Puerto Rico pp. 694.
- Sahayaraj, K. 2004. Indian insect predators in biological control, : 336.

INSECTA : HOMOPTERA (SCALE INSECTS AND MEALY BUGS)

M.J. JADHAV and R.M. SHARMA

Zoological Survey of India, Western Regional Centre, Pune-411044

INTRODUCTION

The Scale insects and mealy bugs fall under the order Homoptera. The name refers to a secretion of waxy scales that serve as a protective covering. They range in size from 1/16 inch (1.5 mm) to one inch (25 mm) in length. They are economically important insects, since many species attack almost any part of a plant and feed by sucking the juice. They cause severe damage to plants like sugarcane, tea, coffee, cotton, sorghum, vegetables and almost all kinds of fruit trees. On the other hand a few species of scale insects are beneficial to humans, e.g. the cochineal insect (*Dactylopius coccus*) yields a carmine dye and the lac insect (*Kerria lacca*) is a source of shellac.

There are about 7,500 species of these insects known at present from the whole world and inhabit almost all parts of the globe. A perusal of literature especially Varshney (1992 & 2002) resulted in the enumeration of 48 species under 37 genera belonging to 10 subfamilies and 9 families from Maharashtra State.

SYSTEMATIC LIST

Superfamily DIASPIDOIDEA

Family DIASPIDIDAE

Subfamily PARLATORIINAE

Tribe Leucaspidini

1. *Radionaspis indica* (Marlatt, 1908)

Host : *Mangifera indica*

Tribe Parlatorini

2. *Parlatoria oleae* (Colvee, 1980)

Host : *Adhatoda*, *Barberries*, *Celtis*, *Citrus*, *Mangifera*, *Olea*, *Pinus* etc

Subfamily ASPIDIOTINAE

Tribe Aspidiotini

3. *Aonidia comperei* McKenzie, 1937

Host : *Citrus* sp.

4. *Aonidia orientalis* (Newstead, 1894)

Host : *Hibiscus rosa-sinensis*, *Citrus*, *Cycas*, *Ziziphus*, *Peach*.

5. *Aspidiella hartii* (Cockerell, 1895)

Host : Pest of ginger and turmeric

6. *Aspidiotus destructor* Signoret, 1869

Hosts : *Adhatoda*, *Banana*, *Citrus*, *Mangifera*, *Hibiscus* sp., *Tamarindus*, *Ziziphus*, etc

7. *Aspidiotus hederæ* (Vallot, 1829)

Host : *Hibiscus* sp., (Polyphagous)

8. *Chrysomphatus aonidum* (Linnaeus, 1758)

Host : *Citrus* sp., *Bambusa* sp., *Mangifera* sp., *Garcinia* sp., *Pandanus* sp., *Artocarpus* sp., *Ziziphus*, etc.

9. *Duplaspidotus tesseratus* (Grandpre & de Charmoy, 1899)

Host : *Oreodoxa regia*, *Broussonetia* sp.,

Pithecolobium saman, *Morinda* sp., *Parkinsonia acuelata*, *Ficus bengalensis*, *Rosa* sp., *Acacia* sp., *Securinega leucopyrus*, *Casuarina* sp., Apple, etc

10. *Hemiberlesia lataniae* (Signoret, 1869)

Host : On twigs, bark and leaves of apple, plum, pear, peach, palms, sisal hemp, grape, sapota, tea, bamboo, fig, cactus, mango, *Citrus*, *Ficus*, *Albizzia*, *Phoenix*, *Polygonum*, *Acacia*, *Ziziphus*, etc.

11. *Lindingaspis fusca* McKenzie, 1943

Host : On sago palm *Cycas circinalis*, *Polyalthia longifolia*, *Tamarindus indica* and *Pandanus fascicularis*.

12. *Lindingaspis rossi* (Maskell, 1891)

Host : On mango, *Carissa carandas*, *Ficus retusa*, pomegranate, *Garcinia* sp.

13. *Melanaspis smilacis* (Comstock, 1883)

Host : On *Ananas* sp. and *Cocos nucifera*

14. *Quadraspidotus perniciosus*
(Comstock, 1881)

Host : On apple, plum, pear, peach, apricot, cherry, grape, beech. Rose, chestnut, *eucalyptus*, Walnut, raspberry, strawberry, mulberry, oak, pumpkin, forest tree and bushes, etc.

15. *Semelaspis artocarpi* (Green, 1896)

Host : On leaves of *Artocarpus integrifolia*, *A. heterophyllus*, *Cinnamomum* sp.

Subfamily DIASPIDINAE

Tribe Diaspidini

16. *Diaspis echinocacti* (Bouche, 1823)

Host : On *Opuntia* sp., *Echinocactus echidnae*, *Ceresus hexagonus*.

17. *Fiorinia fioriniae* (Targiono-Tozzetti, 1867)

Host : On *Garcinia indica*

18. *Fiorinia sapindi* (Green, 1919)

Host : On *Sapindus trifoliatus*

19. *Pinnaspis aspidistrae* (Signoret, 1869)

Host : On apple, plum, pear, peach, apricot, cherry, grape, beech. Rose, chestnut, *eucalyptus*, Walnut, raspberry, strawberry, mulberry, oak, pumpkin, forest tree and bushes, coconut leaves, *Cycas*, *Ficus*, etc.

20. *Pinnaspis strachani* (Cooley, 1899)

Host : On leaves of *Hibiscus* sp., *Albizzia*, *Euphorbia*, *Pithecolobium*, *Ricinus*, *Benincasa*, *Croton*, *Citrus*, *Polygonum*, coconut, pepper.

21. *Pinnaspis cycadis* (Comstock, 1883)

Host : On *Cycas circinalis*

22. *Pinnaspis cockerelli* (Cooley, 1897)

Host : On palm sheath and foliage of *areca* palms, garden ferns, *Mangifera indica*, *Symplocos ramosissima*, *Hevea* sp., *Maranta* sp., *Anacardium occidentale*, *Plumeria rubra*, *Areca catechu*, *Pandanus fascicularis*, *Cocos nucifera*.

Family MARGARODIDAE

Subfamily MARGARODINAE

Tribe Margarodini

23. *Maragrodes indicus* Green, 1912

Host : On root of undetermined plants, attended by ants

Family MONOPHLEBIDAE

Subfamily MONOPHLEBINAE

Tribe Iceryini

24. *Icerya aegyptiaca* (Douglas) Newstead, 1894

Host : On *Annona*, *Acacia*, *Achras*, *Asparagus*, *Cajanus*, *Capsicum*, *Citrus*, *Croton*, *Hypericum*, *Mangifera*, *Montisa*, *Rosa*, *Rubia*, *Prunus*, *Tramarix*, *Pyrus*, *Solanum*, *Tectona*, etc.

25. *Icerya formicarum* Newstead, 1897

Host : On *Acacia*, *Achras*, *Antidesma*, *Cassia*, *Casuarina*, *Citrus*, *Crotalaria*, *Croton*, *Ficus*, *Hibiscus*, *Rosa*, *Rubia*, *Prunus*, *Tramarix*, *Pyrus*, *Solanum*, *Tectona*, *Tamarindus*, *Ocimum*, *Opuntia*, etc.

26. *Icerya purchasi* Maskell, 1879

Host : On *Acacia*, *Barberries*, *Bidens*, *Buxus*, *Cassia*, *Casuarina*, *Desmodium*, *Donoaea*, *Eupatorium*, *Ficus*, *Glochidion*, *Malus*, *Rosa*, *Solanum*, *Prunus*, *Tramarix*, *Pyrus*, *Solanum*, *Sophora*, *Sophubia*, *Tectona*, *Tamarindus*, *Ocimum*, *Opuntia*, *Rhamnus*, etc

27. *Icerya seychellarum* (Westwood) Fernald, 1903

Host : On *Acacia*, *Artocarpus*, *Cassia*, *Casuarina*, *Citrus*, *Cocculus*, *Croton*, *Donoaea*, *Rosa*, *Pyrus*, *Psidium*, *Mangifera*, *Magnolia*, *Olea*, *Pterospermum*, and Sugarcane.

28. *Perissopneumon ferox* Newstead, 1900

Host : On *Citrus* sp., *Azadirachta indica*, *Vicia* sp. mango, etc

Family TACHARDIIDAE

Subfamily TACHARDIINAE

29. *Kerria communis* Varshney, 1966

Host : *Acer*, *Annona*, *Aralia*, *Acacia*, *Albizia*, *Butea*, *Commiphora*, *Casuarina*, *Catha*, *Cailliea*, *Delonix*, *Ficus*, *Glycine*, *Hibiscus*, *Hymenaea*, *Hematoxylon*, *Helianthus*, *Michelia*, *Montonoa*, *Mangifera*, *Parkia*, *Peltophorum*, *Persea*, *Samanea*, *Vitis* and *Wrightia*.

Family ERIOCOCCIDAE

30. *Eriococcus rhodomytri* Green, 1922

Host : On leaves of *Rhodomyrtus roseus* and *Anogeissus latifolia*.

Family DACTYLOPIIDAE

31. *Dactylopius tomentosus* (Lamark)
Cockerell, 1902

Host : On prickly pear (*Opuntia dillenii* and other species) and *Nopalea cochenillifera*.

Family PSEUDOCOCCIDAE

Subfamily PSEUDOCOCCINAE

Tribe Phenacoccini

32. *Brevennia rehi* (Lindinger) Miller, 1973

Host : On leaves or leaf-sheath of (*Oryza*

sativa), *Sorghum vulgare*, *Leptochloa polystachya*, *Eragrotis interrupta*, *Panicum colonum*, *P. javanicum*, *P. repens*, *Fibristylis argentea*, *Andropogon annulatus*, *Apluda varia*, *Cynodon dactylon*, *Cyperus rotundus*, etc

33. *Nipaecoccus viridis* (Newstead) Ali, 1970

Host : On leaves and stems of *Abelmoschus*, *Abrus*, *Artocarpus*, *Althaea*, *Acacia*, *Citrus*, *Cotton*, *Clerodendron*, *Casuarina*, *Cucumis*, *Caesalpinia*, *Desmopdium*, *Dalbergia*, *Embllica*, *Euphorbia*, *Feronia*, *Gelonium*, *Glycosmis*, *Gossypium*, *Helianthus*, *Ixora*, *Luffa*, *Melochia*, *Nerium*, *Opuntia*, *Psidium*, *Solanum*, *Thea*, *Vitis* and *Ziziphus*.

34. *Rastrococcus iceryoides* (Green) Ferris, 1954

Host : On leaves and shoots of mango, *Citrus* sp., *Capparis* sp., *Boswellia* sp., *Ficus indicus*, *Tephrosia candida*, *Pithecellobium saman*, *Callicarpa lanata*, *Hibiscus mutabilis*, *Vitex* sp., *Cajanus* sp., *Ziziphus mauritiana*, *Dolichos lablab*, cotton, sapota, other malvaceous plants, grass, shrubs and cultivated plants.

Tribe Pseudococcini

35. *Farinococcus virgata* (Cockerell) Fullaway,
1923

Host : On leaves, stem and fruits of *Asparagus*, *Azadirachta*, *Acalypha*, *Anacardium*, *Amaranthus*, *Antigonon*, *Annona*, *Artocarpus*, *Adhatoda*, *Brassica*, *Calliandra*, *Coffea*, *Castilloa*, *Cajanus*, *Croton*, *Caesalpinia*, *Casuarina*, *Cephalandra*, *Cannabis*, *Caspicum*, *Dalbergia*, *Desmostachya*, *Duranta*, *Dolichos*, *Erythrina*, *Euphorbia*, *Ficus*, *Gossypium*, *Helianthus*, *Iresine*, *Lantana*, *Mangifera*, *Morus*, *Mimusops*, *Morus*, *Nerium*, *Opuntia*, *Phoenix*, *Punica*, *Piper*, *Rosa*, *Sesbania*, *Solanum*, *Tecoma*, *Tectona*, *Thuja*, *Vitis*, *Viola* and *Ziziphus*.

36. *Kiritshenkella sacchari* (Koteja, 1988)

Host : On different parts of sugarcane (*S. oflicinarum*) plant, other *Saccharum* sp., *Imperata* grass, *Sorghum* sp., *Desmostachya bipinrata* and other grasses.

37. *Planococcoides robustus* Ezzat & McConnell, 1956

Host : On roots and fruits of mango, *Citrus* sp., *Lannea coromandelica*, *Phoenix dactylifera*, *Albizia lebbek*, *Erythrina* sp., *Crossandra* sp., *Ficus bengalensis*, *F. religiosa*, *Acacia arabica*, grape vine and *Coniza ambigua*.

38. *Pseudococcus formiceticola* (Newstead) Fernald, 1903

Host : On undetermined plant, in the nest of an ant *Crematogaster* sp.

39. *Saccharicoccus sacchari* (Cockerell) Fernald, 1950

Host : On roots, leaf sheaths and nodes of sugarcane (*S. oflicinarum*), other *Saccharum* sp. and *Sorghum* sp.

Family CEROCOCCIDAE

40. *Asterococcus ramakrishnai* Lambdin, 1983

Host : On rootlets of *Ficus* sp.

41. *Cerococcus indicus* (Maskell) Green, 1910

Host : On *Hibiscus rosa-sinensis*, *Gossypium* sp., *Tephrosia candida*, *Coffea arabica*, *Solanum melongena*, *Helectores isora*, *Thespecia populnea*, etc

Family COCCIDAE

Subfamily CEROPLASTINAE

42. *Ceroplastes actiniformes* Green, 1896

Host : On leaves of coconut palms and *Hibiscus rosa-sinensis*, *Canna* sp., *Sapium sebiferum*, *Calophyllum cyanophyllum*, *Ficus* sp., *F. carica*, *F. religiosa*, *F. palmata*, sugarcane, mango, guava, betel nut, *Dodonaea viscosa*, *Terminalia catappa*, *Cannabis sativa*, *Santalum album*, *Chenopodium album*, *Ipomoea carnea*, *Thespesia populnea*, *Erythrina* sp., etc

43. *Ceroplastes ceriferus* (Fabricius) Walker, 1852

Host : On *Celastrus ceriferus*, *Ascelpiadron*

sp., *Lawsonia inermis*, *Terminalia* sp., *Buchanania* sp., *Citrus* sp., *Casuarina* sp., *Bowsellia* sp., *Carissa spinarium*, *Morus indica*, *Ficus* sp., *Pouzolzia* sp., mango, mulberry, etc

44. *Vinsonia stellifera* (Westwood) Douglas, 1888

Host : On leaves of coconut palm (*Cocos nucifera*), *Mangifera indica*, *Eugenia jambos*, *Garcinia indica*, *G. spicata*, *Citrus aurantium*, *Antidesma bunius*, *Altostonis scholaris*, *Glycomis pentaphylla*, *Ixora* sp., *Syzigium cumini*, *Phoenix ductylifera*, etc.

Subfamily COCCINAE

Tribe Coccini

45. *Coccus gymnospori* (Green) Sanders, 1909

Host : On *Gymnosporia montana*.

46. *Saissetia coffeae* (Walker) Deplanche, 1859

Host : On Coffee plant and many others including *Citrus* sp., tea, ferns, guava, brinjal, *Abelmoschus esculantus*, *Crotons*, *Thunbergia* sp., *Hibiscus rosa-sinensis*, *Trichosanthes anguina*, *Manichara achras*, *Duranta* sp., *Gardenia florida*, *Ixora parviflora*, palms and orchids in greenhouses, etc.

Tribe Pulvinarini

47. *Chloropulvinaria psidii* (Maskell)

Borchsenius, 1952

Host : On *Psidium*, *Ficus*, *Citrus*, *Eridobotrya*, *Lowsonia*, *Barrigtonia*, *Anthocephalus*, *Achras*, *Melastoma*, *Lagerstromia*, *Mangifera*, *Morinda*, *Camellia*, *Carissa*, *Eugenia*, *Litchi*, *Bassia*, *Cinchona*, *Gardenia*, etc.

Subfamily FILIPIINAE

48. *Inglisia cheloniodes* Green, 1909

Host : On *Gelonium lanceolatum*, *Pithecellobium dulce*, *Parkinsonia aculeate*, *Acacia leucophloea*, *Casuarina equisetifolia* and *Caesalpinia* sp.

SUMMARY

An enumeration of 48 species under 37 genera belonging to 10 subfamilies and 9 families of

scale insects and mealy bugs from Maharashtra State is provided.

REFERENCES

- Varshney K.R. (1992). A Check list of Scale insects and mealy bugs of South Asia, (Part-1), *Rec. zool. Surv. India, Occ. Paper*, **139** : 152 pp.
- Varshney K.R. (2002). A Check list of Scale insects and mealy bugs of South Asia, (Part-2), *Rec. zool. Surv. India, Occ. Paper*, **191** : 147 pp.
- Varshney K.R. (2009). Revised synoptic catalogue of the lac insects of world (Hemiptera : Coccoidea : Tachardiidae), *Bionotes*, **11**(01) : 06-10.

INSECTA : NEUROPTERA

R.M. SHARMA and KAILASH CHANDRA*

Zoological Survey of India, Western Regional Centre, Pune-411044

INTRODUCTION

Neuroptera is an important order of predacious insects commonly known as 'Lacewings, ant lions, alder flies' and includes many small to large sized, soft bodied structurally and biologically heterogenous members. They are readily recognized by the network of veins of generally transparent wings and well developed antennae. The neuropterans are rarely abundant in numbers and most are weak in flight. They feed on soft-bodied insects including pests in their larval and adult stages thus considered as valuable allies of man. Their carnivorous habit offers a better scope for their use in biological control measures.

Numerically about 6,256 species are known from the world and Indian fauna accounts for 341 species (Oswald, 2007). The neuropterans of Maharashtra State belong to 60 recognized species of 30 genera under 10 families as enumerated below, which is about 17.5% of Indian occurrence.

Order NEUROPTERA

Suborder PLANIPENNIA

Family ASCALAPHIDAE

Subfamily ASCALAPHINAE

1. Genus *Nousera* Navás, 1923

1. *Nousera furcifer* (van der Weele, 1909)

Distribution : Maharashtra.

Tribe Ascalaphini

2. Genus *Ascalaphus* Fabricius, 1775

2. *Ascalaphus dicax* Walker, 1853

Distribution : Maharashtra.

3. *Ascalaphus sinister* Walker, 1853

Distribution : Maharashtra.

Tribe Hybrisini

3. Genus *Glyptobasis* MacLachlan, 1908

4. *Glyptobasis dentifera* (Westwood, 1847)

Distribution : Maharashtra.

5. *Glyptobasis nugax* (Walker, 1853)

Distribution : Maharashtra.

Tribe Encyoposini

4. Genus *Ogcogaster* Westwood, 1848

6. *Ogcogaster segmentator* (Westwood, 1847)

Distribution : Maharashtra.

Family BEROETHIDAE

Subfamily BEROETHINAE

5. Genus *Lekrugeria* Navás, 1929

7. *Lekrugeria lineata* Navás, 1929

Distribution : Maharashtra.

Family CHRYSOPIDAE

Subfamily CHRYSOPINAE

Tribe ANKYLOPTERYGINI

6. Genus *Ankylopteryx* Brauer, 1864

Subgenus *Ankylopteryx* Brauer, 1864

8. *Ankylopteryx* (*Ankylopteryx*) *octopunctata* (Fabricius, 1793)

Distribution : Maharashtra.

9. *Ankylopteryx (Ankylopteryx) tessellata*
Needham, 1909

Distribution : Maharashtra.

Tribe **Chrysopini**

7. Genus *Chrysopa* Leach, 1815
10. *Chrysopa benaventii* (Navás, 1930)
Distribution : Maharashtra.
11. *Chrysopa bandrensis* (Navás, 1929)
Distribution : Maharashtra.
12. *Chrysopa bandrina* Navás, 1935
Distribution : Maharashtra.
13. *Chrysopa smitzi* Navás, 1914
Distribution : Maharashtra.
14. *Chrysopa vilallongae* Navás, 1935
Distribution : Maharashtra.
15. *Chrysopa virgestes* Banks, 1911
Distribution : Maharashtra.
8. Genus *Chrysoperla* Steinmann, 1964
16. *Chrysoperla sillemi* (Esben-Petersen, 1935)
Distribution : Maharashtra.
9. Genus *Glenochrysa* Esben-Petersen, 1920
17. *Glenochrysa gloriosa* (Navás, 1931)
Distribution : Maharashtra.
10. Genus *Mallada* Navás, 1925
18. *Mallada bertrani* (Navás, 1931)
Distribution : Maharashtra.
19. *Mallada caesus* (Navás, 1929)
Distribution : Maharashtra.
20. *Mallada herasinus* (Navás, 1929)
Distribution : Maharashtra.
21. *Mallada ignitus* (Navás, 1910)
Distribution : Maharashtra.
22. *Mallada khandalensis* (Navás, 1932)
Distribution : Maharashtra.
23. *Mallada khandalinus* (Navás, 1931)
Distribution : Maharashtra.
24. *Mallada rocasolanoi* (Navás, 1929)
Distribution : Maharashtra.

Family CONIOPTERYGIDAE

Subfamily ALEUROPTERYGINAE

Tribe ALEUROPTERYGINI

11. Genus *Heteroconis* Enderlein, 1905
25. *Heteroconis terminalis* (Banks, 1913)
Distribution : Maharashtra.
12. Genus *Spiloconis* Enderlein, 1907
26. *Spiloconis cerata* (Hagen, 1858)
Distribution : Maharashtra.

Family HEMEROBIIDAE Leach

Subfamily NOTIOBIELLINAE

13. Genus *Psectra* Hagen, 1866
27. *Psectra iniqua* (Hagen, 1859)
Distribution : Maharashtra.

Subfamily HEMEROBIINAE

14. Genus *Hemerobius* Linnaeus, 1758
28. *Hemerobius harmandinus* Navás, 1910
Distribution : Maharashtra.

Subfamily MICROMINAE

15. Genus *Micromus* Rambur, 1842
29. *Micromus australis* Hagen, 1858
Distribution : Maharashtra.
30. *Micromus timidus* Hagen, 1853
Distribution : Maharashtra.
31. *Micromus umbrosus* Navás, 1931
Distribution : Maharashtra.

Family MANTISPIDAE Westood

Subfamily MANTISPINAE

16. Genus *Mantispa* Illiger, 1798
32. *Mantispa salana* (Navás, 1931)
Distribution : Maharashtra.

Family MYRMELEONTIDAE

Subfamily PALPARINAE

Tribe **Palparini**

17. Genus *Indopalpares* Rambur, 1842
33. *Indopalpares pardus* (Rambur, 1842)
Distribution : Maharashtra.

- 33a. *Indopalpares pardus asanai* Kuwayama, 1928

Distribution : Maharashtra.

34. *Indopalpares pardus partitus* Banks, 1910

Distribution : Maharashtra.

18. Genus *Palpares* Rambur, 1842

35. *Palpares contrarius* (Walker, 1853)

Distribution : Maharashtra.

36. *Palpares infimus* (Walker, 1853)

Distribution : Maharashtra.

Subfamily MYRMELEONTINAE

Tribe Acanthaclisini

19. Genus *Centroclisis* Navás, 1909

37. *Centroclisis lutea* Navás, 1912

Distribution : Maharashtra.

20. Genus *Syngenes* Kolbe, 1897

38. *Syngenes horridus* (Walker, 1853)

Distribution : Maharashtra.

Tribe Nesoleontini

21. Genus *Cueta* Navás, 1911

39. *Cueta levis* Navás, 1931

Distribution : Maharashtra.

40. *Cueta salai* Navás, 1929

Distribution : Maharashtra.

Tribe Myrmeleontini

Subtribe Myrmeleontina

22. Genus *Baliga* Navás, 1912

41. *Baliga pupillata* (Navás, 1905)

Distribution : Maharashtra.

23. Genus *Myrmeleon* Linnaeus, 1767

Subgenus *Myrmeleon*

42. *Myrmeleon* (*Myrmeleon*) *frontalis* (Burmeister, 1839)

Distribution : Maharashtra.

43. *Myrmeleon* (*Myrmeleon*) *fulvescens* (Navás, 1934)

Distribution : Maharashtra.

44. *Myrmeleon* (*Myrmeleon*) *tenuipennis* Rambur, 1842

Distribution : Maharashtra.

Tribe Nemoleontini

Subtribe Neuroleontina

24. Genus *Creoleon* Tillyard, 1918

45. *Creoleon fulvinervis* Navás, 1932

Distribution : Maharashtra.

46. *Creoleon griseus* (Klug, 1834)

Distribution : Maharashtra.

47. *Creoleon lugdunensis* (Villers, 1789)

Distribution : Maharashtra.

25. Genus *Distoleon* Banks, 1910

48. *Distoleon rhodocerus* (Navás, 1929)

Distribution : Maharashtra.

49. *Distoleon substigmalis* (Navás, 1917)

Distribution : Maharashtra.

50. *Distoleon umbratus* (Navás, 1930)

Distribution : Maharashtra.

26. Genus *Indoleon* Banks, 1913

51. *Indoleon audax* (Walker, 1853)

Distribution : Maharashtra.

52. *Indoleon barbarus* (Walker, 1853)

Distribution : Maharashtra.

53. *Indoleon infestus* (Walker, 1853)

Distribution : Maharashtra.

27. Genus *Neuroleon* Navás, 1909

Subgenus *Neuroleon* Navás, 1909

54. *Neuroleon* (*Neuroleon*) *guernei* Navás, 1914

Distribution : Maharashtra.

55. *Neuroleon* (*Neuroleon*) *reticulatus* (Navás, 1930)

Distribution : Maharashtra.

56. *Neuroleon* (*Neuroleon*) *roscidus* (Navás, 1937)

Distribution : Maharashtra.

Family NEMOPTERIDAE

Subfamily CROCINAE

28. Genus *Croce* MacLachlan, 1885

57. *Croce filipennis* (Westwood, 1841)

Distribution : Maharashtra.

Family OSMYLIDAE

Subfamily SPILOSMYLINAE

29. Genus *Spilosmylus* Kolbe, 189758. *Spilosmylus tuberculatus* (Walker, 1852)*Distribution* : Maharashtra.

Family SISYRIDAE

30. Genus *Sisyr*a Burmeister, 183959. *Sisyr*a *fasciata* Navás, 1930*Distribution* : Maharashtra.60. *Sisyr*a *indica* Needham, 1909*Distribution* : Maharashtra.

SUMMARY

Altogether 60 recognized species of neuropterans belonging to 30 genera under 10 families so far reported from Maharashtra are enumerated.

REFERENCES

- Ghosh, S.K and Sen, S. 1977. Checklist of Indian Planipennia (Order Neuroptera). *Rec. zool. Surv. India*, **73** : 277-326.
- Oswald, J.D. 2007. Neuropterida species of the World. Version 2.0 <http://lacewing.tamu.edu./Species-catalogue/> (Accessed on 10.12.2009)
- Singh, S.P. and A.Uma Narasimhan. 1992. Indian Chrysopidae. Indian Council of Agricultural Research (ICAR), *Technical Bulletin No.*, **5** : 34 pp.

INSECTA : COLEOPTERA : SCARABAEIDAE (SCARABAEID BEETLES)

M.J. JADHAV and R.M. SHARMA

Zoological Survey of India, Western Regional Centre, Pune-411044

INTRODUCTION

The Scarabaeidae is one of the largest families of order Coleoptera. The members are popularly known as "Dung Beetles". They are generally phytophagous and coprophagous in nature. They are recognized by their characteristic form of lamellate antennae. They are heavily built, stout-bodied with size diminutive to truly massive. Their colors vary from dull brown to metallic green to gold. The majority of members from this family is nocturnal in habit and avoids sunlight. These beetles are beneficial as well as harmful; they play important role in enhancing soil fertility while some are pests of various crops and vegetables.

The inventory of the Scarabaeid beetles is given on the basis of previous work from the area and pertinent literature. The classification is mainly followed after Arrow (1910, 1917 & 1931). The paper incorporates the comprehensive account of 89 species in 32 genera distributed over 6 subfamilies recorded so far from Maharashtra.

SYSTEMATIC ACCOUNT

Order COLEOPTERA

Suborder POLYPHAGA

Superfamily SCARABAEOIDEA

Family SCARABAEIDAE

Subfamily CETONIINAE

1. *Anthrachophora crucifera* Olivier, 1789

Distribution : Maharashtra, West Bengal, Uttar Pradesh, Karnataka.

Elsewhere : Sri Lanka.

2. *Chiloloba acuta* (Wiedemann, 1823)

Distribution: Madhya Pradesh, Maharashtra, West Bengal, Uttar Pradesh.

Elsewhere : Sri Lanka.

3. *Clinteria klugi* Hopes, 1831

Distribution : Madhya Pradesh, Maharashtra, West Bengal, Orissa, Bihar, Karnataka.

4. *Glycosia tricolor* Oliver, 1789

Distribution : Maharashtra, West Bengal, Bihar, Sikkim.

Elsewhere : Sri Lanka.

5. *Heterorrhina planata* Arrow, 1910

Distribution : Maharashtra (Mumbai), Karnataka.

6. *Heterorrhina micans* Guérin, 1840

Distribution : Maharashtra (Mumbai), Karnataka, West Bengal, Bihar.

7. *Coenochilus trabecula* Schanm, 1901

Distribution : Maharashtra (Mumbai), Karnataka, Pondicherry.

8. *Popilia complanata* Newm, 1838

Distribution : Maharashtra, Karnataka (N. Canara), Malabar.

9. *Protaetia peregrina* Herbst, 1842

Distribution : Maharashtra, Bihar, West Bengal, Malabar.

10. *Protaetia alboguttata* (Vigors, 1826)

Distribution : Maharashtra, Gujarat, Madhya Pradesh, West Bengal, Uttar Pradesh.

11. *Protaetia terrosa* Gory & Percheron, 1833

Distribution : Maharashtra, Gujarat, Madhya Pradesh, West Bengal.

12. *Spilophorus cretous* Hope 1835

Distribution : Maharashtra, Bihar, West Bengal.

Elsewhere : Sri Lanka.

13. *Oxycetonia versicolor* (Fabricius, 1775)

Distribution : Madhya Pradesh, Maharashtra, Bihar, West Bengal, Orissa, Karnataka, Assam, Tamil Nadu.

Elsewhere : Sri Lanka.

Subfamily APHODIINAE

14. *Aphodius haafi* Petrovitz, 1961

Distribution : Maharashtra, Bihar, Assam, Orissa.

Elsewhere : Sri Lanka.

Subfamily DYNASTINAE

15. *Heteronychus lioderes* Redtenbacher, 1867

Distribution : Maharashtra, Madhya Pradesh, Haryana, Assam, Orissa.

Elsewhere : Sri Lanka.

16. *Eophileurus platypterus* (Wiedemann, 1823)

Distribution : Madhya Pradesh, Maharashtra (Mumbai), Orissa, Karnataka, West Bengal, Assam, Tamil Nadu, Bihar.

17. *Oryctes rhinoceros* (Linnaeus, 1758)

Distribution : Madhya Pradesh, Maharashtra, Orissa, Karnataka, West Bengal, Tamil Nadu, Kerala.

Elsewhere : Sri Lanka, Myanmar.

18. *Phyllognathus dionysius* (Fabricius, 1792)

Distribution : Madhya Pradesh, Maharashtra, Orissa, Karnataka, West Bengal, Bihar.

Elsewhere : Sri Lanka.

19. *Xylotrupes gideon* (Linnaeus, 1767)

Distribution : Madhya Pradesh, Maharashtra, Karnataka, West Bengal, Assam, Kerala, Sikkim, Meghalaya.

Elsewhere : Sri Lanka.

Subfamily RUTELIINAE

20. *Adoretus lobiceps* Arrow, 1931

Distribution : Maharashtra, Madhya Pradesh, Gujarat.

21. *Adoretus latirostris* Ohaus, 1912

Distribution : Maharashtra, Karnataka.

22. *Adoretus stoliczkae* Ohaus, 1914

Distribution : Maharashtra, Karnataka, Madhya Pradesh, Gujarat.

23. *Adoretus bicolor* Brenske, 1914

Distribution : Maharashtra, Karnataka, Madhya Pradesh, Gujarat, Orissa, Uttar Pradesh.

24. *Adoretus lasiopygus* Burmeister, 1855

Distribution : Maharashtra, Karnataka, Assam, Orissa, Uttar Pradesh, Bihar, West Bengal.

Elsewhere : Sri Lanka, Bangladesh.

25. *Anomala conjuga* (Arrow, 1901)

Distribution : Maharashtra (Mumbai).

26. *Anomala dorsalis* Fabricius 1775

Distribution : Maharashtra, Karnataka, West Bengal, Assam, Bihar, Gujarat, Madhya Pradesh, Punjab, Uttar Pradesh.

27. *Anomala rugosa* Arrow 1899

Distribution : Maharashtra, West Bengal, Himachal Pradesh, Uttar Pradesh.

28. *Anomala versicolor* Gyllenthal 1817

Distribution : Maharashtra, West Bengal, Bihar, Karnataka, Tamil Nadu, Uttar Pradesh.

29. *Anomala bengalensis* Blanchard 1851
Distribution : Madhya Pradesh, Maharashtra, West Bengal, Bihar, Karnataka, Tamil Nadu.
30. *Anomala biharensis* Arrow, 1917
Distribution : Madhya Pradesh, Maharashtra, West Bengal, Bihar, Tamil Nadu.
31. *Anomala ruficapilla* Burmeister, 1855
Distribution : Madhya Pradesh, Maharashtra, West Bengal, Bihar, Tamil Nadu.
32. *Mimela macleayana* (Vigors, 1825)
Distribution : Madhya Pradesh, Maharashtra, West Bengal, Uttar Pradesh, Karnataka, Madhya Pradesh.
- Subfamily SCARABAEINAE
33. *Caccobius meridionalis* Boucomont, 1914
Distribution : Maharashtra, Tamil Nadu, Madhya Pradesh, West Bengal, Rajasthan.
34. *Onthophagus agnus* Gillet, 1925
Distribution : Maharashtra, Uttar Pradesh, Jharkhand, West Bengal, Karnataka.
35. *Onthophagus orientalis* Harold
Distribution : Madhya Pradesh, Maharashtra, Uttar Pradesh, Manipur, West Bengal, Karnataka.
36. *Onthophagus tarandus* Fabricius, 1792
Distribution : Madhya Pradesh, Maharashtra, Uttar Pradesh, Bihar, West Bengal, Karnataka.
37. *Onthophagus pactolus* (Fabricius, 1787)
Distribution : Madhya Pradesh, Maharashtra, Uttar Pradesh, West Bengal, Karnataka.
38. *Onthophagus spinifex* (Fabricius, 1781)
Distribution : Maharashtra (Mumbai, Pune), Karnataka, Delhi.
Elsewhere : Sri Lanka.
39. *Onthophagus ramosellus* Bates, 1891
Distribution : Madhya Pradesh, Maharashtra, Rajasthan, Karnataka, West Bengal, Madhya Pradesh.
40. *Onthophagus tritinctus* Boucomont, 1914
Distribution : Maharashtra, Karnataka, Orissa, Kerala.
Elsewhere : Sri Lanka.
41. *Onthophagus quadridentatus* (Fabricius, 1798)
Distribution : Maharashtra, Assam, Orissa, Arunachal Pradesh, Karnataka, Madhya Pradesh, Kerala, West Bengal.
Elsewhere : Sri Lanka.
42. *Onthophagus ramosus* (Wiedemann, 1823)
Distribution : Madhya Pradesh, Maharashtra, Kashmir, Uttar Pradesh, Orissa, Punjab, Bihar, West Bengal, Karnataka.
43. *Onthophagus fasciatus* Boucomont, 1914
Distribution : Madhya Pradesh, Maharashtra, West Bengal.
44. *Onthophagus truncaticornis* (Schaller, 1783)
Distribution : Maharashtra (Mumbai), Gujarat, Karnataka.
45. *Onthophagus turbatus* Walker, 1858
Distribution : Maharashtra (Mumbai, Pune), Karnataka, Pondicherry.
Elsewhere : Sri Lanka.
46. *Onthophagus centricornis* (Fabricius, 1798)
Distribution : Madhya Pradesh, Maharashtra (Mumbai, Nagpur), Karnataka.
Elsewhere : Sri Lanka.
47. *Onthophagus bonasus* (Fabricius, 1775)
Distribution : Maharashtra, Madhya Pradesh, Bihar, West Bengal, Tamil Nadu, Karnataka, Uttar Pradesh.
Elsewhere : Pakistan.
48. *Onthophagus catta* (Fabricius, 1787)
Distribution : Maharashtra, Madhya Pradesh, Bihar, Andhra Pradesh, Tamil Nadu, Karnataka, Uttar Pradesh.

Elsewhere : Pakistan.

49. *Onthophagus ludio* Boucomont, 1914

Distribution : Maharashtra (Nagpur), Karnataka, Tamil Nadu.

50. *Onthophagus cervus* Fabricius, 1798

Distribution : Madhya Pradesh, Maharashtra, West Bengal, Uttar Pradesh, Tamil Nadu, Kerala, Andaman, Pondicherry.

Elsewhere : Pakistan.

51. *Onthophagus coeruleicollis* Arrow, 1907

Distribution : Maharashtra, Orissa.

52. *Onthophagus zebra* Arrow, 1931

Distribution : Maharashtra, Karnataka, Madhya Pradesh.

53. *Onthophagus griseosetosus* Arrow, 1931

Distribution : Maharashtra, Orissa, Madhya Pradesh, Uttaranchal.

54. *Onthophagus gulo* Arrow, 1931

Distribution : Maharashtra, Madhya Pradesh.

55. *Onthophagus laborens* Arrow, 1931

Distribution : Maharashtra, Madhya Pradesh, Tamil Nadu.

56. *Onthophagus dama* (Fabricius, 1798)

Distribution : Maharashtra, Orissa, Madhya Pradesh, Tamil Nadu, Karnataka.

57. *Onthophagus hystrix* Boucomont, 1914

Distribution : Madhya Pradesh, Maharashtra, Karnataka, Tamil Nadu, Uttar Pradesh, Kerala, Orissa.

58. *Onthophagus unifasciatus* (Schaller, 1783)

Distribution : Maharashtra, West Bengal, Madhya Pradesh, Tamil Nadu, Punjab, Bihar, Jharkhand, Karnataka, Haryana.

Elsewhere : Sri Lanka.

59. *Catharsius molossus* (Linnaeus, 1758)

Distribution : Madhya Pradesh, Maharashtra, Gujarat, Himachal Pradesh, Uttar Pradesh, Orissa, Assam, Bihar, Sikkim, Andaman, Meghalaya.

Elsewhere : Sri Lanka.

60. *Catharsius sagax* Quenstedt, 1806

Distribution : Maharashtra, Karnataka, Madhya Pradesh, Bihar, West Bengal, Kerala.

Elsewhere : Bhutan.

61. *Catharsius pithecius* Fabricius, 1775

Distribution : Maharashtra, Madhya Pradesh, Bihar, Karnataka, Rajasthan, West Bengal, Kerala.

62. *Liatongus rhadamistus* (Fabricius, 1775)

Distribution : Maharashtra, Madhya Pradesh, Tamil Nadu, Orissa, Karnataka.

Elsewhere : Sri Lanka.

63. *Oniticellus pallipes* Fabricius, 1781

Distribution : Maharashtra (Mumbai), Tamil Nadu, Andhra Pradesh, West Bengal.

Elsewhere : Bangladesh.

64. *Oniticellus spinipes* Roth, 1851

Distribution : Maharashtra, Tamil Nadu, Uttar Pradesh, Madhya Pradesh, Orissa, Punjab.

65. *Oniticellus cinctus* (Fabricius, 1775)

Distribution : Maharashtra, Tamil Nadu, Karnataka, Andhra Pradesh, Himachal Pradesh, Uttar Pradesh, Gujarat, Haryana.

66. *Onitis falcatus* (Wulfen, 1786)

Distribution : Maharashtra, Uttar Pradesh, Tamil Nadu, Karnataka, Kerala, Orissa, West Bengal.

Elsewhere : Bangladesh, Sri Lanka.

67. *Onitis philemon* Fabricius, 1801

Distribution : Madhya Pradesh, Maharashtra, Tamil Nadu, Karnataka, Uttar Pradesh, Punjab, Bihar, West Bengal.

Elsewhere : Sri Lanka.

68. *Onitis brahma* Lansberge, 1875

Distribution : Maharashtra, Madhya Pradesh, Rajasthan.

69. *Onitis virens* Lansberge, 1875

Distribution : Maharashtra, Madhya Pradesh, Rajasthan, Karnataka, Punjab, West Bengal.

70. *Gymnopleurus sinuatus* Oliver, 1789

Distribution : Madhya Pradesh, Maharashtra, Karnataka.

71. *Gymnopleurus sumptuosus* Castelnau, 1840

Distribution : Maharashtra, Madhya Pradesh.

72. *Gymnopleurus dejeani* Castelnau, 1839

Distribution : Maharashtra, Madhya Pradesh, Kerala.

73. *Gymnopleurus mundus* Wiedemann, 1819

Distribution : Maharashtra, Madhya Pradesh, Tamil Nadu, West Bengal, Bihar.

74. *Gymnopleurus cyaneus* Fabricius, 1798

Distribution : Maharashtra, Madhya Pradesh, Uttar Pradesh, Tamil Nadu, Karnataka, Kerala, Orissa.

Elsewhere : Bangladesh, Sri Lanka.

75. *Gymnopleurus gemmatus* Harold, 1871

Distribution : Maharashtra, Madhya Pradesh, Bihar, West Bengal, Uttar Pradesh, Karnataka, Kerala, Orissa.

76. *Gymnopleurus miliaris* Fabricius, 1775

Distribution : Maharashtra, Madhya Pradesh, Uttar Pradesh, Tamil Nadu, Karnataka, Kerala, Orissa.

Elsewhere : Bangladesh, Sri Lanka.

77. *Gymnopleurus parvus* (Macleay, 1821)

Distribution : Maharashtra, Madhya Pradesh, Rajasthan, Uttar Pradesh, Tamil Nadu, Karnataka, Kerala, Orissa.

78. *Drepanocerus setosus* Wiedemann, 1823

Distribution : Maharashtra, Madhya Pradesh, Uttar Pradesh, Tamil Nadu, Orissa.

Elsewhere : Sri Lanka.

79. *Heliocopris bucephalus* (Fabricius, 1775)

Distribution : Madhya Pradesh, Maharashtra, Uttar Pradesh, Tamil Nadu, Orissa.

Elsewhere : Sri Lanka.

80. *Chironitis indicus* Landsberg, 1875

Distribution : Madhya Pradesh, Maharashtra, Uttar Pradesh, Tamil Nadu, Orissa.

Elsewhere : Sri Lanka.

81. *Copris repertus* Walker, 1858

Distribution : Maharashtra, Madhya Pradesh, Bihar, Tamil Nadu, Kerala, Karnataka.

Elsewhere : Sri Lanka.

82. *Copris imitans* Felsche, 1910

Distribution : Madhya Pradesh, Maharashtra, Uttar Pradesh, Bihar, West Bengal, Rajasthan, Karnataka.

83. *Copris andrewesi* Waterhouse, 1891

Distribution : Maharashtra, Uttar Pradesh, Bihar, West Bengal, Rajasthan, Karnataka.

84. *Copris davisoni* Waterhouse, 1891

Distribution : Madhya Pradesh, Maharashtra, Uttar Pradesh, West Bengal, Madhya Pradesh.

85. *Sisyphus hirtus* Wiedemann, 1823

Distribution : Madhya Pradesh, Maharashtra, Karnataka.

Elsewhere : Sri Lanka.

86. *Sisyphus longipes* (Oliver, 1789)

Distribution : Madhya Pradesh, Maharashtra, Orissa, Tamil Nadu, West Bengal.

Elsewhere : Sri Lanka.

87. *Sisypus neglectus* Gory, 1833

Distribution : Maharashtra, Gujarat, Madhya Pradesh, Orissa, Uttar Pradesh.

Elsewhere : Pakistan.

Subfamily MELOLONTHINAE

88. *Holotrichia serrata* (Fabricius, 1787)

Distribution : Madhya Pradesh, Maharashtra, Rajasthan.

89. *Holotrichia sculpticollis* (Blanchard, 1850)

Distribution : Madhya Pradesh, Maharashtra (Mumbai), Rajasthan.

SUMMARY

The paper incorporates the comprehensive systematic account of 89 species in 32 genera spread over 6 subfamilies of family Scarabaeidae recorded so far from Maharashtra.

REFERENCES

- Arrow, G.J. 1910. *The Fauna of British India Ceylon and Burma, Coleoptera, Lamellicornia (Cetoniinae and Dynastinae)*, 1 : i + 322, Pl. II (Taylor & Francis) London.
- Arrow, G. J. 1917. *The Fauna of British India Ceylon and Burma, Coleoptera, Lamellicornia (Ruteliinae, Desmonycinae & Euchirinae)*, 2 : i + 387, Pl. V (Taylor & Francis) London.
- Arrow, G.J. 1931. *The Fauna of British India Ceylon and Burma, Coleoptera, Lamellicornia (Coprinae)*, 3 : i + 428. (Taylor & Francis) London.
- Biswas, S. and Mulay, S.V. 1996. Insecta : Scarabid (Coleoptera). *Fauna of Nilgiri Biosphere Reserve, Conservation Area Series*, 11 : 89-112.
- Chatterjee, S.K. and Biswas S. 1995. Coleoptera Scarabaeidae : Cetoniinae : Dynastinae : Ruteliinae. *In : Fauna of West Bengal, State Fauna Series*, 3(Part 6A) : 363-447
- Chandra, K. 2009. Insecta : Coleoptera : Scarabaeidae. *Fauna of Bandhavgarh Tiger Reserve, Conservation Area Series*, 40 : 81-88.
- Chandra, K., and Ahirwar S.C. 2007. Insecta : Coleoptera Scarabaeidae. *In : Fauna of Madhya Pradesh (including Chhattisgarh), State Fauna Series*, 15(Part-1) : 273-300.
- Chandra, K., Sharma, R.M., and Ojha, P. 2010. A compendium on the faunal resources of Narmada River basin in Madhya Pradesh. *Rec. zool. Surv. India, Occ. Paper*, 310 : 1-152.
- Ram Sewak 2009. Dung Beetles (Coleoptera : Scarabaeidae : Coprinae) of Thar Desert of Gujarat. *Rec. zool. Surv. India, Occ. Paper*, 295 : 1-48.

INSECTA : COLEOPTERA : BRUCHIDAE (BRUCHIDS)

R. BANO, KAVITA GUPTA*, CHARAN SINGH* and R.M. SHARMA

Zoological Survey of India, Western Regional Centre, Pune-411 044

INTRODUCTION

Bruchids are commonly known as seed beetles belong to family Bruchidae with more than 1700 species under 62 genera worldwide (Romero & Johnson, 2004). Eggs are usually laid on the seed or fruit of a host plant suitable for development of the larva. The immature stage spent entirely inside a seed while adults live free and feed on pollen and nectar (Gupta *et al.*, 2009). The significance of bruchid infestation is evident from the large number of species attacking on various plant genera belonging to more than 70 families. Only 71 species of 10 genera are recorded in India (Bhalla *et al.*, 2006). The present study is based on the collection made by National Bureau of Plant Genetic Resources, Pusa Campus, New Delhi as a part of domestic quarantine revealed 9 species of 5 genera under 3 subfamilies from Maharashtra state.

SYSTEMATIC ACCOUNT

Order Coleoptera

Suborder Polyphaga

Family Bruchidae

Subfamily Bruchinae

Tribe Bruchini

Genus *Bruchus* Linnaeus, 1767

1. *Bruchus lentis* Froelich, 1799

Distribution : Throughout India

Host Plants : *Lathyrus sativus*, *Lens esculenta*, *Vicia ervilia* and *V. lens*.

Elsewhere : Algeria, Austria, Czechoslovakia, Egypt, France, Germany, Hungary, Israel, Italy, Syria, Turkey, USA, USSR.

Host Plants : *Lathyrus sativus*, *Lens esculenta*, *Vicia ervilia* and *V. lens*.

2. *Bruchus pisorum* Linnaeus 1758

Distribution : Cosmopolitan

Host Plants : *Cassia fistula*, *Cytisus* sp., *Lathyrus latifolius*, *L. odoratus*, *L. sativus*, *Phaseolus vulgaris*, *Pisum arvense*, *P. elatius*, *P. sativum*, *Vicia faba*, *V. faba minor*, *V. leucantha*, *V. minor*, *V. peregrina*, *V. sativa*, and *Vicia* sp.

3. *Bruchus affinis affinis* Froelich 1799

Distribution : Throughout India.

Elsewhere : Algeria, Austria, Egypt, France, Hungary, Syria, Turkey, UK, USSR.

Host Plants : *Dolichos lablab*, *Lathyrus angustifolius*, *L. aphaca*, *L. grandiflora*, *L. latiflorus*, *L. latifolius*, *L. maritimus*, *L. ochrus*, *L. odoratus*, *L. pratensis*, *L. sativus*, *L. sylvestris*, *L. tuberosus*, and *Lotus corniculatus*

Genus *Callosobruchus* Pic, 1902

4. *Callosobruchus chinensis* (Linnaeus, 1758)

Distribution : Cosmopolitan

Host Plants : *Cicer arietinum*, *Phaseolus aureus*, *P. aconitifolius*, *P. angularis*, *P. articulatus*, *P. calcaratus*, *P. lunatus*, *P. mungo*,

*National Bureau of Plant Genetic Resources, Pusa Campus, New Delhi-110 012

P. radiatus, *P. vulgaris*, *Cajanus cajan*, *C. indicus*, *Vigna sinensis*, *V. catjang*, *V. catjang* var. *sinensis*, *V. cylindrica*, *V. oligosperma*, *V. esequipedalis*, *V. unguiculata*, *Pisum sativum*, *P. arvense*, *Cassia tora*, *C. javanica*, *Cyamopsis tetragonolobus*, *Dolichos lablab*, *D. lablab* var. *lignosus*, *D. monocalis*, *Dolichos* sp., *Glycine hispida*, *Lathyrus odoratus*, *L. sativus*, *Lens esculenta*, *Lens culinaris*, *Lens* sp., *Nelumbo nucifera*, *Acacia modesta*, *Arachis hypogea*, *Vicia faba*, *Vicia faba* var. *equine*, *Vicia* sp., and *Voandzeia subterranea*

5. *Callosobruchus maculatus* (Fabricius, 1775)

Distribution : Cosmopolitan

Host Plants : *Acacia arabica*, *Arachis hypogea*, *Cajanus cajan*, *C. indicus*, *Cercis canadensis*, *Cicer arietinum*, *Dolichos biflorus*, *D. cyprus*, *D. lablab*, *D. monocalis*, *D. sesquipedalis*, *D. sudanensis*, *Dolichos* sp., *Glycine hispida*, *G. max*, *Gossypium* sp., *Lathyrus clymenum*, *L. sativus*, *Lens esculenta*, *Medicago ciliaris*, *Phaseolus aureus*, *P. aconitifolius*, *P. mungo*, *P. acutifolius*, *P. angularis*, *P. articulatus*, *P. lunatus*, *P. radiatus*, *P. vulgaris*, *Pisum sativum*, *Pisum* sp., *Vicia arvilia*, *Vicia faba*, *Vigna sinensis*, *V. catjang*, *V. chinensis*, *V. lutea*, *V. sesquipedalis*, *V. sinensis*, *V. unguiculata*, and *Voandzeia subterranea*

6. *Callosobruchus analis* (Fabricius, 1781)

Distribution : Throughout India

Elsewhere : Algeria, Brazil, Burma, China, Egypt, Mauritius, Saudi Arabia

Host Plants : *Arbus precatorius*, *Acacia arabica*, *Cajanus cajan*, *C. indicus*, *Canavalia ensiformis*, *Cicer arietinum*, *Crotolaria* sp., *Dolichos biflorus*, *D. cyprus*, *D. lablab*, *D. lablab* var. *lignosus*, *D. lablab* var. *typicus*, *Glycine hispida*, *Glycine max*, *Lathyrus sativus*, *Lens esculenta*, *Phaseolus aureus*, *P. aconitifolius*, *P. articulatus*, *P. calcaratus*, *P. lunatus*, *P. mungo*, *P. radiatus*, *P. vulgaris*, *Physostigma venenosum*, *Pisum sativum*, *Vicia faba*, *Vigna sinensis*, *V. catjang*, *V. sesquipedalis*, *V. sinensis*, *V. unguiculata*, and *Voandzeia subterranea*

7. *Callosobruchus cajanus* Arora, 1977

Distribution : Cosmopolitan

Host Plant : *Cajanus cajan*

Subfamily PACHYMERINAE

Tribe Caryedontini

Genus *Caryedon* Schoenherr, 1823

8. *Caryedon serratus serratus* (Oliver, 1790)

Distribution : Cosmopolitan

Host Plants : *Acacia albida*, *A. arabica*, *A. chundra*, *A. confusa*, *A. farnesiana*, *A. pennata*, *A. raddiana*, *A. senegal*, *A. spirocarpa*, *A. tomentosa*, *A. tortilis*, *Acacia* sp., *Albizia lebbek*, *Arachis hypogea*, *Bauhinia acuminata*, *B. galpini*, *B. malabarica*, *B. monandra*, *B. racemosa*, *B. rufescens*, *B. tomentosa*, *Caesalpinia praecox*, *C. pulcherrima*, *Cajanus* sp., *Cassia acutifolia*, *Cassia arereh*, *C. auriculata*, *C. brewsteri*, *C. fistula*, *C. foetida*, *C. grandis*, *C. javanica*, *C. kotschyana*, *C. montana*, *C. muritura*, *C. nodosa*, *C. obovata*, *C. sieberiana*, *Cassia* sp., *Casuarina equisetifolia*, *Casuarina* sp., *Colutea* sp., *Dialium quinense*, *Erythrina monosperma*, *Hardwickia* sp., *Helianthemum annuus*, *Oryza sativa*, *Piliostigma reticulatum*, *P. thonningi*, *Poinciana regia*, *Prosopis africana*, *P. alba*, *P. chilensis*, *P. juliflora*, *P. oblonga*, *P. spicigera*, *Rhamnus purshiana*, *Tamarindus indica*, *Tamarindus* sp., and *Terminalia arjuna*

Subfamily AMBLYCERINAE

Tribe Spermophagini

Genus *Zabrotes* Horn, 1885

9. *Zabrotes subfasciatus* Boheman, 1833

Distribution : Cosmopolitan

Host Plants : *Cajanus indicus*, *Cicer arietinum*, *Dolichos lablab*, *D. lignosus*, *D. sesquipedalis*, *D. soja*, *Glycine hispida*, *Phaseolus acutifolius*, *P. articulatus*, *P. lunatus*, *P. multiflorus*, *P. mungo*, *P. vulgaris*, *Phaseolus* sp., *Pisum arvense*, *P. sativum*, *Sesbastiana palmeri*, *Vicia faba*, *V. palmeri*, *V. sebastiana*, *Vigna sesquipedalis*, *V. sinensis*, *Vigna* sp., and *Voandzeia subterranea*.

SUMMARY

An enumeration of 9 species of 5 genera under 3 subfamilies of family Bruchidae from the state of Maharashtra is provided based on domestic quarantine at National Bureau of Plant Genetic Resources, Pusa Campus, New Delhi.

ACKNOWLEDGEMENTS

Authors are thankful to Directors of National Bureau of Plant Genetic Resources, Pusa Campus, New Delhi and Zoological Survey of India, Kolkata for providing opportunity to carry out this study. We are also grateful to Dr R.K. Khetarpal, Science Director (Asia) & Country Director, CABI India for various facilities.

REFERENCES

- Bhalla, Sashi, Manju Lata Kapur, Kavita Gupta, Beche Lal, and R.K. Khetarpal 2006. Checklist of Bruchids associated with seeds of different plant genera, NBPGR, New Delhi, India 38p.
- Kavita Gupta, B. Lal, Charan Singh and Ruquaeya Bano 2009. Detection and identification of insects and mites in quarantine. *In* : V. Celia Chalam, Kavita Gupta, Shashi Bhalla, Rajan and R.K. Khetarpal (eds.) *Biosecurity and Biosafety Policies, Procedures and Issues*, National Bureau of Plant Genetic Resources, New Delhi, India, pp 348-350.
- Romero N., J., and C.D. Johnson. 2004. Checklist of the Bruchidae (Coleoptera) of Mexico. *The Coleopterists Bulletin*, **58**(4) : 613-635.

INSECTA : COLEOPTERA (AQUATIC)

R.M. SHARMA and R. BANO

Zoological Survey of India, Western Regional Centre, Pune-411 044

INTRODUCTION

Coleoptera (beetles and weevils) is the world's most species rich insect order; with about 400,000 described species contain nearly 12,600 aquatic representatives (the Oriental region harbour 2200 species) belonging to 30 families (Jäch & Balke, 2008). Wholly or partially aquatic beetles belonging to families viz. Haliplidae (crawling water beetles), Dytiscidae (predacious diving beetles), Gyrinidae (whirligig beetles), Hydrophilidae (water scavenger beetles) and Amphizoidae are commonly found in streams, rivers, ponds, pools, lakes, tanks and shallow waters of India, where hydrophytes and detritus are in abundance throughout the year. These beetles with an oval, flattened, streamlined shape, head is sunk into the thorax and hind legs are flattened into flippers for swimming. They show various degrees of adaptations to aquatic life and are recognized as indicator organisms of environmental health. Their feeding habits are also very diverse. Dytiscids being predators of mosquitoes play an important role in mosquito bio-control. Our knowledge on Indian aquatic beetles has remarkably increased due to assiduous collections and revisionary studies (1966 onwards). A perusal of literature especially Vazirani (1967 & 1977), Tonapi & Ozarkar (1969a, b & c) and Sharma (2002) together with the identified holdings of Western Regional Centre, Pune revealed the occurrence of 57 species belonging to 27 genera under 4 families of aquatic Coleoptera from Maharashtra state. Further systematic explorations in aquatic habitats of the state will certainly enhance the number.

SYSTEMATIC ACCOUNT

Order COLEOPTERA

Suborder ADEPHAGA

Family NOTERIDAE

Subfamily NOTORINAE

1. *Canthydrus luctosus* (Aube.)
2. *Canthydrus morsbachii* (When.)
3. *Hydrocoptus subvittulus* Motschulsky

Family DYTISCIDAE

Subfamily LACCOPHILINAE

4. *Laccophilus anticatus* Sharp
5. *Laccophilus chinensis inefficiens* Walker
6. *Laccophilus flexuosus* Aube
7. *Laccophilus parvulus* Aube
8. *Laccophilus sharpi* Regimbart

Subfamily HYDROPORINAE

9. *Clypeodytes (Lioclypeus) indicus* (Regimbart)
10. *Clypeodytes (Lioclypeus) severini* (Regimbart.)
11. *Guignotus flammulatus* (Sharp)
12. *Guignotus inconstans* (Regimbart)
13. *Hydrovatus fuscus* Sharp
14. *Hyphydrus (Apriophorus) intermixtus* Walker
15. *Hyphydrus (Apriophorus) renardi* Severin
16. *Hyphoporus nilghiricus* Regimbart
17. *Microdytes belli* Balfour-Browne
18. *Microdytes sabitae* Vazirani
19. *Peschetius quadricostatus* (Aube)
20. *Peschetius toxophorus* Guignot

21. *Uvarus livens* (Regimbart.)

22. *Yola consanguinea* (Regimbart.)

Subfamily COLYMBETINAE

23. *Rhantus (Rhantus) taprobanicus* Sharp

Subfamily DYTISCINAE

24. *Cybister cognatus* Sharp

25. *Cybister confusus* Sharp

26. *Cybister convexus* Sharp

27. *Cybister limbatus* (Fabricius)

28. *Cybister (Melanectes) pectoralis* Sharp

29. *Cybister posticus* Aube.

30. *Cybister rugulosus* Redtenbacher

31. *Cybister tripunctatus asiaticus* Sharp

32. *Cybister ventralis* Sharp

33. *Eretes sticticus* (Linnaeus)

34. *Hydaticus fabricii* Macleay

35. *Hydaticus incertus* Regimbart

36. *Hydaticus luczonius* Aube.

37. *Hydaticus vittatus* (Fabricius)

38. *Rhantaticus congestus* (Klug)

39. *Sandracottus dejeani* Aube.

40. *Sandracottus festivus* (Illiger)

Family GYRINIDAE

Subfamily GYRININAE

41. *Gyrinus convexusculus* MacLeay

Subfamily ENHYDRINAE

42. *Dineutes (Protodineutes) indicus* Aube.

Subfamily ORECTOCHILINAE

43. *Orectochilus (Patrus) aenipennis* Régimbart

44. *Orectochilus (Patrus) discifer* (Walker)

45. *Orectochilus (Patrus) fletcheri* Ochs.

46. *Orectochilus (Patrus) haemorrhous* Regimbart

47. *Orectochilus (Patrus) limbatus* Regimbart

48. *Orectochilus (Patrus) semivestitus* Guérin

49. *Orectochilus (Patrus) similis* Ochs.

Suborder POLYPHAGA

Family HYDROPHILIDAE

Subfamily HYDROPHILINAE

50. *Berosus* sp.

51. *Helochaeres anchoralis* (Sharp)

52. *Hydrophilus indicus* (Bedel)

53. *Hydrophilus olivaceus* (Fabricius)

54. *Hydrophilus senegalensis* Perch.

55. *Regimbertia attenuata* (Fabricius)

56. *Sternolophus rufipes* (Fabricius)

Subfamily HYDRAENINAE

57. *Hydraena quadricollis* Wallaston

SUMMARY

An enumeration of 57 species of 27 genera under 4 families of aquatic Coleoptera from the state of Maharashtra is provided based on review of literature and the identified collection present in the Western Regional Centre, Pune.

ACKNOWLEDGEMENTS

The authors are thankful to Dr. K. Venketraman, Director, Zoological Survey of India, Kolkata for facilities and encouragement.

REFERENCES

- Jäch, M.A. & Balke, M. 2008. Global diversity of water beetles (Coleoptera) in freshwater. *In* : *Freshwater animal diversity assessment, Hydrobiologia*, **595** : 419-442.
- Miller, K.B. and Wewalka, G. 2010. *Microdytes* Balfour-Browne of India with description of three new species (Coleoptera : Dytiscidae : Hydroporinae). *Zootaxa*, **2420** : 26-36.
- Sharma, R.M. 2002. Aquatic Coleoptera (Insecta) *Zool. Surv. India, Wetland Ecosystem Series*, **3** : *Fauna of Ujani Wetland*, 117-131.
- Tonapi, G.T. and Ozarkar, V.A. 1969a. A study on the Aquatic Coleoptera of Poona (Maharashtra). *J. Bom. Nat. Hist. Soc.*, **66**(2) : 310-316.

- Tonapi, G.T. and Ozarkar, V.A. 1969b. A study on the Aquatic Coleoptera of Poona (Maharashtra). *J. Bom. Nat. Hist. Soc.*, **66**(3) : 533-338.
- Tonapi, G.T. and Ozarkar, V.A. 1969c. A new record of *Hydraena quadricollis* Wallaston (Coleoptera : Hydrophilidae) from India. *The Coleopterist's Bulletin*, **23** : 1-4.
- Vazirani, T.G. 1966. A review of the Indian Haliplidae (Insecta : Coleoptera) with descriptions of two new species. *Proc. Zool. Soc. Calcutta*, **19** : 127-134.
- Vazirani, T.G. 1967. Contributions to the study of Aquatic Beetles (Coleoptera) 1. On a collection of Dytiscidae from Western Ghats with descriptions of two new species. *Oriental Insects*, **1**(1-2) : 99-112.
- Vazirani, T.G. 1968. Contributions to the study of Aquatic Beetles (Coleoptera) 2. A review of the subfamilies Noterinae, Laccophilinae, Dytiscinae and Hydroporinae (In part) from India. *Oriental Insects*, **2**(3-4) : 221-341.
- Vazirani, T.G. 1970 a. Contributions to the study of Aquatic Beetles (Coleoptera) V. A review of Hydroporinae: Dytiscidae in part from India. *Oriental Insects*, **4**(1) : 93-129.
- Vazirani, T.G. 1970 b. Contributions to the study of Aquatic Beetles (Coleoptera) VII. A revision of Indian Colymbetinae (Dytiscidae). *Oriental Insects*, **4**(3) : 303-361.
- Vazirani, T.G. 1977a. A collection of Gyrinidae (Coleoptera) from Maharashtra. *News. Zool. Surv. India*, **3**(5) : 279-280.
- Vazirani, T.G. 1977. Catalogue of Oriental Dytiscidae. *Rec. Zool. Surv. India, Occ. Paper*, **6** : 1-111.
- Vazirani, T.G. 1984. *The Fauna of India. Coleoptera: Fam. Gyrinidae and Fam. Haliplidae*. Ed. Director, Zoological Survey of India, Calcutta, 140 pp.

INSECTA : COLEOPTERA : CERAMBYCIDAE

H.V. GHATE

Modern College of Arts, Science and Commerce, Shivajinagar, Pune-411 005

INTRODUCTION

Cerambycidae is an important family of Coleoptera. The members of this family are commonly referred as Longicorn or Longhorn beetles due to very long antennae in many species. These beetles are economically important as their larvae damage both live and dead wood. Many species are serious pests, for example *Batocera* sp., *Anoplophora* sp., *Stromatium barbatum* (a polyphagous species), etc. Some species of Prioninae, like *Acanthophorus serraticornis*, are very large in size reaching over 100 mm from tip of mandibles to the tip of abdomen, while some species of *Pterolophia* are just about 5 mm in length. Some species are metallic colored, like species of *Polyzonus* and *Aphrodisium*, while many carry characteristic pattern of colored pubescences, as in many Clytini.

Gahan (1906) first compiled the known Cerambycidae (excluding Lamiinae) beetles from India in the Fauna of British India volume. Since then there is no comprehensive listing of Cerambycidae of India. Based on Gahan's Fauna, a list of Cerambycidae (excluding Lamiinae), that are reported from Maharashtra, is prepared and supplemented with authors own observations and collections. The names of the species are all current valid names along with the name given in Gahan's fauna. One species described after Gahan's fauna, namely *Oplatocera halli* Lepesme, is also added.

In addition a list of Lamiinae that the author has personally observed or collected in Maharashtra is provided. The list is alphabetical

and uses all current valid names. The study resulted in the enumeration of 59 species belonging to 50 genera spread over four subfamilies. The identifications have been made using a number of publications not given here. A number of experts have helped in identification of Lamiinae, either by providing literature or by directly identifying material based on fine digital images. Many species of Cerambycidae (from Maharashtra as well as from other parts of India) have been illustrated on the author's website as well (Please refer to www.insectsofindia.in).

List of Cerambycidae (other than Lamiinae) following Gahan's (1906) classification

Superfamily CHRYSOMELOIDEA

Family CERAMBYCIDAE

Subfamily PRIONINAE

1. *Dorysthenes* (*Dissorsternus*) *pertii* (Hope, 1834)
= *Dissosternus pertii* (Hope, 1834)
2. *Prionomma atratum* (Gmelin, 1818)
3. *Priotyrannus mordax* (White, 1853)
4. *Acanthophorus serraticornis* (Olivier, 1795)
5. *Rhaphipodus subopacus* Gahan, 1890
6. *Macrotoma crenata* (Fabricius, 1801)

Subfamily DISTENIINAE

7. *Cyrtonops punctipennis* White, 1853
8. *Melegena flavipes* Gahan, 1869

Subfamily CERAMBYCINAE

9. *Xystrocera globosa* (Olivier, 1795)
10. *Oplatocera halli* Lepesme, 1956

11. *Stromatium barbatum* (Fabricius, 1775)
 12. *Zoodes compressus* (Fabricius, 1787)
 13. *Neoplocaederus obesus* (Gahan, 1890)
= *Plocaederus obesus* Gahan, 1890
 14. *Neoplocaederus humeralis* (White, 1853)
 15. *Neocerambyx paris* (Wiedman, 1821)
 16. *Aeoloesthes holosericea* (Fabricius, 1787)
 17. *Diorthus cinereus* (Fabricius, 1792)
= *Diorthus simplex* (White, 1853)
 18. *Derolus volvulus* (Fabricius, 1801)
= *Derolus demisus* (Pascoe, 1906)
 19. *Mergites* sp. cf. *modicus* Gahan, 1906
 20. *Dymasius minor* Gahan, 1906
 21. *Dialeges pauper* Pascoe, 1856
 22. *Rhytidodera robusta* Gahan, 1891
 23. *Xoanodera amoena* Pascoe, 1895
 24. *Nyphasia apicalis* Gahan, 1853
 25. *Ceresium gracile* (Perroud, 1855)
 26. *Purpuricenus sanguinolentus* (Olivier, 1795)
 27. *Aphrodisium cantori* (Hope, 1840)
 28. *Polyzonus prasinus* (White, 1853)
 29. *Polyzonus tetraspilotus* (Hope, 1835)
 30. *Pachylocerus corallinus* Hope, 1834
 31. *Pachylocerus crassicornis* (Olivier, 1795)
 32. *Xylotrechus smei* (Laporte and Gory, 1841)
 33. *Xylotrechus subscutellatus* (Chevrolat, 1863)
 34. *Chlorophorus annularis* (Fabricius 1787)
= *Caloclytus annularis* (Fabricius, 1787)
 35. *Chlorophorus quatuordecimmaculatus*
(Chevrolat, 1863) = *Caloclytus 14-maculatus*
(Chevrolat, 1863)
 36. *Clytocera chionospila* Gahan, 1906
- Subfamily LAMIINAE
(List alphabetically arranged)
37. *Acalolepta nivosa* (White, 1858)
 38. *Acalolepta* sp.
 39. *Batocera numitor* (Newman, 1842)
 40. *Batocera rufomaculata* (DeGreer, 1775)
 41. *Calothyrsa margaritifera* (Westwood, 1848)
 42. *Celosterna scabrator* (Fabricius, 1781)
 43. *Coptops aedificator* (Fabricius, 1792)
 44. *Cremnosterna plagiata* (White, 1858)
 45. *Eucomatocera vittata* White, 1846
 46. *Falsomesosella* sp.
 47. *Glenea andrewesi* Gahan, 1893
 48. *Glenea multiguttata* Guerin-Meneville, 1843
 49. *Oberea* sp.
 50. *Olenecamptus anogeissi* Gardner, 1830
 51. *Olenecamptus bilobus* (Fabricius, 1801)
 52. *Phelipara moringae* (Aurivillius, 1925)
 53. *Pterolophia* sp.
 54. *Macrochenus tessellatus* Guerin-Meneville, 1843
 55. *Sthenias grisator* (Fabricius, 1787)
 56. *Stibara nigricornis* (Fabricius, 1781)
 57. *Stibara suturalis* Gahan, 1890
 58. *Tetraglenes hirticornis* (Fabricius, 1798)
 59. *Thylactus angularis* Pascoe, 1866

SUMMARY

An enumeration of 59 species of longicorn beetles belonging to 50 genera spread over four subfamilies from Maharashtra State is provided.

ACKNOWLEDGEMENTS

I am thankful to the authorities of Modern College, Shivajinagar, Pune, for facilities and encouragement. I also thank BCUD, University of Pune, for providing financial assistance to do taxonomical work on Cerambycidae; Dr. Anil Mahabal, Dr. D.B. Bastawade and Dr. Radheshyam Sharma, all of WRC ZSI, for showing some collected material and also for allowing me to use library facilities.

The work on this group of beetles was possible due to generous help from several expert workers, friends as well as my students. I take this opportunity to thank Carolus Holzschuh (Austria), Francesco Vitali (Luxembourg), Dan Heffern (USA), for their valuable help and constant encouragement as well as for providing useful

literature. I also thank Al Samuelson and Al Allison (Hawaii, USA) for providing a rare publication. I am also grateful to Norbert Delahaye (France) for images of some types of Cerambycidae. Prof. C.A. Viraktamath (Bangalore) also loaned and shared his material and I am grateful to him. My student Mrs. Abhilasha Sen worked with me on this group and had first prepared a list of species that we had studied. D. Roychaudhari (Kolkata) shared some

of his literature, G.P. Bhawane (Kolhapur) and his student S. Aland, collected and shared some interesting species. I also thank Ashwin Baindur (Pune) for sharing some photos. Amol Patwardhan shared some images and also for collected some interesting species. Other people who have been helpful in providing material for study are: R.D. Chaudhari, P. and S. Ranganekar, Nilesh Rane, Sachin Ranade, Milind Gambhir, Aditi Kale and Anand Padhye.

REFERENCE

- Gahan, C.J. 1906. *Fauna of British India Including Ceylon and Burma, Coleoptera* Vol. I (Cerambycidae). Taylor and Francis, London, 329 p.

INSECTA : COLEOPTERA : COCCINELLIDAE

S.S. JADHAV and R.M. SHARMA

Zoological Survey of India, Western Regional Centre, Pune-411044

INTRODUCTION

The Coccinellid beetles, popularly called “Ladybird beetles” are very common insects found in agricultural fields and forests. They vary in size from a few millimeters to almost square-inch with fabulous colours. These beetles are economically important because the phytophagous members cause severe damage to the agriculture products whereas carnivorous members predate on Aphids, Coccids, Plant mites and other soft bodied insects.

Since no consolidated work on the Coccinellidae fauna of the state is available a perusal of literature especially (Poorani, 2004), other relevant papers and the collections available in the holdings of Western Regional Centre, Zoological Survey of India, Pune revealed the records of 20 species under 15 genera and 6 subfamilies from the state.

SYSTEMATIC ACCOUNT

Order COLEOPTERA

Family COCCINELLIDAE

Subfamily CHILOCORINAE

1. *Brumoides suturalis* (Fabricius, 1798)

Distribution : Goa, Karnataka, Madhya Pradesh, Manipur, Maharashtra, Meghalaya, Tamil Nadu, Punjab, Sikkim, Tripura and West Bengal.

Elsewhere : Bhutan, Nepal and Sri Lanka.

2. *Chilochorus nigrita* (Fabricius, 1798)

Distribution : Andhra Pradesh, Karnataka, Kerala, Maharashtra, and Tamil Nadu.

Elsewhere : Bangladesh, Bhutan, Brazil, China, Indonesia, Myanmar, Nepal, Pakistan, South Africa, and Sri Lanka.

3. *Chilochorus subindicus* Booth, 1998

Distribution : Kerala, Maharashtra, Tamil Nadu and Lakshadweep Islands.

Elsewhere : Maldives and Sri Lanka.

Subfamily COCCIDULINAE

4. *Rodolia cardinalis* (Mulsant, 1850)

Distribution : Karnataka, Maharashtra and Tamil Nadu.

Elsewhere : Sri Lanka, Australia, Nearctic.

5. *Rodolia fumida* Mulsant, 1850

Distribution : Assam, Bihar, Delhi, Himachal Pradesh, Karnataka, Madhya Pradesh, Maharashtra, Meghalaya, Punjab, Uttar Pradesh, West Bengal and Tamil Nadu.

Elsewhere : Pakistan.

Subfamily COCCINELLINAE

6. *Cheilomenes sexmaculata* (Fabricius, 1781)

Distribution : Throughout India.

Elsewhere : Australia, Bangladesh, Bhutan, China, Indonesia, Japan, Malaysia, Myanmar, Pakistan, Sri Lanka, Vietnam.

7. *Coccinella septempunctata* Linnaeus, 1758

Distribution : Throughout India.

Elsewhere : Pakistan, Sri Lanka, Palaearctic, North America.

8. *Harmonia octomaculata* (Fabricius, 1781)

Distribution : Throughout India.

Elsewhere : Bangladesh, Nepal, Pakistan, Sri Lanka.

9. *Hippodamia variegata* (Goeze, 1777)

Distribution : Himachal Pradesh, Jammu and Kashmir, Maharashtra and Uttar Pradesh.

Elsewhere : Afghanistan, China, Mongolia, Nepal, Pakistan, Tibet, Northern and Eastern Africa.

10. *Illies cincta* (Fabricius, 1798)

Distribution : India.

Elsewhere : Sri Lanka and Indonesia.

Subfamily EPILACHNINAE

11. *Henosepilachna narayana* (Lal & Kanakavalli, 1961)

Distribution : Karnataka and Maharashtra.

12. *Henosepilachna septima* (Dieke, 1947)

Distribution : India.

Elsewhere : Sri Lanka and Vietnam.

Subfamily SCYMNINAE

13. *Cryptogonus orbiculus* (Gyllenhal, 1808)

Distribution : Assam, Meghalaya.

Elsewhere : Bhutan, China, Nepal, Sri Lanka, Taiwan and Japan.

14. *Pseudaspidimerus trinotatus* (Thunberg, 1781)

Distribution : Andhra Pradesh, Assam, Goa, Kerala, Karnataka, Maharashtra and West Bengal.

Elsewhere : Bangladesh, Myanmar and Sri Lanka.

15. *Scymnus (Scymnus) nubilus* Mulsant, 1850

Distribution : Assam, Karnataka, Maharashtra, Orissa, Tamil Nadu, West Bengal, Goa and Lakshadweep Island.

Elsewhere : Pakistan, Bangladesh, Sri Lanka, Nepal, Myanmar and China.

16. *Stethorus pauperculus* (Weise, 1895)

Distribution : Bihar, Delhi, Karnataka, Maharashtra and Tamil Nadu.

Elsewhere : Pakistan, Thailand and Malaysia.

Subfamily STICHOLOTIDINAE

17. *Serangium parcesetosum* Sicard, 1929

Distribution : Maharashtra, Tamil Nadu, Madhya Pradesh, Uttar Pradesh and Lakshadweep Island.

Elsewhere : Pakistan and Thailand.

18. *Jauravia opaca* (Weise, 1900)

Distribution : Karnataka and Maharashtra.

Elsewhere : Sri Lanka.

19. *Jauravia simplex* (Walker, 1859)

Distribution : Andhra Pradesh, Karnataka and Maharashtra.

Elsewhere : Sri Lanka.

20. *Jauravia pallidula* Motschulsky, 1858

Distribution : Maharashtra, Karnataka, Meghalaya, Tamil Nadu and West Bengal.

Elsewhere : Sri Lanka.

SUMMARY

An enumeration of 20 species under 15 genera and 6 subfamilies of lady bird beetles so far recorded from Maharashtra State are provided.

REFERENCES

- Chakraborty, S.K. and Biswas, S. 2000. Insecta : Coleoptera : Coccinellidae. *Fauna of Meghalaya, State Fauna Series*, 4(part-5) : 201-233.
- Chakraborty, S.K. and Biswas, S. 2000. Insecta : Coleoptera : Coccinellidae. *Fauna of Tripura, State Fauna Series*, 7(part-3) : 113-137.
- Chakraborty, S.K. and Biswas, S. 2003. Insecta : Coleoptera : Coccinellidae. *Fauna of Sikkim, State Fauna Series*, 9(part-3) : 117-152.
- Chakraborty, S.K. 2007. Insecta : Coleoptera : Coccinellidae. *Fauna of Andhra Pradesh, State Fauna Series*, 5(part-3) : 375-392.
- Chakraborty, S.K. 2004. Insecta : Coleoptera : Coccinellidae. *Fauna of Manipur, State Fauna Series*, 10 : 401-419.
- Kapur, A.P. 1948. A revision of the tribe Aspidimerimi Weise (Coleoptera : Coccinellidae). *Trans. R. ent. Soc. Lond.*, 99(2) : 77-128.
- Kapur, A.P. 1950. A note on *Epilachna ocellata* Redt. (Coleoptera : Coccinellidae) with description of three species hitherto confused with it. *Rec. Indian Museum*, 48(3 & 4) : 17-29.
- Kapur, A.P. 1955. The Coccinellidae of Nepal. *Rec. Indian Mus.*, 53(3 & 4) : 309-338.
- Kapur, A.P. 1972. The Coccinellidae (Coleoptera) of Goa. *Rec. zool. Surv. India*, 66(1-4) : 309-320.
- Kapur, A.P. 1996. The Coccinellidae (Coleoptera) of the Andamans. *Proc. Nat. Inst. Sci. India*, 32(3-4) : 148-149.
- Poorani, J. 2004. An annotated Checklist of the Coccinellidae (Coleoptera) of the Indian sub region, online pdf. p. 1-90 (English).

INSECTA : COLEOPTERA : CICINDELIDAE

S.S. JADHAV and R.M. SHARMA

Zoological Survey of India, Western Regional Centre, Pune-411044

INTRODUCTION

The members of the family Cicindelidae are commonly known as "Tiger beetles", on account of their activity and ferocity. They afford excellent examples of protective resemblance and mimicry. They are predacious and usually feed on insects like ants, beetles, bugs, nymphs, caterpillars or dead bodies of large insects. The members of this family are easily recognized by large head with prominent eyes, inner lobe of maxillae elongated and provided with an articulated hook like processes at the end, antennae filiform and 11 segmented, clypeus extending laterally in front of insertion of antennae, elytra covering or nearly covering the abdomen, first three segments of ventrites connate, legs long, slender with five jointed tarsi.

The knowledge on Indian Cicindelids is based upon Fowler (1912), Dover and Rebeiro (1923), Pajni and Bedi (1972), Saha and Halder (1986), Saha et al. (1995), Mukhopadhyay and Halder (2003, 2004).

The inventory of the Tiger beetles is based on previous work from the area and compilation of scattered literature. The paper enumerates the account of 10 species in 3 genera distributed over 2 subfamilies from Maharashtra State.

SYSTEMATIC LIST

Order COLEOPTERA

Suborder ADEPHAGA

Family CICINDELIDAE

Subfamily COLLYRINAE

1. *Collyris brevipennis* W. Horn

Distribution : Maharashtra.

Subfamily CICINDELINAE

2. *Prothyma proxima* Chaudoir

Distribution : Karnataka, Maharashtra, Sikkim, Tamil Nadu and West Bengal.

3. *Cicindela indica* Fleutiaux

Distribution : Maharashtra.

4. *Cicindela melancholica* Fabricius

Distribution : Maharashtra and West Bengal.

5. *Cicindela sumatrensis* Herbst

Distribution : Bihar, Kerala, Maharashtra and West Bengal.

6. *Cicindela funerea* MacLeay

Distribution : Assam, Bihar, Himachal Pradesh, Karnataka Maharashtra, Manipur, Sikkim, Tamil Nadu and West Bengal.

7. *Cicindela whitthilli* Hope

Distribution : Karnataka, Maharashtra and Tamil Nadu.

8. *Cicindela sexpunctata* Fabricius

Distribution : Andaman Islands, Bihar, Karnataka, Maharashtra, Manipur, Sikkim and West Bengal.

9. *Cicindela bicolor* Fabricius

Distribution : Assam, Himachal Pradesh, Maharashtra and West Bengal.

10. *Cicindela gyllenhali* Dejean

Distribution : Maharashtra.

SUMMARY

The paper enumerates the account of 10 species in 3 genera distributed over 2 subfamilies of tiger beetles from Maharashtra State.

REFERENCES

- Dover, C. and Rebeiro, S. 1923. A list of the Indian Cicindelidae with localities. *Rec. Ind. Mus.*, **25** : 343-363.
- Fowler, W.W. 1912. *The Fauna of British India including Ceylon and Burma*, Coleoptera : General Introduction, Cicindelidae and Paussidae, pp.529.
- Pajni, H.R. and Bedi, S.K. 1972. Preliminary survey of the Cicindelid fauna Chandigarh, Punjab, India. *Cicindela*, **5**(3) : 41-54.
- Saha, S.K. and Halder, S.K. 1986. Tiger beetles of Silent Valley, Kerala. *Rec. zool. Surv. India*, **84**(1-4) : 137-142.
- Saha, S.K., Halder, S.K. and Biswas, S. 1995. Insecta : Coleoptera : Adephaga : Fam. Rhysodidae, Paussidae and Cicindelidae. *Zool. Surv. India, State Fauna Series*, **3** : *Fauna of West Bengal*, Part-6(A) : 1-51.
- Mukhopadhyay, P. and Halder, S.K. 2003. Insecta : Coleoptera : Cicindelidae, *Fauna of Sikkim, State Fauna Series*, **9**(Part-3) : 9-17.
- Mukhopadhyay, P. and Halder, S.K. 2004. Insecta : Coleoptera : Cicindelidae, *Fauna of Manipur, State Fauna Series*, **10** : 445-448.

INSECTA : COLEOPTERA : ELATERIDAE

AMOL PATWARDHAN and R.P. ATHALYE*

Department of Zoology, K.J. Somaiya College of Science and Commerce,
Vidyavihar, Mumbai-400077, Maharashtra, India

INTRODUCTION

Family Elateridae Leach 1815, which includes click beetles is the ninth largest family of Order Coleoptera with approximately 400 genera and 9000 identified species all over the world (Lawrence, 1982). Very little is known about click beetles because of their elusive nature, prolonged life cycle and concealed habits (under the bark, stones, crevices etc.) therefore they are difficult to locate. Most of the adults are attracted to the nectar and hence can be collected from the flowers. Larvae of click beetles are long wire like hence called 'wireworms'

The name is based upon Greek word *ἐλάτης* for hurler or driver (elater). The adult elaterids possess a unique click mechanism which gives them ability to upright itself whenever the beetle falls on its back or to slide away from the enemy's grip. The forceful sliding of the projection on the posterior side of prosternum in to a mesosternal cavity causes a violent jerk along with an audible clicking noise and the beetle bounces into the air and falls upright. Due to this clicking ability these beetles are called click beetles, skipjacks, spring beetles, clicker or blacksmiths etc. Sometimes it is called as grasshopper beetle or locust beetle.

Adult : Body colour varies from brown, black to metallic green; size varies from 2 mm to 50 mm. Body distinctly shaped, generally elongate with sides parallel. Posterior end of the body rounded or pointed. Pronotum distinct with

posterior corners projecting posteriorly. Antennae distinct serrate or sub serrate or pectinate or filiform; generally with 11 antennomeres. Body covered by pubescence or scales or both, integument generally with punctures. Prosternum with distinct posterior projection. Mesosternum with a cavity to receive the prosternal projection. Tarsi 5-5-5. Claws simple, pectinate, dentate or bifid with or without basal setae arising from outer flat portion.

A perusal of literature, past records and recent extensive studies on Elateridae from Maharashtra by authors revealed the diversity of 36 species of 28 genera under 5 subfamilies.

SYSTEMATIC LIST

Order COLEOPTERA

Family ELATERIDAE

Subfamily DENTICOLLINAE

Tribe **Denticollini**

1. *Plectrosternus foveatus* Patwardhan & Athalye, 2012

Subfamily CARDIOPHORINAE

Tribe **Cardiophorini**

2. *Paracardiophorus tricolor* Patwardhan & Athalye, 2010
3. *Cardiophorus pellucidus* Patwardhan & Athalye, 2010
4. *Cardiophorus* sp.

*Department of Zoology, B.N. Bandodkar College of Science, Chendani, Bunder Road, Thane-400 601, Maharashtra, India

Subfamily AGRYPNINAE

Tribe Agrypninii

5. *Lanelater moestus* Candèze, 1857
 6. *Lanelater* sp.
 7. *Agrypnus lupinosus* Candèze, 1857
 8. *Adelocera* sp.
 - *9. *Lacon abreptus* Candèze 1893
 - *10. *Lacon muscosus* Candèze 1893
 - *11. *Lacon minisculus* Candèze, 1874
 - *12. *Lacon holocericeous* Candèze 1893
- (* *Lacon* spp. (all these species must be *Adelocera* sp.)

Tribe Hemirrhypini

13. *Punctodensus bifeatus* Patwardhan, Schimmel and Athalye 2008
14. *Punctodensus indicus* Patwardhan, Schimmel and Athalye 2008

Tribe Ampidini

15. *Abelater sangunicollis* Fleutiaux, 1947
16. *Xanthopenthes tandeli* Patwardhan, Schimmel and Athalye 2008
17. *Megapenthes* sp.
18. *Melanoxanthus anticus* Candèze, 1892
19. *Procaerus assamensis* Schimmel, 2003

Subfamily ELATERINAE

Tribe Melanotini

20. *Melanotus* sp.
21. *Metriaulacus bicolor* Patwardhan, Platia and Athalye, 2007

Tribe Dicrepidini

22. *Adiaphorus gracillicornis* Candèze, 1859
23. *Adiaphorus brunneus* Candèze, 1859
24. *Propsephus thanensis* Patwardhan and Athalye, 2009
25. *Elius phansadicus* Patwardhan and Athalye, 2009

Tribe Conoderini

26. *Aeoloderma agnata* Candèze, 1860

27. *Aeoloides sequester* Candèze, 1859
28. *Conoderus* sp.
29. *Heteroderes lenis* Candèze, 1859
30. *Heteroderes chrysites* Candèze, 1859
31. *Monocrepidius tenuis* Candèze, 1859
32. *Drasterius indus* Candèze, 1859

Tribe Adrastini

33. *Silesis* sp.

Tribe Agriotini

34. *Ludioschema* sp.

Tribe Cardiorhinini

35. *Cardiorhinus* sp.

Subfamily TETRALOBIANE

Tribe Tetralibini

36. *Tetralobus* sp

SUMMARY

An account of 36 species belonging to 28 genera under five subfamilies is provided based on the past records and the studies conducted by the authors in the state.

ACKNOWLEDGEMENTS

We are thankful to the Principal, B.N. Bandodkar College of Science, Thane for providing laboratory facilities; Rudiger Preiss, London; Rainer Schimmel, Germany and Giuseppe Platia, Italy for providing literature, Bert Gustafson, Sweden for providing photographs of types in the museum, Muhammad Atique, Karachi for providing some valuable references, Bombay Natural History Society, Mumbai for providing antiquarian references; State Forest Department, Maharashtra and others who assisted during field visits. We express our grateful thanks to Dr. K. Venkatraman, Director, Zoological Survey of India, Kolkata and Dr. R.M. Sharma, Scientist-D & Officer-in-Charge, Zoological Survey of India, Pune for providing opportunity to contribute this study.

REFERENCES

- Banerjee, M.R. 1959. Chromosome complement and meiosis in an elaterid beetle, *Agrypnus fusipes* Fabricius (Coleoptera : Elateridae). *Current Science*, **9** : 370-371.
- Biswas, S. 1995. Coleoptera. In: Zoological Survey of India, *Himalayan Ecosystem Series, Fauna of Western Himalaya*, Part 1, *Uttar Pradesh* : 55-60.
- Candèze, E. 1857. *Monographie des Élatérides*. Vol. 1. *Memoires de la Société Royale des Sciences de Liège* 12, viii + 400 pp., 7 pls.
- Candèze, E. 1859. *Monographie des Élatérides*. Vol. 2. *Memoires de la Société Royale des Sciences de Liège* 14, 543 pp., 7 pls.
- Candèze, E. 1860. *Monographie des Élatérides*. Vol. 3. *Memoires de la Société Royale des Sciences de Liège* 15, 512 pp., 5 pls.
- Candèze, E. 1863. *Monographie des Élatérides*. Vol. 4. *Memoires de la Société Royale des Sciences de Liège* 17, 534 pp., 6 pls.
- Candèze, E. 1878b. Elaterides nouveaux 2. *Annales de la Societe Entomologique de Belgique (Comptes-rendus)* 21 : li-cxliii.
- Chakarborty, P. and Chakraborty, S. 2000. Agrypninae (Coleoptera : Elateridae) of India : Taxonomic review and checklist. *Records of Zoological Survey of India*, **98**(3) : 71-83.
- Eschscholtz, J.F. 1829. Elaterites, Eintheilung derselben in Gattungen. Pp. 31-35 in Thon. *Entomologische Archiv*. Vol., 2. Jena.
- Fabricius, C. 1781. *Species Insectorum*, exhibentes eorum differentias specificas, synonyma auctorum, loca natalia, metamorphosin adiectis observationibus, descriptionibus, Hamburgi et Kilonii : Carol ernest Bohnii. Tome 1 viii+552 pp.
- Fleutiaux, E. 1947. Révision des Élatérides (Coléopères) de l'Indo-Chine Française. Notes d'Entomologie Chinoise, Shanghai, **11** : 233-420.
- Hayek, C.M.F. von 1973. A reclassification of the subfamily Agrypninae (Coleoptera : Elateridae). *Bulletin of the British Museum (Natural History) Entomology Supplement*, **20** : 1-309.
- Hayek, C.M.F. von 1979. Additions and corrections to "A reclassification of the subfamily Agrypninae (Coleoptera : Elateridae)" *Bulletin of the British Museum (Natural History) Entomology*, **38** : 182-261.
- Hayek, C.M.F. von 1990. A reclassification of the *Melanotus* group of genera (Coleoptera : Elateridae). *Bulletin of the British Museum (Natural History) (Entomology)*, **59** : 37-115.
- Hyslop, J.A. 1921. Genotypes of the Elaterid beetles of the world. *Proceedings of the U.S. National Museum*, **58** : 621-673.
- Lawrence, J.F. 1982. Coleoptera. In : Parker, S.P. editor, synopsis and classification of living organisms. pp. 482-553, McGraw Hill.
- Patwardhan A.P. and R.P. Athalye. 2010a. New records and two new species of Cardiophorine Elateridae from Maharashtra, India (Insecta : Coleoptera). *Genus*, **21**(4) : 505-511.
- Patwardhan A.P. and R.P. Athalye. 2010b. Two new species of Dicrepidiinae from Maharashtra, India with a note on structure of hind wing and genitalia of some previously described species. (Coleoptera : Elateridae). *Genus*, **21**(1) : 43-52.

- Patwardhan A.P. and R.P. Athalye. 2010c. Study of the jump of some species of Click Beetles (Coleoptera : Elateridae). *Bionano Frontier* Vol. 3(1) : 71-73.
- Patwardhan A.P. and R.P. Athalye. 2008a. Genera of click beetles (Coleoptera : Elateridae) from Maharashtra, India. *Proceeding of the Seminar on 'Wonderful World of Insects'* Edited by Dr. R.P. Athalye. Thane. 3rd December 2008. pp. 45-49.
- Patwardhan A.P., Platia, G. and R.P. Athalye. 2008b. A new species of *Metriaulacus* Schwarz, 1901 from Maharashtra, India. *Bionano Frontier* Vol. 2(1) : 15-17.
- Patwardhan A.P., Schimmel. R and R.P. Athalye.. 2008c. A new species of *Xanthopenthes* (Elateridae : Ampedinae) from North Western Ghats, Maharashtra, India. *Genus* 19(4) : 675-678.
- Patwardhan A.P., Schimmel. R and R.P. Athalye. 2008d. A new genus *Punctodensus* (Elateridae : Hemirrhini) from North Western Ghats, Maharashtra, India. *Genus* 20(1) : 53-60.
- Patwardhan, A. and R.P. Athalye. 2012. *Pleetrosternus* Lacordaire, 1857 (Coleoptera : Elateridae); genus new to the northern western ghats, India with description of one new species. *Zootaxa*, 3193 : 53-61.
- Schwarz, O. 1906b. Coleoptera Fam. Elateridae. Fascicule 46A.pp. 1-112 in Wytsman, P. (ed.) *Genera Insectorum* Bruxelles : P. Wytsman.
- Schwarz, O. 1906c. Coleoptera Fam. Elateridae. Fascicule 46B. pp. 113-224 in Wytsman, P. (ed.) *Genera Insectorum* Bruxelles : P. Wytsman,
- Schwarz, O. 1907a. Coleoptera Fam. Elateridae. Fascicule 46C.pp. 225-370 pls 1-6 in Wytsman, P. (ed.) *Genera Insectorum* Bruxelles: P. Wytsman,
- Stibick, J. N. L. 1980. A revision of the Hypnoidinae of the World. Part IV. The Hypnoidinae of India. *Eos* 54(1978) : 247-273.
- Vats, L.K. 1991. Systematics of Elateridae. Final technical report submitted to U.S. Dept. of Agriculture (USDA) under PL-480. 175pp.

INSECTA : COLEOPTERA : CHRYSOMELIDAE

PRIYANKA DUTTA SAHA, M.J. JADHAV and R.M. SHARMA

Zoological Survey of India, Western Regional Centre, Pune-411044

INTRODUCTION

The Chrysomelidae is one of the largest families of the order Coleoptera. These beetles are commonly known as leaf beetles and include around 50,000 species in the world (Basu, 1996). Chrysomelids are phytophagous and are among the most diverse and conspicuous insects appearing on plants. The adults feed on living plant material, usually consuming leaves or sometimes various flower parts including pollen. The larvae mostly feed on leaves, while many are subterranean, attacking roots and underground stems.

Works on Indian fauna of Chrysomelidae were done by Jacoby (1908), Maulik (1919, 1926, and 1936) and Scherer, (1969, on Alticinae). Over 1,460 species are recorded so far from India (Basu, 1996). The present work is based on the previous literatures and aims in listing of all the species (barring subfamily Cassidinae which is dealt separately) recorded from the state of Maharashtra. The present list follows essentially the arrangements proposed by Jacoby (1975), Maulik (1926) and Basu (1996).

The present inventory of Chrysomelidae of Maharashtra deals with 68 species under 39 genera and 8 subfamilies.

SYSTEMATIC ACCOUNT

Order COLEOPTERA

Suborder POLYPHAGA

Superfamily CHRYSOMELOIDEA

Family CHRYSOMELIDAE

Subfamily GALERUCINAE

Genus *Oides* Weber, 1801

1. *Oides bipunctata* (Fabricius), 1801

Distribution : Assam, Bengal, Bihar, Maharashtra (Mumbai).

2. *Oides andrewesi* Jacoby, 1900

Distribution : Assam, Bihar, Maharashtra, Meghalaya, Orissa, West Bengal.

Elsewhere : Myanmar, Laos, Vietnam.

Genus *Haplosoma* Jacoby, 1884

3. *Haplosoma unicolor* Illiger, 1800

Distribution : Andaman Islands, Assam, Bengal, Bihar, Eastern Himalayas, Karnataka, Kerala, Maharashtra, Orissa.

Elsewhere : China, Korea, Java, Myanmar, Nepal, Philippines, Sumatra.

Genus *Aulacophora* Chevrolat, 1842

4. *Aulacophora foveicollis* (Lucas, 1849)

Distribution : Andaman Islands, Arunachal Pradesh, Bihar, Gujarat, Kerala, Maharashtra (Mumbai, Pune), Meghalaya, Orissa, Punjab, Sikkim, Tamil Nadu, Tripura, Uttar Pradesh.

Elsewhere : Algeria, Egypt, Greece, Nepal, South Europe, Sri Lanka.

5. *Aulacophora intermedia* Jacoby, 1892

Distribution : Assam, Bihar, Gujarat, Karnataka, Maharashtra.

Elsewhere : Myanmar, Sri Lanka.

6. *Aulacophora impressa* (Fabricius, 1801)

Distribution : Bihar, Karnataka, Maharashtra.

7. *Aulacophora frontalis* Baly, 1888

Distribution : Karnataka, Maharashtra, Tamil Nadu, Tripura, West Bengal.

8. *Aulacophora indica* (Gmelin, 1790)

Distribution : Assam, Haryana, Jammu and Kashmir, Karnataka, Maharashtra, Madhya Pradesh, Orissa, Sikkim, Uttar Pradesh, West Bengal.

Elsewhere : Bhutan, Japan, Nepal, Pakistan.

9. *Aulacophora lewissii* Baly, 1886

Distribution : Assam, Bihar, Gujarat, Haryana, Jammu and Kashmir, Karnataka, Madhya Pradesh, Maharashtra, Meghalaya, Orissa, Punjab, Sikkim, Tamil Nadu, Uttar Pradesh, West Bengal.

Elsewhere : Bhutan, Myanmar, Nepal, Sri Lanka.

Genus *Monolepta* Erichson, 1843

10. *Monolepta Longitarsis* Jacoby, 1896

Distribution : Maharashtra, Nilgiri Hills.

11. *Monolepta nigrobilineata* (Motschulsky 1860)

Distribution : Maharashtra, Tamil Nadu, West Bengal.

Elsewhere : China, Japan.

12. *Monolepta khasiensis* Weise, 1916

Distribution : Assam (Khasi Hills), Maharashtra.

13. *Monolepta scripta* (Motschulsky, 1866)

Distribution : Assam (Khasi hills), Karnataka, Maharashtra (Mumbai, Khandesh).

Elsewhere : Myanmar, Sri Lanka.

14. *Monolepta orientalis* Jacoby, 1889

Distribution : Assam, Karnataka, Maharashtra (Mumbai, Nashik, Deolali), Tamil Nadu.

Elsewhere : Myanmar, Sri Lanka.

15. *Monolepta andrewesi* Jacoby, 1896

Distribution : Karnataka, Maharashtra.

16. *Monolepta signata* (Olivier, 1889)

Distribution : Arunachal Pradesh, Assam, Gujarat, Haryana, Karnataka, Kerala Maharashtra, Meghalaya, Orissa, Sikkim, Tamil Nadu, Tripura, Uttar Pradesh, West Bengal.

Elsewhere : Bangladesh, Bhutan, China, Hongkong, Myanmar, Nepal, Pakistan, Sri Lanka, Tibet, Vietnam.

Genus *Mimastra* Baly, 1865

17. *Mimastra scutellata* Jacoby, 1904

Distribution : Maharashtra (Igatpuri), Tamil Nadu (Nilgiri Hills).

Elsewhere : Myanmar.

Genus *Medythia* Jacoby, 1887

18. *Medythia nigrobilineata* (Motschulsky, 1981)

Distribution : Maharashtra, Orissa, Tamil Nadu, Uttar Pradesh, West Bengal.

Elsewhere : China, Japan, Korea.

Genus *Sphenoraira* Clark, 1865

19. *Sphenoraia (Sphenoraia) bicolor* (Hope, 1831)

Distribution : Andhra Pradesh, Assam, Himachal Pradesh, Kerala, Maharashtra, Meghalaya, Sikkim, Uttar Pradesh, West Bengal.

Elsewhere : Myanmar, Nepal.

Genus *Gallerucida* Motschulsky, 1860

20. *Gallerucida bicolor* (Hope, 1831)

Distribution : Himachal Pradesh, Maharashtra, Kerala, West Bengal (Darjeeling).

Elsewhere : Lower Myanmar, Nepal.

Genus *Palpoxena* Baly, 1861

21. *Palpoxena pilicornis* (Jacoby, 1896)

Distribution : Maharashtra.

Subfamily HISPINAE

Genus *Callispa* Baly, 1858

22. *Callispa duodecimmaculata* Chapuis,
1876

Distribution : Maharashtra (Bombay Presidency).

Genus *Leptispa*, Baly, 1858

23. *Leptispa pygmaea* Baly, 1858

Distribution : Karnataka, Maharashtra (Pune), Tamil Nadu.

Elsewhere : Sri Lanka.

Genus *Hispella* Chapuis, 1875

24. *Hispella brachycera* Gestro, 1897

Distribution : Assam, Himachal Pradesh, Maharashtra (Nagpur), Tamil Nadu, West Bengal.

25. *Hispella stygia* Chapuis, 1877

Distribution : Maharashtra (Mumbai, Satara dist., Nagpur).

Genus *Dactylispa* Weise, 1897

26. *Dactylispa filiola* Weise, 1897

Distribution : Maharashtra, Tamil Nadu (Nilgiri Hills).

Elsewhere : Sri Lanka.

27. *Dactylispa nalika* Maulik, 1919

Distribution : India : Maharashtra (Mumbai, Matheran); Tamil Nadu (Nilgiri Hills).

Genus *Hispa* Linnaeus, 1767

28. *Hispa pallescens* Guérin, 1841

Distribution : Maharashtra (Nagpur).

Genus *Platypria* Guérin, 1840

29. *Platypria andrewesi* Weise, 1906

Distribution : Gujarat (Surat), Madhya Pradesh (Jabalpur), Maharashtra (Nagpur), Punjab, Tamil Nadu.

30. *Leptispa pygmaea* Baly, 1858

Distribution : Karnataka, Maharashtra, Meghalaya, Tamil Nadu.

Elsewhere : Sri Lanka.

Subfamily CHRYSOMELINAE

Genus *Chrysolina* Motschulsky, 1860

31. *Chrysolina fulvoaenea* Jacoby, 1900

Distribution : Maharashtra (Bombay, Pune).

32. *Chrysolina madrasae* Jacoby, 1900

Distribution : Karnataka (Coorg), Maharashtra (Mumbai, Igatpuri), Tamil Nadu (Nilgiri Hills).

Subfamily HALTICINAE (= ALTICINAE)

Genus *Chaetocnema* Stephens, 1831

33. *Chaetocnema basalis* Bely, 1877

Distribution : Assam, Karnataka, Maharashtra (Mumbai, Khandesh), Tamil Nadu (Nilgiri Hills).

Elsewhere : Myanmar, Sri Lanka.

34. *Chaetocnema belly* Jacoby, 1986

Distribution : Maharashtra (Mumbai, Khandesh).

Genus *Ophridia*, Chapuis, 1875

35. *Ophridia hirsute* Stebbing, 1914

Distribution : Maharashtra (Pune, Bhamburda Reserve Forest).

Genus *Luperomorpha* Weise, 1887

36. *Luperomorpha bombayensis* Jacoby,
1896

Distribution : Maharashtra (Mumbai).

Genus *Aphthona* Chevrolat, 1842

37. *Aphthona nigrilabris* Duvivier, 1892

Distribution : Assam, Bihar, Karnataka, Maharashtra, Meghalaya, Orissa, Uttar Pradesh West Bengal.

Elsewhere : Laos, Nepal, Sri Lanka, Sumatra, Vietnam.

38. *Aphthona huheli* Jacoby, 1900

Distribution : Maharashtra (Mumbai, Satara).

Genus *Phyllotreta* Stephens, 1839

39. *Phyllotreta downesi* Baly, 1877

Distribution : Maharashtra (Mumbai).

Elsewhere : Tenasserim.

40. *Xuthea orientalis* Baly, 1865

Distribution : Arunachal Pradesh, Assam, Himachal Pradesh, Maharashtra, Manipur Meghalaya, Sikkim, Tamil Nadu, Uttar Pradesh, West Bengal.

Elsewhere : Bangladesh, Bhutan, China, Myanmar, Nepal,

Subfamily CRIOCERINAE

Genus *Lema* Fabricius, 1798

41. *Lema flavimana* Jacoby, 1908

Distribution : Maharashtra (Mumbai).

42. *Lema subiridea* Jacoby, 1900

Distribution : Kerala, Maharashtra, Nilgiris.

Genus *Oulema* Des Gozis, 1886

43. *Oulema downesi* Baly, 1865

Distribution : Maharashtra, Malabar Coast, West Bengal,

Subfamily CLYTRINAE

Genus *Smaragdina* Chevrolat, 1837

44. *Smaragdina minuta* Jacoby, 1908

Distribution : Maharashtra, West Bengal.

Elsewhere : Myanmar, Sri Lanka.

45. *Smaragdina divisa* (Duvivier, 1889)

Distribution : Kerala, Maharashtra, Tamil Nadu, West Bengal.

Elsewhere : Myanmar, Sri Lanka.

Genus *Aetheomorpha* Lacord, 1848

46. *Aetheomorpha punctata* Jacoby 1895

Distribution : Karnataka, Maharashtra.

Genus *Pantocometis* Lacordaire, 1848

47. *Pantocometis downesi* Baly, 1865

Distribution : Maharashtra.

Genus *Clytra* Laicharting, 1781

48. *Clytra lefevrei* Jacoby, 1895

Distribution : Karnataka, Kerala, Maharashtra (Mumbai), Nilgiris, West Bengal.

Genus *Coptocephala* Chevrolat, 1837

49. *Coptocephala minuta* Jacoby, 1908

Distribution : Maharashtra (Mumbai), West Bengal.

50. *Coptocephala nair* Locordaire, 1848

Distribution : Kerala, Maharashtra, Tamil Nadu, Uttar Pradesh, West Bengal.

Subfamily CRYPTOCEPHALINAE

Genus *Cryptocephalus* Geoffroy, 1847

51. *Cryptocephalus angustomarginatus* Jacoby, 1903

Distribution : Karnataka, Maharashtra, Nilgiris.

52. *Cryptocephalus sandrocottus* Suffrain, 1854

Distribution : Maharashtra (Mumbai); Southern India.

53. *Cryptocephalus sehestedti* Jacoby, 1908

Distribution : Kerala, Maharashtra, Nilgiris, Orissa, Tamil Nadu, West Bengal.

Elsewhere : Sri Lanka.

54. *Cryptocephalus indicus* Suffrian, 1854

Distribution : Maharashtra (Mumbai); Southern India.

55. *Cryptocephalus guttifer* Suffrian, 1854

Distribution : Jammu and Kashmir, Maharashtra, Madhya Pradesh, Punjab, Uttar Pradesh.

Elsewhere : China

56. *Cryptocephalus senarius* Suffrian, 1860

Distribution : Karnataka, Maharashtra (Igatpuri).

Subfamily EUMOLPINAE

Genus *Nodina* Motschulsky, 1858

57. *Nodina indica* Jacoby, 1895

Distribution : Arunachal Pradesh, Karnataka, Maharashtra, West Bengal.

Genus *Colasposoma* de Laporte, 1833

58. *Colasposoma pretiosum* Baly, 1880

Distribution : Assam, Maharashtra, Meghalaya, Sikkim, Tamil Nadu, West Bengal.

Elsewhere : China, Myanmar, Sri Lanka, Vietnam.

59. *Colasposoma ornatum* Jacoby, 1881

Distribution : Maharashtra, West Bengal.

60. *Colasposoma metallicum* Clark, 1865

Distribution : Andaman Islands, Maharashtra, Meghalaya, Orissa, West Bengal.

Elsewhere : China, Laos, Myanmar, Vietnam.

61. *Colasposoma caeruleatum* Baly, 1879

Distribution : Assam, Maharashtra.

Elsewhere : China, Myanmar, Sri Lanka.

62. *Colasposoma bicoloratum* Jacoby, 1908

Distribution : Maharashtra

Genus *Scelodonta* Westwood, 1837

63. *Scelodonta vittata* Olivier, 1808

Distribution : Andaman Islands, Bihar, Maharashtra, West Bengal.

Elsewhere : Cambodia, Laos, Thailand, Vietnam.

Genus *Neculla* Baly, 1863

64. *Neculla pollinaria* Baly, 1860

Distribution : Maharashtra.

Genus *Cleoporus* Lefèvre, 1884

65. *Cleoporus maculicollis* Jacoby, 1904

Distribution : Maharashtra (Khandesh).

Genus *Corynodes* Hope, 1840

66. *Corynodes amethystinus* Marshall, 1865

Distribution : Karnataka, Kerala, Maharashtra (Igatpuri), Nilgiri.

Genus *Heminodes* Jacoby, 1895

67. *Heminodes unicolor* Duvivier, 1908

Distribution : Karnataka, Maharashtra, West Bengal.

Elsewhere : Myanmar.

Genus *Pagria* Lefevre, 1884

68. *Pagria kanaraensis* (Jacoby, 1908)

Distribution : Karnataka, Maharashtra, Tripura, West Bengal.

SUMMARY

The present inventory of family Chrysomelidae of Maharashtra deals with 68 species under 39 genera and 8 subfamilies.

REFERENCES

- Basu, C.R. 1996. Insecta : Coleoptera : Chrysomelidae. In : *Fauna of West Bengal, State Fauna Series*, 3(Part-6B) : 559-773.
- Basu, C.R. 1997. Insecta : Coleoptera : Chrysomelidae. In : *Fauna of Meghalaya, State Fauna Series*, 4(Part-5) : 235-381.
- Jacoby, M. 1908. *The Fauna of British India, including Sri Lanka and Myanmar*. Coleoptera, Chrysomelidae, 1 : XX + 534 pp.
- Maulik, S. 1919. *The Fauna of British India, including Sri Lanka and Myanmar*. Coleoptera : Chrysomelidae (Hispidinae & Cassidinae) : xii + 440 pp.
- Maulik, S. 1926. *The Fauna of British India, including Sri Lanka and Myanmar*. Coleoptera : Chrysomelidae (Chrysomelinae & Halticinae) : xiii + 442 pp.
- Maulik, S. 1936. *The Fauna of British India, including Sri Lanka and Myanmar*. Coleoptera : Chrysomelidae (Galerucinae) : xiv + 648 pp.

INSECTA : COLEOPTERA : CHRYSOMELOIDEA : CHRYSOMELIDAE : CASSIDINAE

H.V. GHATE

Department of Zoology, Modern College, Shivajinagar, Pune-411 005, India
hemanthghate@gmail.com

INTRODUCTION

Tortoise beetles belong to the sub-family Cassidinae, of the family Chrysomelidae. These are all leaf eating beetles and are often conspicuously colored. These beetles are easily recognized due to their characteristic shape.

Formerly Cassidinae and Hispinae were treated as separate subfamilies, by Maulik (1919), however, now these are combined and the accepted subfamily name is Cassidinae. For the present work, however, Cassidinae *sensu* Maulik is maintained here as convenience only. Hispinae are not included in the present work.

The World Catalogue of Borowiec (1999) lists all the major taxonomic papers published on World Cassidinae, gives all the synonyms and known distribution of each species as well as names of host plants (wherever known). The address of the website is : (www.biol.uni.wroc.pl/cassidae/katalog%20internetowy.index.htm)

Since there is no comprehensive list of tortoise beetles of Maharashtra, an attempt has been made to prepare an updated list of Cassidinae known to be present in Maharashtra. This list is based on past records and the studies conducted by the author, and his batch of students in recent past, and works it out to 40 species belonging to 12 genera. The list gives current taxonomic name of the beetle, as per Borowiec (1999), in **bold italics** while the name used by Maulik (1919) is given below each current name in *italics*.

These insects, which grow and complete their life cycles on plants that are mostly weeds, need better attention as potential controllers of the unwanted vegetation. None of these species appear to be serious pests destroying useful vegetation (exception being *Craspedonta*). In fact, these insects are feeding on green biomass which otherwise is left to decay after rains are over, there being few other herbivores feeding on these plants. Perhaps Cassidinae are then one of the important primary consumers of the ecosystem. Intensive surveys are likely to reveal more species and even species new to science.

SYSTEMATIC LIST

Order COLEOPTERA

Superfamily CHRYSOMELOIDEA

Family CHRYSOMELIDAE

Subfamily CASSIDINAE

Tribe Notosacanthini

1. ***Notosacantha chandrapurensis*** (Swietojska, Ghatte and Marathe 2001)
2. ***Notosacantha severini*** (Spaeth, 1913)
Hoplionota severini Spaeth
3. ***Notosacantha tenuicula*** (Spaeth 1913)
Hoplionota tenuicula Spaeth
4. ***Notosacantha vicaria*** (Spaeth, 1913)
Hoplionota vicaria Spaeth

Tribe Basiprionotini

5. *Craspedonta leayana* (Latreille, 1807)

Calopepla leayana Latreille

6. *Epistictina reicheana* (Guérin, 1844)

Epistictia reicheana Guerin

Tribe Cassidini

- *7. *Aspidimorpha* (*Aspidimorpha*) *furcata* (Thunberg, 1789)

Aspidomorpha furcata, Thunberg

8. *Aspidimorpha* (*Aspidimorpha*) *fuscopunctata* Boheman, 1854

Aspidomorpha fuscopunctata

9. *Aspidimorpha* (*Aspidimorpha*) *indica* Boheman, 1854

Aspidomorpha indica, Boheman

10. *Aspidimorpha* (*Aspidimorpha*) *inuncta* Boheman, 1854

Aspidomorpha inuncta, Boheman

11. *Aspidimorpha* (*Aspidimorpha*) *lobata* Boheman, 1854

12. *Aspidimorpha* (*Aspidimorpha*) *miliaris* (Fabricius, 1775)

Aspidomorpha miliaris Fabricius

13. *Aspidimorpha* (*Aspidimorpha*) *sanctaecrucis* (Fabricius, 1792)

Aspidomorpha sanctaecrucis Fabricius

14. *Capelocassis dorsata* (Duvivier, 1891)

Cassida dorsata Duvivier

15. *Cassida* (*Crepidaspis*) *belli* Weise, 1897

Cassida belli Weise

16. *Cassida* (*Crepidaspis*) *circumdata* Herbst, 1799

Cassida circumdata, Herbst

17. *Cassida* (*Crepidaspis*) *cognobilis* Spaeth, 1926

18. *Cassida* (*Crepidaspis*) *devalaensis* Borowiec & Takizawa, 1991

19. *Cassida* (*Crepidaspis*) *exilis* Boheman, 1854

Cassida exilis Boheman

20. *Cassida* (*Crepidaspis*) *flavoguttata* Spaeth, 1914

Cassida flavoguttata Spaeth

Cassida (*Crepidaspis*) *flavoscutata* Spaeth

21. *Cassida flavoscutata* Spaeth 1914

22. *Cassida* (*Crepidaspis*) *informis* Boheman, 1862

Cassida informis Boheman

23. *Cassida* (*Crepidaspis*) *obtusata* Boheman, 1854

Cassida obtusata Boheman

24. *Cassida* (*Crepidaspis*) *saginata* Spaeth, 1914

Cassida saginata Spaeth

25. *Cassida* (*Crepidaspis*) *varians* Herbst, 1799

Cassida varians Herbst

Cassida syrtica, Boheman (synonymized by Borowiec 1999: 291).

26. *Chiridopsis bipunctata* (Linnaeus, 1767)

Chirida bipunctata Linnaeus

Chirida promiscua, Boheman (synonymized by Borowiec 2001: 529).

27. *Chiridopsis bistrimaculata* (Boheman, 1855)

Chirida bistrimaculata Boheman

28. *Chiridopsis nigropunctata* Borowiec Ghate, 1999

29. *Chiridopsis rubromaculata* Borowiec *et al.*, 2001

30. *Chiridopsis undecimnotata* (Boheman, 1855)

Chirida undecimnotata, Boheman

31. *Chiridopsis ventralis* (Boheman, 1855)

Chirida ventralis, Boheman

32. *Conchyloctenia nigrovittata* (Boheman, 1854)

Conchyloctenia nigrovittata, Boheman

- *33. *Laccoptera* (*Orphnodella*) *foveolata* (Boheman, 1856)

Sindia foveolata Boheman

34. *Laccoptera* (*Laccopteroidea*) *nepalensis* Boheman 1855

Laccoptera quadrimaculata Thunberg

35. *Laccoptera* (*Laccopteroidea*) *quatuordecimnotata* Boheman 1855

Laccoptera quatuordecimnotata, Boheman

36. *Laccoptera* (*Sindia*) *depressa* Świętojańska, 2001

37. *Laccoptera (Sindia) sulcata* (Olivier, 1808)*Sindia clathrata* Fabricius38. *Glyphocassis trilineata* (Hope 1831)39. *Oocassida pudibunda* (Boheman, 1856)*Oocassida pudibunda* Boheman40. *Rhytidocassis indicola* (Duvivier, 1892)*Cassida indicola* Duvivier*Chiridopsis hina* Maulik (synonymized by Borowiec 1999 : 316)

*After Borowiec (1999) catalogue, Swietojanska (2001) shifted genera *Aspidomorpha conchyloctenia* and *Laccoptera* to Tribe Aspidomorhini. *Aspidomorpha lobata* was treated as synonym of *A. sanctaecrucis* in Maulik (1919).

SUMMARY

An account of 40 species belonging to 12 genera of tortoise beetles (subfamily Cassidinae) from Maharashtra State has been provided.

ACKNOWLEDGEMENTS

The author is deeply indebted to Prof. Lech Borowiec and Dr. Jolanta Swietojanska, Wroclaw University, Poland for their continued support, to the authorities of Modern College for facilities and encouragement. He is also thankful to Rahul Bahulikar, Rahul Marathe, Sanjay Thakur, Vivek Gaur-Broome, Aparna Watve, Jay Kadapatti, Ashok Captain, Anand Padhye, Aditi Kale and Priyanka for help in field work and to Rohan Joshi and Girish Pathak for their many fold courtesies. A part of the work on Cassidinae was financed by University Grants Commission under Minor Research Project which is duly acknowledged. The author is also thankful to Dr. K. Venkatraman, Director, Zoological Survey of India, Kolkata and Dr. R.M. Sharma, Scientist-D & Officer-in-Charge, Zoological Survey of India, Pune for providing opportunity to contribute the study.

REFERENCES

- Borowiec, L. 1999. A World Catalogue of the Cassidinae (Coleoptera : Chrysomelidae). *Biologica Silesiae*, Wroclaw, Poland. 476 pp.
- Borowiec, L., and Ghate, H.V., 1999. *Chiridopsis nigropunctata* n. sp. and notes on *Ch. selecta* (Weise) (Coleoptera : Chrysomelidae : Cassidinae). *Genus*, **10** : 103-108.
- Borowiec, L., Ranade, S., Rane, N., Ghate, H.V., 2001. *Chiridopsis rubromaculata* n. sp. from India, and notes on its bionomy and immature stages (Coleoptera : Chrysomelidae : Cassidinae). *Genus*, **12** : 361-371.
- Borowiec, L., and Takizawa, H., 1991. Notes on chrysomelid beetles of India and its neighboring areas-Part 10. *Japanese J. Entomol.*, **59** : 637-654.
- Ghate, H.V., Ranade, S.P. 2002. New locality records and additional comments on the life history stages of *Epistictina reicheana* (Guerin). (Coleoptera: Chrysomelidae: Cassidinae). *Zoos' Print Journal*, **17** : 729-731.
- Maulik, S., 1919. The Fauna of British India including Ceylon and Burma. Coleoptera Chrysomelidae (Hispinidae and Cassidinae). Taylor and Francis, London. 439 pp.
- Rane, N., Marathe, R., Ghate, H.V., 1999. First record of *Cassida flavoguttata* Spaeth (Coleoptera : Chrysomelidae : Cassidinae) from Satara District, Maharashtra. *J. Bombay Nat. Hist. Soc.*, **96** : 169.
- Rane, N., Ranade, S., and Ghate, H.V., 2000. Some observations on the biology of *Notosacantha vicaria* (Spaeth) (Coleoptera : Chrysomelidae : Cassidinae). *Genus*, **11** : 197-204.

- Rane, N., Ranade, S., and Ghate, H.V., 2001. Notes on the life History of *Conchyloctenia nigrovittata* (Boheman) (Coleoptera : Chrysomelidae : Cassidinae). *J. Bombay Nat. Hist. Soc.*, **98** : 53-57.
- Swietojanska, J., 2001. A revision of the tribe Aspidimorphini of the Oriental Region (Coleoptera : Chrysomelidae : Cassidinae). *Genus* (supplement), Polish Taxonomical Society, Wroclaw, 318 pp. + 18 pl.
- Swietojanska, J., Ghate, H.V., and Marathe, R., 2001. *Notosacantha chandrapurensis* n.sp. from India (Coleoptera : Chrysomelidae : Cassidinae). *Genus*, **12** : 489-492.

INSECTA : COLEOPTERA : RHYNCHOPHORA : CURCULIONIDAE

S.S. JADHAV AND R.M. SHARMA

Zoological Survey of India, Western Regional Centre, Pune-411044

INTRODUCTION

It is one of the largest families of the order Coleoptera and the members of the family Curculionidae are commonly called as 'weevils'. The family is generally divided into two groups, the "Curculionidae Adelongnathi" characterized by a short snout and other by a long snout is "Curculionidae Phanerognathi". The family is characterized by the possession of geniculate antennae, with each antenna differentiated into a scape, a funicle composed of several segments and a club constituted by the merger of 3-4 segments.

The inventory of the weevils is given on the basis of previous works from the area and scientific literature. The paper incorporates the comprehensive account of 32 species in 15 genera spread over 3 subfamilies from Maharashtra State.

SYSTEMATIC LIST

Order COLEOPTERA

Suborder RHYNCHOPHORA

Family CURCULIONIDAE

Subfamily EREMNINAE

1. *Cyrtepistomus albus* Pajni

Distribution : Maharashtra.

2. *Doliophron gracilicornis* (Faust, 1897)

Distribution : Chota Nagpur and Maharashtra.

3. *Crinorrhinus foveifrons* (Faust, 1897)

Distribution : Karnataka and Maharashtra.

4. *Crinorrhinus crassirostris* (Faust, 1897)

Distribution : Goa and Jammu & Kashmir, Karnataka and Maharashtra.

5. *Crinorrhinus approximans* Marshall, 1942

Distribution : Gujarat, Karnataka, Madhya Pradesh, Maharashtra and Orissa.

6. *Crinorrhinus foveifrons* (Faust, 1897)

Distribution : Karnataka and Maharashtra.

7. *Crinorrhinus cuprisetus* Marshall, 1942

Distribution : Maharashtra.

8. *Amblyrrhinus cavirostris* Pajni

Distribution : Maharashtra and Tamil Nadu.

9. *Amblyrrhinus subrecticollis* Marshall, 1913

Distribution : Bihar, Maharashtra and Uttar Pradesh.

10. *Hamartus instabilis* (Marshall, 1925)

Distribution : Goa, Karnataka and Maharashtra.

11. *Cyphicerus necopinus* (Faust, 1897)

Distribution : Maharashtra.

12. *Cyphicerus novemlineatus* (Olivier)

Distribution : Maharashtra.

13. *Hypenephorus cylindricollis* Pajni

Distribution : Karnataka and Maharashtra.

14. *Peltotrachelus juvenis* (Faust, 1891)

Distribution : Chhattisgarh, Maharashtra, and Punjab.

Subfamily BRACHYDERINAE

15. *Blosyrus inaequalis* Boheman

Distribution : Karnataka, Maharashtra and Tamil Nadu.

Elsewhere : Sri Lanka

16. *Blosyrus unisulcatus* Marshall

Distribution : Karnataka, Maharashtra and Tamil Nadu.

17. *Tanymecus andrewesi* Faust

Distribution : Maharashtra and Tamil Nadu.

Elsewhere : Myanmar.

18. *Tanymecus lentus* Faust

Distribution : Assam, Maharashtra and West Bengal.

Elsewhere : Myanmar.

19. *Tanymecus tetricus* Faust

Distribution : Assam, Bihar, Karnataka, Maharashtra, Tamil Nadu and West Bengal.

Elsewhere : Myanmar.

Subfamily OTIORRHYNCHINAE

20. *Dereodus sparsus* Beheman

Distribution : Bihar, Karnataka, Maharashtra, Tamil Nadu and West Bengal.

Elsewhere : Sri Lanka

21. *Parapionus varicolor* Marshall

Distribution : Maharashtra

22. *Episomus lacerta* Fabricius

Distribution : Gujarat, Karnataka, Maharashtra, Orissa, Tamil Nadu and West Bengal.

23. *Episomus arrogans* Bohemans

Distribution : Karnataka, Maharashtra and Tamil Nadu.

Elsewhere : Myanmar.

24. *Drepanoderus viridifasciatus* Waterhouse

Distribution : Maharashtra.

25. *Mylocherus catechu* Marshall

Distribution : Maharashtra.

26. *Mylocherus desquamatus* Marshall

Distribution : Maharashtra.

27. *Mylocherus dorsatus* Fabricius

Distribution : Bihar, Karnataka, Maharashtra, Tamil Nadu and West Bengal.

28. *Mylocherus tenuicornis* Faust

Distribution : Bihar, Maharashtra and Tamil Nadu.

29. *Mylocherus minutus* Faust

Distribution : Maharashtra.

30. *Mylocherus transmarinus* Herbst

Distribution : Bihar, Maharashtra, Punjab, Tamil Nadu, Uttaranchal, Uttar Pradesh and West Bengal

31. *Mylocherus subfasciatus* Guerin

Distribution : Karnataka, Maharashtra and Tamil Nadu.

32. *Mylocherus 11-pustulatus* Faust

Distribution : Bihar, Gujarat, Karnataka and Maharashtra.

SUMMARY

The paper incorporates the comprehensive account of 32 species in 15 genera spread over 3 subfamilies of weevils from Maharashtra State.

REFERENCES

- Marshall, G.A.K. 1916. *The Fauna of British India including Ceylon and Burma*, Coleoptera : Rhynchophora : Curculionidae, Taylor and Francis, London, pp. 1-367.
- Pajni, H.R. 1990. Insecta : Coleoptera : Eremninae. *Fauna of India and Adjacent Countries*, pp. 1-568. (Published by Director, ZSI, Kolkata).
- Mukhopadhyay, P. and Halder, S.K. 2003. Insecta: Coleoptera : Curculionidae. *Fauna of Sikkim, State Fauna Series*, 9 (Part-3): 201-208.

INSECTA : MECOPTERA (SCORPIONFLIES)

R.M. SHARMA and KAILASH CHANDRA*

Zoological Survey of India, Western Regional Centre, Pune-411044

INTRODUCTION

The insects, commonly known as scorpion flies belong to the Order Mecoptera. They are recognized by upturning of terminal abdominal segments like scorpions in males. They have beak like prolongation of head and often maculated wings. The winged forms are active fliers. The adults are omnivorous and feed on nectar, pollen, petals, fruits, mosses and small insects. They are also known as hanging flies, because some species of *Bittacus*, which hang from the vegetation with their front legs and catch small insects they prey on by their hind legs.

These insects are relatively scanty both qualitatively and quantitatively. World wide, the

order is represented by about 500 species belonging to nine families (Penny and Byers, 1979), of which, 23 species belonging to 2 genera under two families viz., Bittacidae and Panorpidae are known from India (Chandra, 2004). Out of 23 species, the following 2 species are recorded from Maharashtra.

Order MECOPTERA

Family BITTACIDAE

1. *Neopanorpa indica* Rust and Byers 1976
Maharashtra : Mumbai.
2. *Neopanorpa salai* Navas 1929
Maharashtra : Khandala, Mumbai

REFERENCES

- Chandra, Kailash. 2004. Check-list of Mecoptera from India. *Rec. zool. Surv. India*, **102**(Pt 1-2) : 73-76.
- Penny, N. D. and Byers, G.W. 1979. A check-list of the Mecoptera of the World. *Acta Amazonica*, **9**(2) : 365-388.

* Zoological Survey of India, M-Block, New Alipore, Kolkata-700 053

INSECTA : DIPTERA

PRIYANKA DUTTA SAHA, R.M. SHARMA and BULGANIN MITRA*

Zoological Survey of India, Western Regional Centre, Pune-411044

INTRODUCTION

The Diptera are commonly known as true flies and include many familiar insects such as mosquitoes, black flies, midges, fruit flies, blow flies and house flies. The earliest fossil flies are known from the Upper Triassic of the Mesozoic geological period, some 225 million years ago (Evenhuis, 1994). Since that time they have diversified to become one of the largest groups of insects.

It is generally agreed by contemporary dipterists that the true flies are the fourth most diverse, and one of the most important and popular insect orders comprising more than 100,000 described living species, but in the absence of a complete regional checklist it is difficult to determine the precise number. So the aim of this present paper is to list all the species reported from the state of Maharashtra from various publications viz. Delfinado and Hardy (1973, 1975 & 1977), Joseph and Parui (1992), Nandi (1993), Lahiri and Mitra (2004), organizing them into a comprehensive classification and document it into a checklist form. This exercise resulted in to enumeration of 278 species belonging to 157 genera under 36 families (excluding Cecidomyiidae and Tabanidae as they are dealt separately).

Order DIPTERA

Suborder NEMATOCERA

Infraorder TIPULOMORPHA

Family TIPULIDAE

Genus *Nephrotoma* Meigen, 1803

1. *Nephrotoma bombayensis* (Macquart)

Family LIMONIIDAE

Genus *Limonia* Meigen, 1803

2. *Limonia* (*Dicranomyia*) *flavocincta* (Brunetti)

Genus *Hexatoma* Latreille, 1809

3. *Hexatoma* (*Eriocera*) *gnava* Alexander

Genus *Trentepohlia* Bigot, 1854

4. *Trentepohlia* (*Mongoma*) *bombayensis* Edwards

Family PSYCHODIDAE

Genus *Phlebotomus* Loew 1845

5. *Phlebotomus* (*Anaphlebotomus*) *colabaensis* Young and Chalam

Genus *Sergentomyia* Franca and Parrot 1920

6. *Sergentomyia* (*Grassomyia*) *poonaensis* Mitra and Roy
7. *Sergentomyia* (*Parrotomyia*) *thapari* (Mitra and Roy)
8. *Sergentomyia* (Uncertain) *chakravarti* (Mitra)
9. *Sergentomyia* (Uncertain) *smithi* (Mitra and Roy)

Family CHAOBORIDAE

Genus *Chaoborus*, Lichtenstein (1800)

10. *Chaoborus* (*Sayomyia*) *asiaticus* (Giles)

Family CULICIDAE

Genus *Anopheles*, Meigen, 1818

11. *Anopheles (Anopheles) aitkenii* James
 12. *Anopheles (Anopheles) culiciformis* Cogill
 13. *Anopheles (Anopheles) nigerrimus* Giles
 14. *Anopheles (Anopheles) barbirostris* vander Wulp
 15. *Anopheles (Cellia) culicifacies* Giles
 16. *Anopheles (Cellia) theobaldi* Giles
 17. *Anopheles (Cellia) annularis* van der Wulp
 18. *Anopheles (Cellia) elegans* (James)
 19. *Anopheles (Cellia) stephensi* Liston
 20. *Anopheles (Cellia) jeyporiensis* James
 21. *Anopheles (Cellia) moghulensis* Christophers
 22. *Anopheles (Cellia) stephensi (intermedia)* Liston
 23. *Anopheles (Cellia) stephensi (folquei)* Liston
 24. *Anopheles (Cellia) jamesii* Theobald
 25. *Anopheles (Cellia) splendidus* Koidzumi
 26. *Anopheles (Cellia) subpictus* Grassi
 27. *Anopheles (Cellia) turkhudi* Liston
 28. *Anopheles (Cellia) vagus* Donitz
 29. *Anopheles (Cellia) varuna* Iyenger
 30. *Anopheles (Cellia) karwari* (James)
 31. *Anopheles (Cellia) maculatus* Theobald
 32. *Anopheles (Cellia) philippinensis* Ludlow
- Genus *Aedes* Meigen, 1818
33. *Aedes (Aedimorphus) syntheticus* Barraud, 1928
 34. *Aedes (Aedimorphus) trimaculatus* (Theobald)
 35. *Aedes (Aedimorphus) trimaculatus littoralis* Barraud, 1927
 36. *Aedes (Finlaya) deccanus* (Barraud)
 37. *Aedes (Finlaya) gubernatoris* (Giles)
 38. *Aedes (Finlaya) niveoides* Barraud
 39. *Aedes (Finlaya) stevensoni* (Barraud)
 40. *Aedes (Neomacleaya) cautus* Barraud
 41. *Aedes (Stegomyia) submediopunctatus* (Barraud)

42. *Aedes (Stegomyia) subalbopictus* Barraud

Genus *Armigeres* Theobald, 1901

43. *Armigeres (Armigeres) kuchingensis* Edwards

Genus *Mansonia* Blanchard, 1901

44. *Mansonia (Mansonoides) annulifera* (Theobald)

Genus *Culex* Linnaeus, 1758

45. *Culex (Culex) cornutus* Edwards
46. *Culex (Culex) tritaeniorhynchus biroi* Theobald

Family CERATOPOGONIDAE

Genus *Stilobezzia* Kieffer, 1911

47. *Stilobezzia (Eukraiohelea) minima* Kieffer
48. *Stilobezzia (Stilobezzia) crassipes* Kieffer

Genus *Xenohalea* Kieffer, 1917

49. *Xenohalea pruinosa* (Kieffer)

Family CHIRONOMIDAE

Genus *Xenochironomus* Kieffer, 1921

50. *Xenochironomus albiscapula* Kieffer
51. *Xenochironomus pentastictus* Kieffer

Family SIMULIIDAE

Genus *Simulium* Latreille, 1802

52. *Simulium (Eusimulium) aureohirtum* Brunetti
53. *Simulium (Eusimulium) rufithorax* Brunetti
54. *Simulium (Eusimulium) grisescens* Brunetti
55. *Simulium (simulium) gurneyae* Senior-White
56. *Simulium (simulium) palmatum* Puri
57. *Simulium (simulium) striatum* Brunetti

Suborder BRACHYCERA

Infraorder STRATIOMYOMORPHA

Superfamily TABANOIDEA

Family STRATIOMYIDAE

Genus *Evaza* Walker, 1857

58. *Evaza indica* Kertész

Genus *Sargus* Fabricius, 1798

59. *Sargus metallinus* Fabricius

Infraorder TABANOMORPHA

Family RHAGIONIDAE

Genus *Rhagio* Fabricius, 1775

- 60.
- Rhagio biroi*
- Szilady

Superfamily ASILOIDEA

Family ASILIDAE

Genus *Philodicus* Loew, 1848

- 61.
- Philodicus grandissimus*
- Ricardo

Genus *Stichopogon* Loew, 1847

- 62.
- Stichopogon inaequalis*
- (Loew)

- 63.
- Stichopogon indicus*
- Joseph & Parui

Genus *Laxenecera* Macquart, 1838

- 64.
- Laxenecera albibarbis*
- Macquart

- 65.
- Laxenecera flavibarbis*
- Macquart

Genus *Promachus* Loew, 1838

- 66.
- Promachus duvaucelii*
- (Macquart)

Family ACROCERIDAE

Genus *Ogcodes* Latreille, 1796

- 67.
- Ogcodes guttatus*
- Costa

Family BOMBYLIIDAE

Genus *Geron* Meigen, 1820

- 68.
- Geron albescens*
- Brunetti

- 69.
- Geron argentifrons*
- Brunetti

Genus *Heterotropus* Loew, 1873

- 70.
- Heterotropus indicus*
- Nurse

Genus *Bombylius* Linnaeus, 1758

- 71.
- Bombylius comastes*
- Brunetti

- 72.
- Bombylius*
- (
- Bombylius*
-)
- cirrhopus*
- Evenhuis

- 73.
- Bombylius fulvipes*
- Bigot

Genus *Bombylella* Greathead, 1995

- 74.
- Bombylella albosparsus*
- Bigot

Genus *Eurycarenum* Loew, 1860

- 75.
- Eurycarenum indicus*
- Bowden

- 76.
- Eurycarenum erectus*
- (Brunetti)

Genus *Bombomyia* Greathead, 1995

- 77.
- Bombomyia tricolor*
- Guérin-Meneville 1835/
-
- 1844

Genus *Anthrax* Scopoli, 1763

- 78.
- Anthrax argentiapicalis*
- (Brunetti)

- 79.
- Anthrax gestroi*
- (Brunetti)

- 80.
- Anthrax indicatus*
- Nurse

Genus *Satyramoeba* Sack, 1909

- 81.
- Satyramoeba bipunctata*
- (Fabricius), 1805

Genus *Exoprosopa* Macquart, 1840

- 82.
- Exoprosopa*
- (
- Exoprosopa*
-)
- affinissima*
-
- Senior-White

- 83.
- Exoprosopa*
- (
- Exoprosopa*
-)
- abrogata*
- Nurse

- 84.
- Exoprosopa*
- (
- Exoprosopa*
-)
- albida*
- (Walker)

- 85.
- Exoprosopa*
- (
- Exoprosopa*
-)
- dulcis*
- Austen

- 86.
- Exoprosopa efflatouni*
- Bezzi 1925

Genus *Micomitra* Bowden, 1964

- 87.
- Micomitra iridipennis*
- Nurse 1922a

- 88.
- Micomitra vitripennis*
- (Brunetti)

- 89.
- Micomitra vitrea*
- (Bigot)

Genus *Ligyra* Newman, 1841

- 90.
- Ligyra semifuscata*
- (Brunetti)

- 91.
- Ligyra sphinx*
- (Fabricius)

Genus *Heteralonia* Rondani, 1863

- 92.
- Heteralonia*
- (
- Isotamia*
-)
- insulata*
- (Walker)

- 93.
- Heteralonia*
- (
- Homolonia*
-)
- gujaratica*
- Nurse
-
- 1922a

- 94.
- Heteralonia*
- (
- Isotamia*
-)
- siva*
- (Nurse) 1922a

- 95.
- Heteralonia*
- (
- Zygodiola*
-)
- abjecta*
- Nurse
-
- 1922a

Genus *Litorhina* Bowden, 1975

- 96.
- Litorhina lar*
- (Fabricius), 1781

Genus *Exhyalanthrax* Becker 1916

- 97.
- Exhyalanthrax absalon*
- (Wiedemann) 1824

Superfamily EMPIDOIDEA

Family EMPIDIDAE

Genus *Hybos* Meigen, 1800

- 98.
- Hybos bisetosus*
- Bezzi

Genus *Drapetis* Meigen, 1822

- 99.
- Drapetis*
- (
- Elaphropeza*
-)
- discoidalis*
- (Bezzi)

Family DOLICHOPODIDAE

Genus *Sciapus* Zeller, 1842

- 100.
- Sciapus interdictus*
- Becker

Genus *Neurigona* Rondani, 1856

- 101.
- Neurigona angulata*
- de Meijere

- Genus *Dolichopus* Latreille, 1796
102. *Dolichopus sapphirus* Becker
- Genus *Hercostomus* Loew, 1857
103. *Hercostomus compositus* Becker
- Genus *Tachytereichus* Haliday, 1851
104. *Tachytereichus picticornis* (Bigot)
- Genus *Medetera* Fischer von Waldheim, 1819
105. *Medetera grisescens* de Meijere
- Genus *Chrysotus* Meigen, 1824
106. *Chrysotus degener* Frey
- Genus *Diaphorus* Meigen, 1824
107. *Diaphorus flavipilus* Becker
108. *Diaphorus mandarinus* Wiedemann
- Division ASCHIZA
- Family PHORIDAE
- Genus *Apocephalus* Coquillett, 1901
109. *Apocephalus* (*Apocephalus*) *caudatarius* (Schmitz)
- Genus *Bolsiusia* Schmitz, 1913
110. *Bolsiusia termitophila* Schmitz
- Genus *Chonocephalus* Wandolleck, 1898
111. *Chonocephalus similis* Brues
- Genus *Megaselia* Rondani, 1856
112. *Megaselia* (*Megaselia*) *apicalis* (Brues)
113. *Megaselia* (*Megaselia*) *tibialis* (Brues)
- Genus *Puliciphora* Dahl, 1897
114. *Puliciphora matheranensis* Brues
115. *Puliciphora velocipes* (Schmitz)
- Genus *Rhynchomicropterum* Annandale, 1912
116. *Rhynchomicropterum caecutiens* Schmitz
- Genus *Clitelloxenia* Kemner, 1932
117. *Clitelloxenia assmuthi* (Wasmann)
- Genus *Indoxenia* Schmitz, 1936
118. *Indoxenia heimi* (Wasmann)
- Family PIPUNCULIDAE
- Genus *Tomosvaryella* Aczel, 1939
119. *Tomosvaryella limpidipennis* (Brunetti)
- Family SYRPHIDAE
- Genus *Sphaerophoria* Lepeletier and Serville, 1828
120. *Sphaerophoria poonaensis* Joseph

- Genus *Baccha* Fabricius, 1805
121. *Baccha* (*Allobaccha*) *sapphirina* Wiedemann
- Genus *Paragus* Latreille, 1804
122. *Paragus* (*Paragus*) *serratus* (Fabricius)
- Genus *Eumerus* Meigen, 1822
123. *Eumerus aurifrons* (Wiedemann)
- Genus *Primocerioides* Shannon, 1927
124. *Primocerioides laetus* (Wiedemann)
- Genus *Microdon* Meigen, 1803
125. *Microdon* (*Microdon*) *contractus* Brunetti
- Division SCHIZOPHORA
- Section ACALYPTRATE
- Superfamily CONOPOIDEA
- Family CONOPIDAE
- Genus *Archiconops* Krober, 1939
126. *Archiconops erythrocephala* (Fabricius)
- Genus *Conops* Linnaeus, 1758
127. *Conops* (*Conops*) *claripennis* Brunetti
- Superfamily DIOPSOIDEA
- Family DIOPSIDAE
- Genus *Cryptodiopsis* Frey, 1928
128. *Cryptodiopsis whitei* (Curran)
- Genus *Teleopsis* Rondani, 1875
129. *Teleopsis sykesii* (Westwood)
- Genus *Sphyracephala* Say, 1828
130. *Sphyracephala hearseiana* (Westwood)
- Superfamily TEPHRITOIDEA
- Family TEPHRITIDAE
- Genus *Dacus* Fabricius, 1805
131. *Dacus* (*Asiadacus*) *dutti* Kapoor
132. *Dacus* (*Asiadacus*) *poonensis* Kapoor
133. *Dacus* (*Didacus*) *ciliatus* Loew
- Genus *Craspedoxantha* Bezzi, 1913
134. *Craspedoxantha octopunctata* Bezzi
- Subfamily SCHISTOPOTERINAE
- Genus *Rhabdochaeta* de Meijere, 1904
135. *Rhabdochaeta gladifera* Hering
- Family PLATYSTOMATIDAE
- Genus *Rivellia* Robineau-Desviody, 1830
136. *Rivellia angulata* Hendel

137. *Rivellia gamma* Hendel
 138. *Rivellia impunctata* Hendel
 139. *Rivellia pulchra* Hendel
 140. *Rivellia sinuosa* Coquillett
 Genus *Trigonosoma* Gray, 1832
 141. *Trigonosoma indicum* Steyskal
 Family LAUXANIIDAE
 Genus *Cestrotus* Loew, 1862
 142. *Cestrotus frontalis* (Kertész)
 Genus *Homoneura* van der Wulp, 1891
 143. *Homoneura (Homoneura) sublucida* Malloch
 Superfamily SCIOMYZOIDEA
 Family SEPSIDAE
 Genus *Sepsis* Fallen, 1810
 144. *Sepsis coprophilia* de Meijere
 145. *Sepsis indica* Wiedemann
 146. *Sepsis thoracica* (Robineau-Desvoidy)
 Genus *Australosepsis*, Malloch, 1925
 147. *Australosepsis frontalis* (Walker)
 Genus *Dicranosepsis* Duda, 1926
 148. *Dicranosepsis bicolor* (Wiedemann)
 Superfamily OPOMYZOIDEA
 Family AGROMYZIDAE
 Genus *Agromyza* Fallen, 1810
 149. *Agromyza graminivora* Spencer
 150. *Agromyza pallidifrons* Spencer
 Genus *Japanagromyza* Sasakawa, 1958
 151. *Japanagromyza loranthei* Spencer
 Genus *Melanagromyza* Hendel, 1920
 152. *Melanagromyza metallica* (Thomson)
 153. *Melanagromyza obtusa* (Malloch)
 154. *Melanagromyza theae* (Cotes)
 Genus *Ophiomyia* Braschnikov, 1897
 155. *Ophiomyia lantanae* (Froggatt)
 Genus *Liriomyza* Mik, 1894
 156. *Liriomyza brassicae* (Riley)
 157. *Liriomyza compositella* Spencer

- Superfamily CARNOIDEA
 Family CHLOROPIDAE
 Genus *Oscinella* Becker, 1909
 158. *Oscinella minuta* Becker
 Genus *Pseudogaurax* Malloch, 1915
 159. *Pseudogaurax* spp.
 Genus *Rhodesiella* Adams, 1905
 160. *Rhodesiella sanctijohani* Cherian
 Genus *Sepsidoscini* Hendel, 1914
 161. *Sepsidoscini maculipennis* Hendel
 Genus *Siphunculina* Rondani, 1856
 162. *Siphunculina funicola* (de Meijere)
 Genus *Neoloxotaenia* Sabrosky, 1964
 163. *Neoloxotaenia gracilis* (de Meijere)
 Genus *Pachylophus* Loew, 1858
 164. *Pachylophus rufescens* (de Meijere)
 Genus *Phyladelphus* Becker, 1910
 165. *Phyladelphus cornifer* Becker
 Genus *Mepachymerus* Speiser, 1910
 166. *Mepachymerus (Steleocerellus) crucifer* (de Meijere)
 Genus *Semaranga* Becker, 1911
 167. *Semaranga dorsocentralis* Becker
 Genus *Conioscinella* Duda, 1929
 168. *Conioscinella orientalis* (Becker)
 169. *Conioscinella semimaculata* (Beker)
 Superfamily SPHAEROCEROIDEA
 Family SPHAEROCERIDAE
 Genus *Acuminiseta* Duda, 1920
 170. *Acuminiseta elegantula* Duda
 Genus *Poecilomella* Duda, 1920
 171. *Poecilomella varians* (Duda)
 172. *Poecilomella punctipennis* (Wiedemann)
 Genus *Norrbomia* Papp, 1988
 173. *Norrbomia tropica* (Duda, 1923)
 Superfamily EPHYDROIDEA
 Family EPHYDRIDAE
 Genus *Allotrichoma* Becker, 1896
 174. *Allotrichoma biro* Cresson

175. *Allotrichoma livens* Cresson
Genus **Ditrichophora** Cresson, 1924
176. *Ditrichophora triseta* Cresson
Genus **Ochthera** Latreille, 1802
177. *Ochthera margarita* Cresson
Genus **Psilopa** Fallen, 1823
178. *Psilopa sorella* Becker
Family DROSOPHILIDAE
Genus **Leucophenga** Mik, 1886
179. *Leucophenga (Leucophenga) guttiventris* (de Meijere)
180. *Leucophenga (Leucophenga) subpollinosa* (de Meijere)
Genus **Drosophila** Fallen, 1823
181. *Drosophila (Drosophila) repleta* Wollaston
182. *Drosophila (Scaptodrosophila) paratriangulata* Gupta and Ray-Chaudhuri
183. *Drosophila (Scaptodrosophila) latifshahi* Gupta and Ray-Chaudhuri
184. *Drosophila (Sophophora) ananassae* Doleschall
185. *Drosophila (Sophophora) biarmipes* Malloch
186. *Drosophila (Sophophora) bipectinata* Duda
187. *Drosophila (Sophophora) jambulina* Parshad and Paika
188. *Drosophila (Sophophora) kikkawai* Burla
189. *Drosophila (Sophophora) malerkotliana* Parshad and Paika
190. *Drosophila (Sophophora) melanogaster* Meigen
191. *Drosophila (Sophophora) takahashii* Sturtevant
Genus **Hypselothyrea** de Meijere, 1906
192. *Hypselothyrea fascipennis* de Meijere
Genus **Zaprionus** Coquillett, 1902
193. *Zaprionus indiana* Gupta
Division SCHIZOPHORA
Section CALYPTRATE
Family HIPPOBOSCIDAE
Genus **Icosta** Speiser, 1905
194. *Icosta (Icosta) corvina* Maa
195. *Icosta (Ornithoponus) sensilis reducta* Maa
Genus **Ornithophila** Rondani, 1879
196. *Ornithophila metallica* (Schiner)
Genus **Cyclopodia** Kolenati, 1863
197. *Cyclopodia sykesii* (Westwood)
Genus **Eucampsipoda** Kolenati, 1857
198. *Eucampsipoda latisternum* Schuurmans Stekhoven and Hardenberg
Genus **Leptocyclopodia** Theodor, 1959
199. *Leptocyclopodia (Leptocyclopodia) ferrarii ferrarii* (Rondani)
Genus **Basilina** Miranda Ribeiro, 1905
200. *Basilina (Basilina) blainvillii amiculata* (Speiser)
201. *Basilina (Basilina) fletcheri* (Scott)
202. *Basilina (Basilina) brevipes* (Theodor)
203. *Basilina (Basilina) majuscula* (Edwards)
204. *Basilina (Basilina) pumila* (Scott)
205. *Basilina (Paracyclopodia) chlamydophora* (Speiser)
Genus **Nycteribia** Latreille, 1796
206. *Nycteribia parvula* Speiser
207. *Nycteribia allotopa allotopa* Speiser
Genus **Penicillidia** Kolenati, 1963
208. *Penicillidia indica* Scott
Genus **Phthiridium** Hermann, 1804
209. *Phthiridium phillipsi* (Scott)
Genus **Brachytarsina** Macquart, 1851
210. *Brachytarsina (Brachytarsina) amboinensis* Rondani
211. *Brachytarsina (Brachytarsina) modesta* (Jobling)
212. *Brachytarsina (Brachytarsina) diversa* (Fravenfeld)
Genus **Megastrebla** Maa, 1971
213. *Megastrebla (Megastrebla) parviar parviar* (Maa)
Genus **Raymondia** Frauenfeld, 1856
214. *Raymondia joblingi* Hiregaudar and Bal
Genus **Pseudolynchia** Bequaert, 1926
215. *Pseudolynchia canariensis* (Macquart)

Family MUSCIDAE

Genus *Musca* Linnaeus, 1758216. *Musca (Musca) domestica* Linnaeus217. *Musca (Philaematomyia) crassirostris* SteinGenus *Orthellia* Robineau-Desvoidy, 1863218. *Orthellia indica* (Robineau-Desvoidy)219. *Orthellia ruficornis* ShinongaGenus *Lispe* Latreille, 1796220. *Lispe leucospila* (Wiedemann)221. *Lispe glabra* WiedemannGenus *Pyrellia* Robineau-Desvoidy, 1830222. *Pyrellia proferens* (Walker)Genus *Ophyra* Robineau-Desvoidy, 1830223. *Ophyra chalcogaster* (Wiedemann)Genus *Gymnodia* Robineau-Desvoidy, 1863224. *Gymnodia tonitruum* (Wiedemann)225. *Gymnodia distincta* (Stein)Genus *Dichaetomyia* Malloch, 1921226. *Dichaetomyia luteiventris* (Rondani)227. *Dichaetomyia pallens* (Stein)Genus *Atherigona* Rondani, 1865228. *Atherigona (Acritochaeta) orientalis* Schiner229. *Atherigona (Atherigona) atripalpis* Malloch230. *Atherigona (Atherigona) falcata* (Thomson)231. *Atherigona (Atherigona) oryzae* Malloch232. *Atherigona (Atherigona) reversura*
Villeneuve233. *Atherigona (Atherigona) soccata* Rondani234. *Atherigona (Atherigona) laeta* (Wiedemann)Genus *Graphomya* Robineau-Desvoidy, 1830235. *Graphomya rufitibia* SteinGenus *Lasiopelta* Malloch, 1928236. *Lasiopelta steini* (Emden)Genus *Haematobia* Le Peletier and Serville, 1828237. *Haematobia irritans exigua* de Meijere238. *Haematobosca sanguinolenta* (Austen)Genus *Stomoxys* Geoffroy, 1762239. *Stomoxys calcitrans* (Linnaeus)

Family CALLIPHORIDAE

Genus *Pollenia* Robineau-Desvoidy, 1830240. *Pollenia asiatica* (Senior-White)Genus *Isomyia* Walker, 1860241. *Isomyia flavicornis* (Bigot)242. *Isomyia pseudonebulosa* (Senior-White,
Aubertein, Smart)Genus *Lucillia* Robineau-Desvoidy, 1830243. *Lucillia papuensis* Macquart

Family RHINIIDAE

Genus *Rhinia* Robineau-Desvoidy, 1830244. *Rhinia apicalis* (Wiedemann)Genus *Idiella* Brauer and Bergenstamm, 1889245. *Idiella mandarina* (Wiedemann)Genus *Rhyncomya* Robineau-Desvoidy, 1830246. *Rhyncomya pollinosa* (Townsend)

Family SARCOPHAGIDAE

Genus *Parasarcophaga* Johnston and Tiegs, 1921247. *Parasarcophaga (Liosarcophaga) dux*
(Thomson)248. *Parasarcophaga (Liosarcophaga)*
brevicornis (Ho)249. *Parasarcophaga (Liopygia) ruficornis*
(Fabricius)250. *Parasarcophaga (Pandelleisca) kurahashii*
Nandi251. *Parasarcophaga (Pandelleisca) ballardi*
(Senior-White)252. *Parasarcophaga (Parasarcophaga) albiceps*
(Meigen)253. *Parasarcophaga (Parasarcophaga) hirtipes*
(Wiedemann)254. *Parasarcophaga (Parasarcophaga) sericea*
(Walker)255. *Parasarcophaga (Parasarcophaga) misera*
(Walker)Genus *Blaesoxipha* Loew, 1861256. *Blaesoxipha aldrichi* NandiGenus *Boettcherisca* Rohdendorf, 1937257. *Boettcherisca bengalensis* Nandi258. *Boettcherisca nathani* Lopes

259. *Boettcherisca peregrina* (Robineau-Desvoidy)
Genus *Pierretia* Robineau-Desvoidy, 1863
260. *Pierretia (Ascelotella) calcifera* (Boettcher)
Genus *Thyrsochnema* Enderlein, 1928
261. *Thyrsochnema (Pseudothyrsochnema) indica*
Shinonaga and Lopes
262. *Kozlovea vervesi* Nandi
Genus *Harpagophalla* Rohdendorf, 1937
263. *Harpagophalla panchganiensis* Nandi
Genus *Iranihindia* Rohdendorf, 1961
264. *Iranihindia futilis* (Senior-White)
265. *Iranihindia martellata* (Senior-White)
266. *Iranihindia martellatoides* (Baranov)
Genus *Seniorwhitea* Rohdendorf, 1937
267. *Seniorwhitea reciproca* (Walker)
Family TACHINIDAE
Genus *Peribaea* Robineau-Desvoidy, 1863
268. *Peribaea suspecta* (Malloch)
Genus *Carcelia* Robineau-Desvoidy, 1830
269. *Carcelia (Senometopia) illota* (Curran)
Genus *Palexorista* Townsend, 1921
270. *Palexorista solennis* (Walker)
- Genus *Sisyropa* Brauer and Bergenstamm, 1889
271. *Sisyropa formosa* Mesnil
Genus *Sturmiopsis* Townsend, 1916
272. *Sturmiopsis inferens* Townsend
Genus *Bactromyia* Brauer and Bergenstamm, 1891
273. *Bactromyia aurora* Mesnil
Genus *Elodia* Robineau-Desvoidy, 1863
274. *Elodia atra* (Gardner)
Genus *Pseudoperichaeta* Brauer and Bergenstamm, 1889
275. *Pseudoperichaeta indica* (Gardner)
Genus *Thelairodino* Mesnil, 1954
276. *Thelairodino gracilis* (Mesnil)
Genus *Zenillia* Robineau-Desvoidy, 1830
277. *Zenillia grisellina* (Gardner)
Family OESTRIDAE
Genus *Hypoderma* Latreille, 1818
278. *Hypoderma lineatum* (Villers)

SUMMARY

A checklist of 278 species belonging to 157 genera of true flies recorded from Maharashtra is provided.

REFERENCES

- Delfinado, M.D and Hardy, D.E. 1973. A Catalog of the Diptera of the Oriental Region, Vol. I. The University Press of Hawaii, Honolulu, pp. 618.
- Delfinado, M.D and Hardy, D.E. 1975. A Catalog of the Diptera of the Oriental Region, Vol. II. The University Press of Hawaii, Honolulu, pp.295.
- Delfinado, M.D and Hardy, D.E. 1977. A Catalog of the Diptera of the Oriental Region, Vol. III. The University Press of Hawaii, Honolulu, pp.851.
- Evenhuis, N.L. 1994. Catalog of the fossil flies of the world (Insecta: Diptera). Backhuys Publishers, Leiden, pp: 1-600
- Joseph, A.N.T. and Parui, P. 1992. Asilidae (Diptera) from Gujarat, India. *Rec. zool. Surv, India*, **92**(1-4) : 123-129
- Nandi, B.C. 1993. Sarcophagidae fauna (Diptera : Sarcophagidae) of Maharashtra, India. *Rec. zool. Surv. India*, **93**(1-2) : 283-293.
- Lahiri, A.R. and Mitra, B. 2004. Fauna of Gujarat (Diptera : Insecta), Zoological Survey of India. *State Fauna Ser.*, **8**(2) : 127-159.

INSECTA : DIPTERA : CECIDOMYIIDAE (GALL MIDGES)

R.M. SHARMA

Zoological Survey of India, Western Regional Centre, Pune-411044

INTRODUCTION

The name gall midge comes from the ability of the larvae to produce galls or abnormal growths on various organs of plants and the family name *Cecidomyiidae* is derived from the Latin word '*Cecidium*' meaning 'gall'. The family *Cecidomyiidae* best known as plant gall makers, is one of the largest families of order Diptera not only from the point of view of regional fauna but also from the standpoint of global distribution (Skuhrava, Skuhravy and Brewer, 1984).

Presently, the family consists of four subfamilies viz. *Catotrichinae*, (not reported from India) *Lestremiinae*, *Porricondyliinae* and *Cecidomyiinae*. The species belonging to second and third subfamilies are mycophagous, saprophagous, phytosaprophagous and xylophagous in nature. The subfamily *Cecidomyiinae* includes phytophagous (gall forming or non gall forming and inquiline), zoophagous or predatory species. Several phytophagous gall midges cause considerable damage to economically important agricultural/horticultural crops and have gained the status of serious pests.

The number of species of all *Cecidomyiidae* in the world at large and India in particular is still unknown and inestimable. Of the 5451 species and 598 genera of living and fossil gall midges known from the world (Gagné 2004), Indian diversity accounts for 394 described species belonging to 125 genera under three subfamilies, which is approximately 7.10% of world diversity (Sharma, 2009).

The following checklist enumerates 90 species of 45 genera under three subfamilies so far known from the state which comes to 22.84% of Indian diversity. The studies on gall midges from the state of Maharashtra depicted mostly in the works of Chandra (1993), Bhalerao *et al.* (2009), Deshpande (1983, 1985), Deshpande, *et al.*, (2002a,b,c, & 2005), Felt (1921); Grover & Bakshi (1978); Grover & Kashyap (1991), Kashyap (1988a,b,c & 1989), Mani (1934), Rao, (1950 & 1967); Rao and Adwant (1970 & 1975); Rao and Grover (1960); Rao and Sharma, (1977-1981); Sharma (1984-2003); Sharma and Rao, (1978-1981) and Shivpuje and Raodeo (1985).

SYSTEMATIC LIST

Order DIPTERA

Suborder NEMATOCERA

Family CECIDOMYIIDAE

Subfamily LESTREMIINAE

Tribe *Lestremiini*

1. *Anarete* Haliday

1. *basmatensis* Bhalerao, Shaikh & Deshpande, 2009

Type Locality : Basmatnagar.

Host : Unknown.

2. *bharati* Bhalerao, Shaikh & Deshpande, 2009

Type Locality : Nanded.

Host : Unknown.

3. *longipalpi* Bhalerao, Shaikh & Deshpande, 2009*Type Locality* : Nanded.*Host* : Unknown.2. *Anaretella* Enderlein4. *bhokarensis* Deshpande, Shaikh and Sharma, 2002*Type Locality* : Bhokar, Nanded dist. (Maharashtra).*Host* : Unknown.5. *deepica* Deshpande, Shaikh and Sharma, 2002*Type Locality* : Bhokar, Nanded dist. (Maharashtra)*Host* : Unknown.6. *indica* Deshpande, Shaikh and Sharma, 2002*Type Locality* : Bhokar, Nanded dist. (Maharashtra)*Host* : Unknown.7. *spinosa* Deshpande, Shaikh and Sharma, 2002*Type Locality* : Bhokar, Nanded, dist. (Maharashtra)*Host* : Unknown.3. *Conarete* Pritchard8. *deepica* Deshpande, 1983*Type Locality* : Nanded, (Maharashtra).*Host* : Unknown.9. *indica* (Mani), 1934 (*Anarete*)*Type Locality* : Medha, Yenna Valley, Satara, (Maharashtra)*Host* : Unknown.4. *Gongromastix* Enderlein10. *bharatae* Sharma and Rao, 1979*Type Locality* : Aurangabad, (Maharashtra)*Host* : Unknown.11. *indicata* Gagne n. name for *indica* Rao and Adwant, 1975, (*Pararete*)*Type Locality* : Nanded, (Maharashtra)*Host* : Unknown.12. *orientalis* (Rao and Adwant) 1975, (*Pararete*)*Type Locality* : Aurangabad, (Maharashtra)*Host* : Unknown.5. *Lestremia* Macquart13. *deepica* Sharma and Rao, 1980*Type Locality* : Aurangabad, (Maharashtra)*Host* : Unknown.6. *Neolestremia* Mani14. *longipalpia* Deshpande, Shaikh and Sharma, 2002*Type Locality* : Bhokar, Nanded dist. (Maharashtra)*Host* : Unknown.15. *orientalis* Sharma and Rao, 1979*Type Locality* : Aurangabad, (Maharashtra)*Host* : Unknown.Tribe *Micromyini*7. *Monardia*Subg. *Xylopriona* Kieffer16. *indica* (Sharma and Rao), 1979*Type Locality* : Aurangabad, (Maharashtra)*Host* : Unknown.Tribe *Peromyiini*8. *Peromyia* Kieffer17. *bengalensis* Kieffer, 1905*Type Locality* : Kurseong (West Bengal); Maharashtra: Aurangabad Dist.*Host* : Unknown.

Subfamily PORRICONDYLINEAE

Tribe *Asynaptini*9. *Asynapta* Loew18. *aurangabadensis* Sharma, 1987*Type Locality* : Aurangabad, (Maharashtra)*Host* : Unknown.

19. *bharathi* (Rao and Adwant), 1971
(*Rubsaamenia*)

Type Locality : Aurangabad, (Maharashtra)

Host : Unknown.

10. *Camptomyia* Kieffer

20. *ratneshwarae* Najam, Siddique, Deshpande
& Sharma, 2009

Type Locality : Ratnagiri, Nanded
dist.(Maharashtra)

Host : Unknown.

Tribe Bryocryptini

11. *Bryocrypta* Kieffer

21. *triangulobata* Grover, 1973

Type Locality : Allahabad (Uttar Pradesh);
Maharashtra: Deola vill. Beed dist.

Host : Unknown.

Tribe Porricondylini

12. *Claspettomyia* Grover

22. *dentata* Kashyap, 1988

Type Locality : Parbhani, (Maharashtra)

Host : Unknown.

23. *indica* Rao and Sharma, 1978

Type Locality : Aurangabad, (Maharashtra)

Host : Unknown.

24. *octoclaspettii* Grover, 1964

Type Locality : Allahabad (Uttar Pradesh);
Maharashtra: Deola vill Beed Dist.

Host : Unknown.

25. *serrulata* Kashyap, 1988

Type Locality : Parbhani, (Maharashtra)

Host : Unknown.

26. *spinosa* Kashyap, 1988

Type Locality : Parbhani, (Maharashtra)

Host : Unknown.

13. *Parepidosis* Kieffer

27. *trilobata* Sharma and Rao, 1979

Type Locality : Aurangabad, (Maharashtra)

Host : Unknown.

14. *Rabindrodiplosis* Grover

28. *orientalis* Sharma and Rao, 1980

Type Locality : Aurangabad, (Maharashtra)

Host : Unknown.

Subfamily CECIDOMYIINAE

Supertribe LASIOPTERIDI

Tribe Dasineurini

15. *Dasineura* Rondani

29. *citri* (Rao and Grover), 1960
(*Pectinodiplosis*)

Type Locality : Nagpur, (Maharashtra)

Host : *Citrus* sp. (Rutaceae).

30. *lini* Barnes, 1936

Type Locality : Pusa (Bihar); Maharashtra:
Aurangabad Dist.

Host : *Linum usitatissimum* L. (Linaceae)

31. *psoraleae* Sharma, 1987

Type Locality : Himayat Bagh, Aurangabad,
(Maharashtra)

Host : *Cullen corylifolia* L. Medik (Fabaceae).

32. *sesami* Grover & Prasad, 1966

Type Locality : Allahabad (Uttar Pradesh);
Maharashtra: Aurangabad, Nanded Dist.

Host : *Sesamum orientale* L. (Pedaliaceae)

16. *Gephyraululus* Rübsaamen

33. *indica* (Grover and Prasad), 1966
(*Procytiphora*)

Type Locality : Lucknow (Uttar Pradesh);
Throughout Maharashtra.

Host : *Mangifera indica* L. (Anacardiaceae)

(see Gagné & Etienne, 2006)

34. *mangiferae* (Felt.) 1927 (*Dasineura*)

Type Locality : Coimbatore (Tamil Nadu);
Throughout Maharashtra.

Host : *Mangifera indica* L. (Anacardiaceae)
(see Gagné & Etienne, 2006)

Tribe Lasiopterini

17. *Lasioptera* Meigen35. *achyranthesae* Sharma, 1988

Type Locality : Aurangabad, (Maharashtra),
Distribution: Throughout Maharashtra.

Host : *Achyranthes aspera* L. (Amaranthaceae)

36. *bothriochloae* Rao and Sharma, 1977

Type Locality : Aurangabad, (Maharashtra),
Distribution: Throughout Maharashtra.

Host : *Dichanthium pertusum* (L.) W.D.
Clayton. (Poaceae)

37. *bryoniae* Schiner, 1868

Type Locality : Chennai, (Tamil Nadu);
Maharashtra: Amravati, Dist. (Melghat Tiger
Reserve), Pune Dist. (Akurdi)

Host : *Diplocyclos palmatus* (L.) C. Jeffrey
(Cucurbitaceae).

38. *cephalandrae* (Mani), 1934

Type Locality : Thanjavur, Chennai (Tamil
Nadu), Throughout Maharashtra.

Host : *Coccinia indica* W. & A.
(Cucurbitaceae)

39. *crataevae* (Mani), 1934

Type Locality : Grand Anicut Canal, Thanjavur,
Chennai (Tamil Nadu), Maharashtra : Marathwada.

Host : *Crateva magna* (Lour.) DC.
(Capparaceae)

40. *nenuae* (Grover), 1965

Type Locality : Allahabad (Uttar Pradesh);
Maharashtra : Amravati, Dist. (Melghat Tiger
Reserve).

Host : *Luffa acutangula* (L.) Roxb.
(Cucurbitaceae)

41. *tomentosae* (Grover), 1967

Type Locality : Allahabad (Uttar Pradesh).

Distribution : Throughout Maharashtra.

Host : *Setaria intermedia* R. & S. (Poaceae)

42. *Sp. 1.*

Host : *Leea indica* (Burm.f.) Merr. (Leeaceae)

Distribution : Maharashtra : Tamhini, Mulshi,
Pune Dist.

43. *Sp. 2*

Host : *Momordica dioica* Roxb.
(Cucurbitaceae)

Distribution : Maharashtra : Sanjay Gandhi
National Park, Borivali, Mumbai.

Supertribe Stomatosematidi

18. *Stomatosema* Kieffer44. *biclaspettii* Kashyap, 1989

Type Locality : Parbhani, (Maharashtra)

Host : Unknown.

45. *kamali* (Grover), 1961 (*Vanchidiplosis*)

Type Locality : Mihijam (Bihar); Throughout
Maharashtra.

Host : Unknown.

Supertribe Cecidomyiidi

Tribe Asphondyliini

Subtribe Asphondyliina

19. *Asphondylia* Loew46. *tectonae* Mani, 1974

Type Locality : Top Slip Anamalai Hills (Tamil
Nadu); Maharashtra: Satpura ranges and Western
Ghats

Host : *Tectona grandis* L. (Verbanaceae)

47. *tephrosiae* Mani, 1943

Type Locality : Delhi; Maharashtra:
Aurangabad.

Host : *Tephrosia candida* Dc. (Fabaceae)

48. *trichoecedarum* Mani, 1934

Type Locality : Thanjavur (Tamil Nadu);
Maharashtra: Raigad dist.

Host : *Acacia leucophloea* (Fabaceae)

Tribe **Cecidomyiini**20. *Cecidomyia* Meigen49. *artocarpus* Felt, 1921

Type Locality : Godavari, Maharashtra.

Host : *Artocarpus* sp. (Moraceae)

21. *Contarinia* Rondani50. *bivalviae* (Rao), 1950 (*Cincticornia*)

Type Locality : Shahapur, Thane Dist.
(Maharashtra)

Host : *Acacia catechu* Willd (Fabaceae).

51. *eragrostidis* Felt, 1927

Type Locality : Java, In India known from
Andaman Islands (Sharma, 1984); Maharashtra :
Amravati dist. (Melghat Tiger Reserve).

Host : *Eragrostis unioides* (Retz) Nees
(Poaceae).

52. *orientalis* (Rao and Sharma), 1977
(*Bothriochloamyia*)

Type Locality : Aurangabad, (Maharashtra),
Amravati dist. (Melghat Tiger Reserve)

Host : *Dichanthium pertusum* (L.) W.D.
Clayton (Poaceae).

53. *prosopidis* (Mani), 1938

Type Locality : New Delhi; Maharashtra:
Aurangabad dist.

Host : *Prosopis spicigera* L. (Leguminosae)

54. *sesami* Grover and Bakshi, 1978

Type Locality : Raipur (Chhattisgarh);
Maharashtra: Aurangabad dist.

Host : *Sesamum orientale* L. (Pedaliaceae)

22. *Procontarinia* Kieffer and Cecconi55. *matteina* Kieffer and Cecconi, 1906

Type Locality : India, Throughout Maharashtra.

Host : *Mangifera indica* L. (Anacardiaceae)

23. *Stenodiplosis* Reuter56. *sorghicola* (Coquillett), 1899 (*Contarinia*)

Type Locality : Texas, U.S.A. known from all
over India.

Host : *Sorghum bicolor* (L.) Moench, *Sorghum*
spp. (Poaceae)

Tribe **Clinodiplosini**24. *Clinodiplosis* Kieffer57. *graminicola* (Rao and Adwant), 1971
(*Charidiplosis*)

Type Locality : Daulatabad, Marathwada
(Maharashtra).

Host : *Setaria intermedia* R & S (Poaceae).

Tribe **Lestodiplosini**25. *Arthrocnodax* Rübsaamen58. *orientalis* Grover and Bakshi, 1978

Type Locality : Allahabad (Uttar Pradesh);
Maharashtra: Dhadgaon, Dhule, Dist.

Host : Unknown.

26. *Endaphis* Kieffer59. *aphidimyza* Shivpuje and Raodeo, 1985

Type Locality : Parbhani, (Maharashtra)

Host : *Uroleucon sonchi* Linn. (Homoptera :
Aphididae)

27. *Feltiella* Rübsaamen60. *acarisuga* (Vallot), 1827
(= *quadrata* Kashyap, 1988)

Type Locality : Parbhani, (Maharashtra)

Host : Unknown.

28. *Lestodiplosis* Kieffer61. *brevilobata* Sharma, 1988

Type Locality : Aurangabad, (Maharashtra)

Host : Unknown.

62. *emarginata* Sharma and Rao, 1979

Type Locality : Aurangabad, (Maharashtra)

Host : Unknown.

63. *irregularifila* Kashyap, 1989

Type Locality : Parbhani (Maharashtra).

Host : Unknown.

29. *Odontodiplosis* Felt64. *fingeriformis* Kashyap, 1988

Type Locality : Parbhani (Maharashtra).

Host : Unknown.

65. *raoi* Sharma, 1986

Type Locality : Aurangabad (Maharashtra).

Host : Unknown.

30. *Trisopsis* Kieffer66. *indica* Grover, 1962

Type Locality : Kings way, Nagpur, (Maharashtra)

Host : Unknown.

67. *nandedensis* Deshpande, 1985

Type Locality : Nanded, (Maharashtra)

Host : Unknown.

68. *spiniformis* Grover and Kashyap, 1991
(*Adiplosis*)

Type Locality : Parbhani (Maharashtra).

Host : Unknown.

Tribe *Microdiplosini*31. *Coquilletomyia* Felt69. *fungivora* (Nayar), 1949 (*Octodiplosis*)

Type Locality : Thanjavur (Tamil Nadu) and Venganur nr. Trivandrum, Maharashtra : Nagpur.

Host : rust on *Andropogon sorghum* (L.) Moench (Poaceae) and rust on *Jasminum grandiflorum* L. (Oleaceae)70. *indica* Rao and Saksena, 1959
(*Dactylodiplosis*)

Type Locality : Nagpur, (Maharashtra)

Host : Unknown.

71. *orientalis* (Sharma and Rao), 1980
(*Odontodiplosis*)

Type Locality : Aurangabad (Maharashtra).

Host : Unknown.

72. *triradiata* Chandra, 1993

Type Locality : Parbhani (Maharashtra).

Host : Unknown.

32. *Mycodiplosis* Rübsaamen73. *sesami* (Rao and Sharma), 1981
(*Clinodiplosis*)

Type Locality : Aurangabad (Maharashtra).

Host : *Sesamum indicum* L. (Pedaliaceae)74. *setariae* Sharma, new name for *indica* Rao and Adwant, 1971 (*Isodiplosis*, preoccupied Felt, 1920)

Type Locality : Aurangabad (Maharashtra).

Host : *Setaria intermedia* (= *tomentosae*) R & S (Poaceae).

Unplaced to Tribe

33. *Garugadiplosis* Deshpande, Shaikh and Sharma75. *brevipalpis* Deshpande, Shaikh and Sharma, 2002

Type Locality : Bhokar, Nanded (Maharashtra).

Host : *Garuga pinnata* Roxb. (Burseraceae)34. *Geromyia* Coutin and Harris76. *akolensis* Grover and Bakshi, 1978

Type Locality : Akola (Maharashtra).

Host : *Panicum miliaceum* L.; *P. miliare* Lamrk. (Poaceae)77. *penniseti* (Felt), 1920

Type Locality : Coimbatore (Tamil Nadu); Maharashtra : Daulatabad, Aurangabad dist.

Host : *Pennisetum setosum* Rich. (Poaceae)35. *Harmandiola* Skuhrava' 1997, new name for *Harmandia* Kieffer 189678. *longiterminalis* Sharma, 1987

Type Locality : Aurangabad (Maharashtra).

Host : Unknown.

36. *Horidiplosis* Felt79. *mathuri* Mani, 1935

Type Locality : Dehra Dun (Uttarakhand);
Throughout Maharashtra.

Host : *Ficus glomerata* Roxb. (Moraceae)

37. *Karshomyia* Felt

80. *orientalis* Gagné new name for *orientalis*
Sharma and Rao, 1978 (*Apamargamyia*)

Type Locality : Aurangabad (Maharashtra).

Host : *Achyranthes aspera* L. (Amaranthaceae)

38. *Kitella* Deshpande, Shaikh and Sharma

81. *orientalis* Deshpande, Shaikh and Sharma,
2005

Type Locality : Hadgaon, Dist. Nanded,
(Maharashtra)

Host : Unknown.

39. *Myricomyia* Kieffer82. *pongamiae* Mani, 1934

Type Locality : A scrub jungle near Tanjore,
Marina (Chennai) (Tamil Nadu); Maharashtra :
Sanjay Gandhi National Park, Borivali, Mumbai.

Host : *Pongamia pinnata* (L.) Pierre (Fabaceae)

40. *Octodiplosis* Giard83. *bispina* Sharma, 1987

Type Locality : Aurangabad (Maharashtra).

Host : Unknown.

41. *Odinadiplosis* Mani84. *odinae* Mani, 1935

Type Locality : Tanjore (Tamil Nadu);
Maharashtra: Amravati, Dhule, Pune dists.

Host : *Lannea coromandelica* (Houtt.) Mer.
(Anacardiaceae)

42. *Orseolia* Kieffer and Massalongo85. *difficilis* Gagne, 1973

Type Locality : Allahabad (Uttar Pradesh);
Maharashtra : Nagpur.

Host : *Cynodon dactylon* (L.) Pers. (Poaceae)

86. *ischaemi* (Kieffer), 1910

Type Locality : Mumbai, (Maharashtra)

Host : *Ischaemum pilosum* (Klein ex Willd.)
Wight (Poaceae)

87. *oryzae* (Wood-Mason), 1889

Type Locality : Kurruckpore (West Bengal);
Maharashtra: Nagpur.

Host : *Oryza sativa* L.; *Oryza perrenis* Moench
(nom. Illeg.)(Poaceae)

43. *Pipaldiplosis* Mani88. *pipaldiplosis* Mani, 1942

Type Locality : Delhi, Agra, Allahabad (Uttar
Pradesh) ; Maharashtra : Aurangabad dist.

Host : *Ficus religiosa* L. (Moraceae)

44. *Punarnovomyia* Mani89. *boerhaaviaefoliae* Mani, 1943

Type Locality : Delhi; Maharashtra :
Marathwada.

Host : *Boerhaavia repanda* Willd.
(Nyctaginaceae)

45. *Resseliella* Seitner90. *salvadorae* (Rao), 1951

Type Locality : Castle Grant Garden, Agra
(Uttar Pradesh); Maharashtra: Alibaug, Raigad
dist.; Vikroli, Mumbai and Marathwada.

Host : *Salvadora persica* L. (Salvadoraceae)

SUMMARY

Ninety species of gall midges belonging to 45
genera spread over three subfamilies from
Maharashtra State are enumerated.

REFERENCES

- Chandra, R. 1993. Two new species of the genus *Coquilletomyia* Felt (Cecidomyiidae : Diptera) from India. *Cecodologia Internationale*, **13-14** : 9-22.
- Bhalerao, S.S., Shaikh, T.H. and V.D. Deshpande. 2009. Three new gall midge (Diptera : Cecidomyiidae) from Maharashtra, India. *Journal of Threatened Taxa*, **1(4)** : 226-229.
- Deshpande, V.D. 1983. On a new gall midge species (Diptera : Cecidomyiidae : Lestremiinae). *Proc. 70th Indian Science Congress*, **70(3)** : 124-125.
- Deshpande, V.D. 1985. A new gall midge species (Cecidomyiidae : Diptera). *Cecodologia Internationale*, **6** : 59-62.
- Deshpande, V.D., Shaikh, T.H. and Sharma, R.M. 2002a. A new species of gall midge Diptera : Cecidomyiidae) from India. *Zoo's Print Journal*, **17(7)** : 817-819.
- Deshpande, V.D., Shaikh, T.H. and Sharma, R.M. 2002b. Four New Indian Gall midges of *Anaretella* Enderlein (Diptera : Cecidomyiidae : Lestremiinae) *Rec. zool. Surv. India*, **100(1-2)** : 35-44.
- Deshpande, V.D., Shaikh, T.H. & Sharma, R.M. 2002c. A new genus and new species of gall midge (Cecidomyiidae : Diptera) infesting *Garuga pinnata* Roxb. (Burseraceae) from India *Rec. zool. Surv. India*, **100(3-4)** : 111-115.
- Deshpande, V.D., Shaikh, T.H. & Sharma, R.M. 2005. A New Genus and New Species of Gall midge (Cecidomyiidae : Diptera) *Rec. zool. Surv. India*, **104(1-2)** : 79-83.
- Felt, E.P. 1921. Indian grass gall midges. *Memoirs Dept. Agri. India, Ent. Series*, **7** : 15-22.
- Gagné, R.J. 1973. *Family Cecidomyiidae*. In : Delfinado, M.D. and D.E. Hardy, eds. *A Catalogue of the Diptera of the Oriental Region*, Vol., **1** : 480-517.
- Gagné, R.J. 2004. A Catalog of the Cecidomyiidae (Diptera) of the *World Memoirs of the Entomological Society of Washington* No., **25** : pp. 408
- Gagné, R.J. and Etienne, J. 2006. *Gephyraulius mangiferae* (Felt), N. Comb. (Diptera : Cecidomyiidae) : A mango Pest from India newly recorded from the Western Hemisphere. *Proc. Entomol. Soc. Wash*, **108(4)** : 930-937.
- Grover, P. 1981. Studies on Gall-Midges of India XLIV. A Catalogue of Indian Gall Midges. *Cecodologia Internationale*, **2(2-3)** : 63-108.
- Grover, P. and Bakshi, M. 1978. On the study of one new genus and thirty-one new species (Cecidomyiidae : Diptera) from India. *Cecodologia indica*, **12-13** : 5-267.
- Grover, P. and Kashyap, V. 1991. Three new species of the supertribe Cecidomyiidi (Diptera : Cecidomyiidae) from India. *Cecodologia Internationale*, **12** : 85-100.
- Kashyap, V. 1988a. A new species of *Odontodiplosis* Felt. *Cecodologia Internationale*, **9** : 1-6.
- Kashyap, V. 1988b. A new species of the genus *Feltiella* Rübsaamen. *Cecodologia Internationale*, **9** : 59-64.
- Kashyap, V. 1988c. Three new species of genus *Claspettomyia* Grover. *Cecodologia Internationale*, **9** : 125-139.
- Kashyap, V. 1989. A new species of *Lestodiplosis* Kieffer (Cecidomyiidae : Diptera) from India. *Cecodologia Internationale*, **10** : 123-126.

- Mani, M.S. 1934. Studies on Indian Itonididae (Cecidomyiidae : Diptera). *Rec. Indian Mus.*, **36** : 371-451. pl. VII.
- Naja, A.K.A. Siddique, M.S., Deshpande, V.D. and Sharma, R.M. 2009. A new species of the genus *Camptomyia* Kieffer (Diptera : Cecidomyiidae : Porricondylinae) from Maharashtra, India. *Rec. zool. Surv. India*, **109**(pt. 3) : 85-89.
- Rao, S.N. 1950. Descriptions of gall midges (Itonididae : Diptera) from India. *Rec. Indian Mus.*, **48**(3-4) : 31-42.
- Rao, S.N. 1967. New Records of Midge galls (Cecidomyiidae : Diptera) from Marathwada. *Cecidol. Indica*, **2**(3) : 125-132.
- Rao, S.N. and Adwant P.D. 1970. Studies on Indian Cecidomyiidae (Itonididae) from Marathwada. *Marath. Univ. J. Sci.*, **9** : 113-115.
- Rao, S.N. and Adwant P.D. 1975. Studies on Indian Cecidomyiidae (Itonididae: Diptera) from Marathwada-IV. *Marath. Univ. J. Sci.*, **14** : 177-182.
- Rao, S.N. and Grover, P. 1960. A new citrus midge (Itonididae : Diptera) from India. *Ann. Mag. Nat. Hist.*, (13)**2** : 745-749.
- Rao, S.N. and Sharma, R.M. 1977a. Insect: Host- Plant Index of gall midges Cecidomyiidae from the Oriental Region. *Marath. Univ. J. Sci.*, **14** : 157-167.
- Rao, S.N. and Sharma, R.M. 1977b. A new Indian grass gall-midge (Diptera : Cecidomyiidae). *J. ent. Res.*, **1** : 148-150.
- Rao, S.N. and Sharma, R.M. 1977c. A new Indian grass gall-midge (Diptera : Itonididae : Cecidomyiidae). *Entomon*, **2** : 237-240.
- Rao, S.N. and Sharma, R.M. 1978. A new gall midge (Diptera : Cecidomyiidae : Porricondylinae) from India. *Nat. Acad. Sci. Letters*, **1** : 115-116.
- Rao, S.N. and Sharma, R.M. 1981. A new midge (Cecidomyiidae : Diptera) from flower-bud galls of *Sesamum indicum* L. from India. *Marath. Univ. J. Sci.*, **20** : 26-29.
- Sharma, R.M. 1984. *Contarinia eragrostidis* Felt—An addition to the gall midge fauna of India. *Geobios New Reports*, **3** : 146-147.
- Sharma, R.M. 1985. On a synonymy of the genus *Bothriochloamyia* (Diptera : Cecidomyiidae). *Bull. Zool. Surv. India*, **7**(2-3) : 331.
- Sharma, R.M. 1986. Description of a new gall midge species (Diptera : Cecidomyiidae) from Maharashtra. *J. Bombay Nat. Hist., Soc.*, **83** : 165-168.
- Sharma, R.M. 1987a. On a new species of genus *Octodiplosis* Giard (Diptera : Cecidomyiidae) from India. *Geobios New Reports*, **6** : 2-4.
- Sharma, R.M. 1987b. A new species of *Asynapta* Loew (Diptera : Cecidomyiidae: Porricondylinae) from Aurangabad, India. *J. Bombay Nat. Hist., Soc.*, **84** : 170-172.
- Sharma, R.M. 1987c. *Dasineura psoraleae* (Diptera : Cecidomyiidae) A new gall midge, infesting inflorescences of *Psoralea corylifolia* Linn. *J. Bombay Nat. Hist., Soc.*, **84** : 186-189.
- Sharma, R.M. 1987d. *Harmandia longiterminalis* (Diptera : Cecidomyiidae), A new gall-midge from India. *Geobios New Reports*, **6** : 174-176.

- Sharma, R.M. 1988a. A new gall-midge of the genus *Lestodiplosis* Kieffer (Diptera : Cecidomyiidae) from Maharashtra. *J. Bombay Nat. Hist. Soc.*, **85** : 155-157.
- Sharma, R.M. 1988b. Description of a new Indian gall-midge (Diptera : Cecidomyiidae : Lasiopteridi) causing galls on *Achyranthes aspera* Linn. *J. Bombay Nat. Hist. Soc.*, **85** : 376-379.
- Sharma, R.M. 2000. Checklist of Indian grass gall midges (Diptera : Cecidomyiidae) with their host grass (Poaceae) index *Zoo's Print Journal*, **15**(7) : 297-299.
- Sharma, R.M. 2003. New Records of Lasiopterine midge galls (Diptera : Cecidomyiidae : Cecidomyiinae : Lasiopteridi) from Maharashtra *Zoo's Print Journal*, **18**(1) : 993.
- Sharma, R.M. 2003. A Checklist of gall midges (Diptera : Cecidomyiidae) from Maharashtra State. *Ann. For.*, **11**(2) : 269-279.
- Sharma, R.M. 2009. Checklist of Indian Gall midges (Diptera : Cecidomyiidae) <http://www.zsi.gov.in/zoologicalsurveyofindia/zsidata/checklist>
- Sharma, R.M. and Bastawade, D.B. 2001. Occurrence of gall midges (Diptera : Cecidomyiidae) on webs of spiders (Araneae : Pholcidae). *Bionotes*, **3**(4) : 84.
- Sharma, R.M. and Rao, S.N. 1978. A new gall -midge (Diptera : Cecidomyiidae) from India. *Entomon*, **3** : 287-290.
- Sharma, R.M. and Rao, S.N. 1979a. A new gall -midge (Diptera : Itonididae : Lestremiinae) from India. *J. ent. Res.*, **3** : 36-37.
- Sharma, R.M. and Rao, S.N. 1979b. A new gall-midge species of Indian Porricondylinae (Diptera : Cecidomyiidae). *Proc. Nat. Acad. Sci. India*, **49**(B) : 125-128.
- Sharma, R.M. and Rao, S.N. 1979c. On a new gall-midge (Diptera : Cecidomyiidae : Lestremiinae) from India. *Biology*, **2**(2) : 29-30.
- Sharma, R.M. and Rao, S.N. 1979d. A new species *Lestodiplosis emarginata* (Diptera : Cecidomyiidae) from India. *Marath. Univ. J. Sci.*, **18**(11) : 117-119.
- Sharma, R.M. and Rao, S.N. 1979e. A new gall-midge (Diptera : Itonididae : Lestremiinae) from India. *Entomon*, **4** : 299-301.
- Sharma, R.M. and Rao, S.N. 1980a. *Lestremia deepica*, A new midge (Diptera : Cecidomyiidae) from India. *Biology*, **2**(4) : 39-40.
- Sharma, R.M. and Rao, S.N. 1980b. *Odontodiplosis orientalis*, a new Indian gall-midge (Diptera : Cecidomyiidae). *Oriental Insects*, **13**(1979) : 299-302.
- Sharma, R.M. and Rao, S.N. 1980c. On a new Indian gall-midge species (Diptera : Cecidomyiidae). *Curr. Sci.*, **49** : 290-291.
- Sharma, R.M. and Rao, S.N. 1981. Checklist of gall midges (Diptera : Cecidomyiidae) of Marathwada. I. *Marath. Univ. J. Sci.*, **20**(13) : 20-25.
- Shivpuje, P.R. and Raodeo, A.K. 1985. A new species of parasitic midge from safflower aphid from Maharashtra. *J. Maharashtra Agri. Univ.*, **10** : 61-63.
- Skuhrava, M. Skuhravy, V. and Brewer, J.W. 1984. Biology of Gall midges. In : *Biology of Gall Insects* ed. T.N. Ananthkrishnan, Oxford & IBH Publishing Co. India, Pp. 169-222.

INSECTA : DIPTERA : TABANIDAE

R.M. SHARMA

Zoological Survey of India, Western Regional Centre, Pune-411044

INTRODUCTION

The brachyceran flies commonly referred to as horse flies, deer flies or clegs are stout bodied, medium to large (5-33 mm in length) in size having capacity to fly swiftly. Adult flies are generally colourful, have a pair of large black, brown to green or yellow eyes with iridescent coppery red and green bands or spots in the living condition. Males have holoptic eyes which meet in the mid line whereas females have dichoptic eyes which are markedly separated. The antennae are porrect and horn-like. Wings are transparent or clouded, banded or striped or with mottled infuscations. The thorax and abdomen are usually striped or banded with various colours.

Tabanid flies are mostly diurnal except a few which are nocturnal. They are mostly exophilic and exophagic, enter the human habitations along with livestock. The adults of both sexes feed on nectar and pollen of flowers, honeydew or on plant juice. Most of the females also suck blood from vertebrate animals including man and transmit several pathogens. These flies are facultative haematophagous ectoparasites, thus important from medical and veterinary point of view. They are efficient mechanical carriers of various diseases and are responsible for transmission of more than 25 animal diseases.

Indian fauna of Tabanid flies is represented by 240 species (Veer, 2004), of which, 18 species of 4 genera under three subfamilies are known from Maharashtra State.

SYSTEMATIC LIST

Order DIPTERA

Suborder BRACHYCERA

Family TABANIDAE

Subfamily PANGONIINAE

Tribe **Philolichini**

1. *Philoliche macquartiana* Chvála, 1969

Distribution : Maharashtra : Mahabaleshwar and Matheran.

Subfamily CHRYSOPSINAE

Tribe **Chrysopsini**

2. *Chrysops flaviventris* Macquart, 1846

Distribution : Maharashtra : Lonavala.

Subfamily TABANINAE

Tribe **Haematopotini**

3. *Haematopota annandalei* Ricardo, 1911

Distribution : Maharashtra : Igatpuri.

4. *Haematopota bilineata* Ricardo, 1911

Distribution : Maharashtra : Igatpuri near Mumbai.

5. *Haematopota biroi* Szilády, 1926

Distribution : Maharashtra : Mumbai

6. *Haematopota cana* Walker, 1848

Distribution : Maharashtra : Pune, Lonavala, Mumbai.

7. *Haematopota immaculata* Ricardo, 1911*Distribution* : Maharashtra.8. *Haematopota inconspicua* Ricardo, 1911*Distribution* : Maharashtra : Igatpuri near Mumbai, Lonavala.9. *Haematopota matherani* Szila'dy, 1926*Distribution* : Maharashtra : Matheran near Mumbai.10. *Haematopota taunggyiensis* Stone & Philip, 1974*Distribution* : Maharashtra : Pachora; Khandesh; Mumbai.11. *Haematopota zophera* Stone & Philip, 1974*Distribution* : Maharashtra : Mumbai, Nagpur.Tribe **Tabanini**12. *Tabanus bombayensis* Schuurmans Stekhoven, 1926*Distribution* : Maharashtra : Mahabaleshwar.13. *Tabanus imparicallosus* Schuurmans Stekhoven, 1926*Distribution* : Maharashtra : Mahabaleshwar.14. *Tabanus indianus* Ricardo, 1911*Distribution* : Maharashtra : Pune.15. *Tabanus jucundus* Walker, 1848*Distribution* : Maharashtra : Igatpuri near Mumbai.16. *Tabanus rubidoides* Szila'dy, 1926*Distribution* : Maharashtra : Mumbai.17. *Tabanus siamensis* Ricardo, 1911*Distribution* : Maharashtra : Mumbai.18. *Tabanus subhirtus* Ricardo, 1911*Distribution* : Maharashtra : Mumbai.**SUMMARY**

A checklist of 18 species belonging to 4 genera under three subfamilies of Tabanid flies recorded from Maharashtra State is provided.

REFERENCES

- Ricardo, G. 1911a. A revision of the species of *Tabanus* from the Oriental Region including notes on species from surrounding countries. *Rec. Indian Mus.*, **4** : 111-255, pls 13-14.
- Ricardo, G. 1911b. A revision of the Oriental species of the genus of the family Tabanidae other than *Tabanus*. *Rec. Indian Mus.*, **4** : 321-397.
- Stone, A. 1975. Family Tabanidae. In : *A catalogue of the Diptera of the Oriental Region* (Delfinado and Hardy, eds.). University Press of Hawaii, Honolulu. **2** : 43-81.
- Stone, A. and Philip, C.B. 1974. The Oriental species of the tribe Haematopotini (Diptera : Tabanidae). *U.S. Dep. Agri. Res. Sev. Tec. Bull.*, 1489 : 1-240.
- Szila'dy, Z. 1926. New and old World horse-flies. *Biol. Hungarica*, **1** : 1-30, pl 4.
- Vijay Veer. 2004. Tabanidae Flies (Diptera) from the Indian subregion. *Annals of Forestry*, **12**(2) : 301-447.
- Walker, F. 1848. List of the specimens of dipterous insects in the collection of the British Museum. *Br. Mus (Nat. Hist.) London*, **1** : 1-229.

INSECTA : LEPIDOPTERA : RHOPALOCERA AND GRYPOCERA

R.M. SHARMA

Zoological Survey of India, Western Regional Centre, Pune-411044

INTRODUCTION

The butterflies being phytophagous insects with fair degree of food and host plant specificity, their species diversity and richness is indicative of floral diversity of the habitat in which they occur and decline in the diversity of these fascinating insects suggests the habitat degradation. It is estimated that the Indian region harbours 1641 species of butterflies representing roughly 9.50% of the total world occurrence (Varshney, 2006). Earlier excellent works of Bell (1909-1927) detailing about 250 species from the Western Ghats still remains valid. Another dedicated work on butterflies of Nilgiri Mountains of Southern India covering Tamil Nadu, Kerala & Karnataka by Larsen (1987-88) providing an account of 229 species is noteworthy. Recent authentic study on Butterflies of the Western Ghats including Sri Lanka by Goankar (1996) taking into account 330 species (about 20% of Indian diversity) belonging to 166 genera spread over five families is a classic work.

Out of 330 species recorded by Goankar (1996) from Western Ghats covering Gujarat, Maharashtra, Goa, Karnataka, Tamil Nadu and

Kerala, enumerated 213 species of 125 genera from Maharashtra. Of which, 150 species are common, 63 rare and 3 species endemic to Western Ghats found in Maharashtra. Ten species fall under different schedules of Indian Wildlife Act. The species (148) marked with asterisk (*) were actually collected by either author/s (Kurahde & Kadlag, 1995; Sharma & Radhakrishnan, 2004-2006a, Sharma & Chaturvedi, 2006b and Sharma, 2008 while studying diversity of butterflies from various conservation areas in the State or the scientists of Western Regional Station, Zoological Survey of India, Pune during various faunistic surveys of the State conducted from time to time. The present compilation is based on Goankar (1996) and authors own studies referred above. The classification and nomenclature followed here is after Goankar (1996), except for family Hesperidae Smetacek (2006 & 2007). The butterfly fauna of Maharashtra constitutes approximately 64.5% of the entire Western Ghats butterfly richness. Family wise species richness analysis reveals that family Lycaenidae (73) outnumber all other families followed by Nymphalidae (59), Hesperidae (43), Pieridae (25) and Papilionidae (13) in the State.

SYSTEMATIC ACCOUNT OF BUTTERFLIES

Sr. No.	Species	Common Name	Status
	Family PAPILIONIDAE Subfamily PAPILIONINAE Tribe Troidini		
1	<i>Troides minos</i> Cramer	Southern Birdwing	Endemic to Western Ghats Schedule I Rare
2	* <i>Pachliopta aristolochiae</i> (Fabricius)	Common Rose	Common
3	* <i>Pachliopta hector</i> (Linn.)	Crimson Rose	Schedule I Common
	Tribe Leptocircini		
4	* <i>Graphium sarpedon</i> (Linn.)	Common Bluebottle	Common
5	* <i>Graphium doson</i> C. & R. Felder	Common Jay	Rare
6	* <i>Graphium agamemnon</i> (Linn.)	Tailed Jay	Common
7	* <i>Graphium nomius</i> (Esper.)	Spot Swordtail	Rare
	Tribe Papilionini		
8	* <i>Papilio clytia</i> (Linn.)	Common Mime	Rare
9	* <i>Papilio demoleus</i> Linn.	Lime Butterfly	Common
10	* <i>Papilio helenus</i> Linn.	Red Helen	Common
11	* <i>Papilio polytes</i> Linn.	Common Mormon	Common
12	* <i>Papilio polymnestor</i> Cramer	Blue Mormon	Common
13	<i>Papilio paris</i> Linn.	Paris Peacock	Rare
	Family PIERIDAE Subfamily COLIADINAE Tribe Coliadini		
14	* <i>Catopsilia pomona</i> (Fab.)	Common Emigrant	Common
15	* <i>Catopsilia pyranthe</i> (Linn.)	Mottled Emigrant	Common
16	* <i>Eurema brigitta</i> (Stoll)	Small Grass Yellow	Common
17	* <i>Eurema laeta</i> Boisduval	Spotless Grass Yellow	Common
18	* <i>Eurema hecabe</i> (Linn.)	Common Grass Yellow	Common
19	* <i>Eurema blanda</i> (Boisduval)	Three Spot Grass Yellow	Common
	Subfamily PIERINAE		
	Tribe Pierini		
20	* <i>Delias eucharis</i> (Drury)	Common Jezebel	Common
21	* <i>Leptosia nina</i> (Fabricius)	Psyche	Common
22	<i>Prioneris sita</i> C. & R. Felder	Painted Sawtooth	Rare
23	* <i>Cepora nerissa</i> (Fab.)	Common Gull	Common
24	* <i>Cepora nadina</i> (Lucas)	Lesser Gull	Rare

Sr. No.	Species	Common Name	Status
25	<i>*Anaphaeis aurota</i> (Fab.)	Pioneer or Caper White	Common
26	<i>*Appias indra</i> (Moore)	Plain Puffin	Rare
27	<i>*Appias libythea</i> Fabricius	Striped Albatross	
28	<i>*Appias lyncida</i> Cramer	Chocolate Albatross	Rare; Schedule II
29	<i>*Appias albina</i> Boisduval	Common Albatross	Rare
30	<i>*Colotis amata</i> (Fab.)	Small Salmon Arab	Common
31	<i>*Colotis etrida</i> (Boisduval)	Small Orange Tip	Common
32	<i>*Colotis eucharis</i> (Fab.)	Plain Branded Tip	Common
33	<i>Colotis danae</i> (Fabricius)	Crimson Tip	Common
34	<i>Colotis fausta</i> (Olivier)	Large Salmon Arab	Common
35	<i>*Ixias marianne</i> (Cramer)	White Orange Tip	Common
36	<i>*Ixias pyrene</i> Linn.	Yellow Orange Tip	Common
	Tribe Euchloeini		
37	<i>*Pareronia valeria</i> Cramer	Common Wanderer	Common
38	<i>*Hebomoia glaucippe</i> Linn.	Great Orange Tip	Common
	Family NYMPHALIDAE Subfamily SATYRINAE Tribe Melanitini		
39	<i>*Melanitis leda</i> (Linn.)	Common Evening Brown	Common
40	<i>Melanitis phedima</i> (Stoll)	Dark Evening Brown	Common
	Tribe Elymniini		
41	<i>Elymnias hypermnestra</i> (Linn.)	Common Palmfly	Common
42	<i>*Lethe europa</i> (Fabricius)	Bamboo Tree Brown	Common
43	<i>Lethe drypetis</i> Hewitson	Tamil Tree Brown	Rare
44	<i>*Lethe rohria</i> (Fabricius)	Common Tree Brown	Common
45	<i>*Mycalesis pereus</i> Fabricius	Common Bush Brown	Common
46	<i>*Mycalesis mineus</i> (Linn.)	Dark Branded Bush Brown	Common
47	<i>Mycalesis patina</i> Eliot	Gladeye Bush Brown	Rare
	Tribe Satyrini		
48	<i>*Ypthima asterope</i> (Klug)	Common Threering	Common
49	<i>*Ypthima huebneri</i> Kirby	Common Fourring	Common
50	<i>Ypthima avanta</i> Moore	Jewel Fourring	Rare
51	<i>*Ypthima baldus</i> Fabricius	Common Fivering	Common
	Subfamily CHARAXINAE Tribe Charaxini		
52	<i>*Polyura athamas</i> (Drury)	Common Nawab	Common
53	<i>Polyura agraria</i> Swinhoe	Anomalous Nawab	Rare

Sr. No.	Species	Common Name	Status
54	<i>Polyura schreiber</i> Godart	Blue Nawab	Rare
55	* <i>Charaxes bernardus</i> Fabricius	Tawny Rajah	Rare
56	* <i>Charaxes solon</i> (Fabricius)	Black Rajah	Common
	Subfamily HELICONIINAE Tribe Acraeini		
57	* <i>Acraea violae</i> (Fab.)	Tawny Coster	Common
	Tribe Heliconiini		
58	<i>Cethosia nietneri</i> Felder & Felder	Tamil Lacewing	Endemic to Western Ghats. Rare
59	* <i>Vindula erota</i> Fabricius	Cruiser	Rare
	Tribe Argynnnini		
60	<i>Cupha erymanthis</i> Drury	Rustic	Rare
61	* <i>Phalanta phalantha</i> (Drury)	Common Leopard	Common
62	<i>Argyreus hyperbius</i> Linn.	Indian Fritillary	Rare
	Subfamily APATURINAE Tribe Apaturini		
63	<i>Rohana parisatis</i> Westwood	Black Prince	Rare
64	<i>Euripus consimilis</i> Westwood	Painted Courtesan	Rare
	Subfamily LIMENITINAE Tribe Neptini		
65	* <i>Neptis jumbah</i> Moore	Chestnut-Streaked Sailer	Schedule I; Rare
66	* <i>Neptis hylas</i> (Linn.)	Common Sailer	Common
67	<i>Pantoporia hordonia</i> Stoll	Common Lascar	Common
	Tribe Limenitini		
68	* <i>Athyma perius</i> (Linn.)	Common Sergeant	Common
69	* <i>Limenitis procris</i> (Cramer)	Commander	Common
	Tribe Euthaliini		
70	* <i>Euthalia aconthea</i> (Moore)	Common Baron	Schedule II, Common
71	* <i>Euthalia lubentina</i> Cramer	Gaudy Baron	Rare
72	* <i>Euthalia nais</i> (Forster)	Baronet or Red Baron	Common
73	<i>Dophla evelina</i> Stoll	Red Spot Duke	Rare
	Tribe Biblini		
74	* <i>Byblia ilithyia</i> Drury	Joker	Common
75	* <i>Ariadne ariadne</i> (Linn.)	Angled Castor	Common
76	* <i>Ariadne merione</i> (Cramer)	Common Castor	Common
	Tribe Marpesiini		
77	* <i>Cyrestis thyodamas</i>	Common Map	Rare

Sr. No.	Species	Common Name	Status
	Subfamily LIBYTHEINAE		
78	<i>Libythea myrrha</i> Godart	Club Beak	Common
	Subfamily NYMPHALINAE Tribe Nymphalini		
79	* <i>Junonia hierta</i> (Fab.)	Yellow Pansy	Common
80	* <i>Junonia orithya</i> (Linn.)	Blue Pansy	Common
81	* <i>Junonia lemonias</i> (Linn.)	Lemon Pansy	Common
82	* <i>Junonia almana</i> (Linn.)	Peacock Pansy	Common
83	* <i>Junonia atlites</i> (Linn.)	Grey Pansy	Common
84	* <i>Junonia iphita</i> (Cramer)	Chocolate Pansy	Common
85	* <i>Cynthia cardui</i> (Linn.)	Painted Lady	Common
86	* <i>Hypolimnas bolina</i> (Linn)	Great Eggfly	Common
87	* <i>Hypolimnas misippus</i> (Linn.)	Danaid Eggfly	Schedule I; Common
88	<i>Doleschallia bisaltide</i> Cramer	Autumn Leaf	Rare
89	* <i>Kallima horsfieldi</i> Kollar	South Indian Blue Oakleaf	Endemic to Western Ghats. Common
	Subfamily DANAINAE Tribe Danaini		
90	* <i>Parantica aglea</i> (Stoll)	Glassy Tiger	Common
91	* <i>Tirumala limniace</i> (Cramer)	Blue Tiger	Common
92	<i>Tirumala septentrionis</i> Butler	Dark Blue Tiger	Common
93	* <i>Danaus chrysippus</i> (Linn)	Plain Tiger	Common
94	* <i>Danaus genutia</i> (Cramer)	Striped or Common Tiger	
	Tribe Euploeini		
95	* <i>Euploea core</i> (Cramer)	Common Indian Crow	Common
96	* <i>Euploea sylvester</i> (Fab.)	Double-Branded Crow	Rare
97	* <i>Euploea klugii</i> (Hors.)	The Brown King Crow	Rare
	Family LYCAENIDAE Subfamily RIODININAE Tribe Riodiniini		
98	* <i>Abisara echerius</i> Stall	Plum Judy	Common
	Subfamily MILETINAE Tribe Spalgini		
99	* <i>Spalgis epius</i> Westwood	Apefly	Common
	Subfamily POLYOMMATINAE Tribe Polyommataini		
100	* <i>Castalius rosimon</i> (Fab.)	Common Pierrot	Schedule I; Common
101	* <i>Caleta caleta</i> (Hewitson)	Angled Pierrot	Common

Sr. No.	Species	Common Name	Status
102	<i>Discolampa ethion</i> Westwood	Banded Blue Pierrot	
103	<i>Tarucus ananda</i> de Niceville	Dark Pierrot	Schedule IV Common
104	* <i>Tarucus nara</i> Kollar	Rounded Pierrot	Common
105	<i>Tarucus callinara</i> Butler	Spotted Pierrot	Rare
106	<i>Tarucus indica</i> Evans		Rare
107	* <i>Leptotes plinius</i> (Fabricius)	Zebra Blue	Common
108	<i>Azanus ubaldus</i> Stoll	Bright Babul Blue	Common
109	<i>Azanus uranus</i> Butler	Dull Babul Blue	Common
110	<i>Azanus jesous</i> Guerin-Meneville	African Babul Blue	Common
111	<i>Everes lacturnus</i> Godart	Indian Cupid	Common
112	* <i>Acytolepis puspa</i> Horsfield	Common Hedge Blue	Common
113	<i>Megisba malaya</i> Horsfield	Malayan	Rare
114	* <i>Pseudozizeeria maha</i> (Kollar)	Pale Grass Blue	Common
115	* <i>Zizeeria karsandra</i> Moore	Dark Grass Blue	Common
116	* <i>Zizina otis</i> Fabricius	Lesser Grass Blue	Common
117	* <i>Zizula hylax</i> Fabricius	Tiny Grass Blue	Common
118	* <i>Chilades laius</i> Stoll	Lime Blue	Common
119	<i>Chilades parrhasius</i> (Fabricius)	Small Cupid	Common
120	* <i>Chilades pandava</i> (Horsfield)	Plains Cupid	Common
121	* <i>Freyeria trochylus</i> (Freyer)	Grass Jewel	Common
122	* <i>Euchrysops cnejus</i> (Fabricius)	Gram Blue	Schedule II; Common
123	* <i>Catochrysops strabo</i> (Fabricius)	Forget-Me-Not	Common
124	* <i>Lampides boeticus</i> (Linn.)	Pea Blue	Schedule II; Common
125	* <i>Jamides bochus</i> Stoll	Dark Cerulean	Common
126	* <i>Jamides celeno</i> (Cramer)	Common Cerulean	Common
127	<i>Nacaduba pactolus</i> Felder	Large 4-Lineblue	Rare
128	<i>Nacaduba hermus</i> Felder	Pale 4-Lineblue	Common
129	* <i>Nacaduba kurava</i> Moore	Transparent 6-Lineblue	Common
130	* <i>Nacaduba beroe</i> Felder & F Felder	Opaque 6-Lineblue	Common
131	* <i>Prosotas nora</i> Felder	Common Lineblue	Common
132	* <i>Prosotas dubiosa</i> Semper	Tailless Lineblue	Common
133	<i>Petrelaea dana</i> de Niceville	Dingy Lineblue	Common
134	* <i>Talicauda nyseus</i> Guerin-Meneville	Red Pierrot	Common
135	* <i>Celastrina lavendularis</i> (Moore)	Plain Hedge Blue	Rare

Sr. No.	Species	Common Name	Status
	Tribe Lycaenesthini		
136	<i>Anthene emolus</i> Godart	Ciliate Blue	Rare
137	<i>Anthene lycaenina</i> Felder	Pointed Ciliate Blue	Rare
	Subfamily THECLINAE Tribe Aropalini		
138	* <i>Arhopala psedocentaurus</i> (Doubleday)	Western Centaur Oak Blue	Rare
139	* <i>Arhopala amantes</i> (Hewitson)	Large Oak Blue	Common
140	<i>Arhopala atrax</i> Hewitson	Dark Broken-Band Oakblue	Rare
141	<i>Arhopala abseus</i> Hewitson	Aberrant Oakblue	Rare
142	<i>Thaduca multicaudata</i> Moore	Many tailed Oak Blue	Rare
143	* <i>Surendra quercetorum</i> Moore	Common Acacia Blue	Common
	Tribe Amblypodiiini		
144	* <i>Iraota timoleon</i> (Stoll)	Blue Silver Streak	Common
145	* <i>Amblypodia anita</i> Hewitson	Leaf Blue	Common
	Tribe Aphnaeini		
146	* <i>Spindasis vulcanus</i> (Fabricius)	Common Silverline	Common
147	<i>Spindasis schistacea</i> (Moore)	Plumbeous Silverline	Common
148	* <i>Spindasis ictis</i> Hewitson	Shot Silverline	Common
149	<i>Spindasis elima</i> (Moore)	Scarce Shot Silverline	Common
150	<i>Spindasis abnormis</i> Moore	Abnormal Silverline	Rare
151	<i>Spindasis lohita</i> Horsfield	Long Banded Silverline	Rare
152	<i>Apharitis lilacinus</i> (Moore)	Liliac Silverline	Rare
	Tribe Catapaecilmatini		
153	<i>Catapaecilma major</i> Druce	Common Tinsel	Rare
	Tribe Loxurini		
154	* <i>Loxura atymnus</i> Stoll	Yamfly	Common
	Tribe Cheritrini		
155	<i>Cheritra freja</i> Fabricius	Common Imperial	Rare
	Tribe Horagini		
156	* <i>Rathinda amor</i> Fabricius	Monkey Puzzle	Common
157	<i>Horaga onyx</i> Moore	Common Onyx	Common
	Tribe Zesiini		
158	* <i>Zesius chrysomallus</i>	Red Spot	Rare
	Tribe Iolaini		
159	<i>Ancema blanka</i> de Niceville	Silver Royal	Common

Sr. No.	Species	Common Name	Status
160	<i>*Pratapa deva</i> (Moore)	White Royal	Rare
161	<i>Tajuria cippus</i> (Fabricius)	Peacock Royal	Common
162	<i>*Tajuria jehana</i> Moore	Plains Blue Royal	Rare
	Tribe Hypolycaenini		
163	<i>*Hypolacaena othona</i> Hewitson	Orchid Tit	Rare
	Tribe Deudorigini		
164	<i>Deudorix epijarbus</i> (Moore)	Cornelian	Common
165	<i>*Deudorix isocrates</i> (Fabricius)	Common Guava Blue	Common
166	<i>*Deudorix perse</i> Hewitson	Large Guava Blue	Common
167	<i>*Rapala iarbus</i> Fabricius	Indian Red Flash	Common
168	<i>*Rapala manea</i> Hewitson	Slate Flash	Common
169	<i>*Rapala varuna</i> Horsfield	Indigo Flash	Rare
	Subfamily CURETINAE		
170	<i>*Curetis thetis</i> Drury	Indian Sunbeam	Common
	Family HESPERIIDAE Subfamily COELIADINAE		
171	<i>*Bibasis sena</i> (Moore)	Orange Tail Awl	Rare
172	<i>*Hasora chromus</i> Cramer	Common Banded Awl	Common
173	<i>Hasora badra</i> Moore	Common Awl	Common
174	<i>*Badamia exclamationis</i> (Fab.)	Brown Awl	Common
	Subfamily PYRGINAE		
175	<i>*Celaenorrhinus leucocera</i> (Kollar)	Common Spotted Flat	Common
176	<i>*Celaenorrhinus ambareesa</i> (Moore)	Malabar Flat	Common
177	<i>Tagiades japetus</i> Stoll	Suffused Snow Flat	Common
178	<i>Tagiades gana</i> Moore	Large Snow Flat	Common
179	<i>Tagiades litigiosa</i> Moschler	Water Snow Flat	Common
180	<i>*Pseudocoladenia dan</i> (Fab.)	Pied Flat	Common
181	<i>*Coladenia indrani</i> Moore	Tricolour Pied Flat	Rare
182	<i>*Sarangesa dasahara</i> (Moore)	Common Small Flat	Common
183	<i>Sarangesa purendra</i> (Moore)	Spotted Small Flat	Common
184	<i>*Tapena thwaitesi</i> Moore	Black Angle	Common
185	<i>Odontoptilum angulata</i> (R. Felder)	Chestnut Angle	Common
186	<i>*Odontoptilum ransonnnettii</i> (R. Felder)	Golden Angle	Rare
187	<i>Gomalia elma</i> Trimen	African Marbled Skipper	Common
188	<i>*Spialia galba</i> (Fabricius)	Indian Skipper	Common

Sr. No.	Species	Common Name	Status
	Subfamily HESPERIINAE		
189	<i>Ampittia dioscorides</i> Fab.	Bush Hopper	Common
190	<i>Halpe homolea</i> Hewitson	Indian Ace	Rare
191	<i>Iambrix salsala</i> Moore	Chestnut Bob	Rare
192	<i>Notocrypta paralysos</i> Wood-Mason & de Niceville	Common Banded Demon	Rare
193	<i>Notocrypta curvifascia</i> R. Felder	Restricted Demon	Rare
194	* <i>Udaspes folus</i> (Cramer)	Grass Demon	Common
195	* <i>Suastus gremius</i> (Fabricius)	Indian Palm Bob	Common
196	* <i>Gangara thyrsis</i> (Fabricius)	Giant Redeye	Common
197	* <i>Matapa aria</i> (Moore)	Common Redeye	Common
198	* <i>Taractrocera maevius</i> (Fabricius)	Common Grass Dart	Common
199	* <i>Taractrocera ceramas</i> Hewitson	Tamil Grass Dart	Common
200	* <i>Oriens goloides</i> Moore	Common Dartlet	Rare
201	* <i>Potanthus pseudomaesa</i> Moore	Common Dart	Common
202	* <i>Potanthus dara</i> Kollar	Dart	Rare
203	* <i>Telicota colon</i> Fabricius	Common Palm Dart	Common
204	* <i>Telicota ancilla</i> Herrich-Schiiffer	Dark Palm Dart	Common
205	<i>Parnara naso</i> Fabricius	Straight Swift	Common
206	<i>Gegenes nostradamus</i> Fabricius	Dingy Swift	Rare
207	* <i>Borbo cinnara</i> Walker	Rice Swift	Common
208	* <i>Borbo bevani</i> Moore	Bevan's Swift	Rare
209	<i>Pelopidas agna</i> Moore	Obscure Branded Swift	Common
210	* <i>Pelopidas mathias</i> Fabricius	Small Branded Swift	Common
211	* <i>Pelopidas conjuncta</i> Herrich-Schiiffer	Conjoined Swift	Common
212	* <i>Caltoris kumara</i> Moore	Blank Swift	Rare
213	<i>Caltoris philippina</i> Herrich-Schiiffer	Philippine Swift	Rare

SUMMARY

The enumeration of 213 species belonging to 125 genera of five families occurring in the State of Maharashtra is provided especially compiled from Goankar (1996) and the scattered published work.

ACKNOWLEDGEMENTS

The author is grateful to the Director, Zoological Survey of India, Kolkata for facilities, to Dr. Anil Mahabal, Scientist E and Officer-in-Charge, Zoological Survey of Pune for giving me an opportunity to contribute this work. The encouragement and facilities provided by Dr. Kailash Chandra, Scientist-F and Officer-in-Charge, Zoological Survey of India, Jabalpur are thankfully acknowledged.

REFERENCES

- Andheria, A.P. 2001. Diversity of Butterflies near a Pool in the Sanjay Gandhi National Park, Mumbai, *J. Bombay Nat. Hist. Soc.*, **98**(2) : 302-303.
- Bell, T.R. 1909. Common butterflies of the plains of India. *J. Bombay Nat. Hist. Soc.*, **19** : 16-58, 438-74, 635-682.
- Bell, T.R. 1910. Common butterflies of the plains of India Parts VII, VIII. *J. Bombay Nat. Hist. Soc.*, **19** : 846-879, **20** : 279-330.
- Bell, T.R. 1911. Common butterflies of the plains of India Part IX. *J. Bombay Nat. Hist. Soc.*, **20** : 1115-36.
- Bell, T.R. 1912. Common butterflies of the plains of India. Parts X, XI. *J. Bombay Nat. Hist. Soc.*, **21** : 517-44, 740-66 Part XII, **21** : 1131-57.
- Bell, T.R. 1913. Common butterflies of the plains of India. Parts XIII, XIV, XV. *J. Bombay Nat. Hist. Soc.*, **22** : 92-100, 320-44, 517-31.
- Bell, T.R. 1914. Common butterflies of the plains of India. Part XVI. *J. Bombay Nat. Hist. Soc.*, **23** : 73-103.
- Bell, T.R. 1915. Common butterflies of the plains of India. Part XVII. *J. Bombay Nat. Hist. Soc.*, **24** : 481-498.
- Bell, T.R. 1916. Common butterflies of the plains of India. Part XVIII. *J. Bombay Nat. Hist. Soc.*, **24** : 656-672.
- Bell, T.R. 1918. Common butterflies of the plains of India. Parts XIX, XX. *J. Bombay Nat. Hist. Soc.*, **25** : 430-453, 636-644; Part XXI **26** : 98-140.
- Bell, T.R. 1919. Common butterflies of the plains of India Parts XXII, XXIII *J. Bombay Nat. Hist. Soc.*, **26** : 438-487, 750-769.
- Bell, T.R. 1920. Common butterflies of the plains of India Parts XXIV, XXV *J. Bombay Nat. Hist. Soc.*, **26** : 941-954, **27** : 26-32; Part XXVI **27** : 211-227.
- Bell, T.R. 1921. Common butterflies of the plains of India Parts XXVII, XXVIII. *J. Bombay Nat. Hist. Soc.*, **27** : 431-447, 778-793.
- Bell, T.R. 1923. Common butterflies of the plains of India Parts XXIX, XXX. *J. Bombay Nat. Hist. Soc.*, **28** : 429-455, 703-717.
- Bell, T.R. 1924. Common butterflies of the plains of India Parts XXXI. *J. Bombay Nat. Hist. Soc.*, **29** : 921-946, Part XXXII, **30** : 132-150.
- Bell, T.R. 1925. Common butterflies of the plains of India Parts XXXIII, XXXIV, XXXV. *J. Bombay Nat. Hist. Soc.*, **30** : 285-305, 561-585, 820-837.
- Bell, T.R. 1926. Common butterflies of the plains of India Parts XXXVI, XXXVII. *J. Bombay Nat. Hist. Soc.*, **31** : 323-351, 655-686.
- Bell, T.R. 1927. Common butterflies of the plains of India Part XXXVIII. *J. Bombay Nat. Hist. Soc.*, **31** : 951-974.
- Best, A.E.G. 1952. *J. Bombay Nat. Hist. Soc.*, **50**(2) : 331-339.

- Best, A.E.G. 1953. *J. Bombay Nat. Hist. Soc.*, **53**(2) : 282-284.
- Editors, 1956. *J. Bombay Nat. Hist. Soc.*, **56**(2) : 358-359
- Chaturvedi, N. and Satheesan S.M. 1980. Butterflies of Bombay-1, *Hornbill*, (1) : 6-8, 32.
- Chaturvedi, N. and Satheesan S.M. 1980. Butterflies of Bombay-2, *Hornbill*, (2) : 8 & 16.
- Chaturvedi, N. and Satheesan S.M. 1980. Butterflies of Bombay-3, *Hornbill*, (3) : 26
- Chaturvedi, N. and Satheesan S.M. 1980. Butterflies of Bombay-4, *Hornbill*, (4) : 30.
- Chaturvedi, N. and Satheesan S.M. 1981. Butterflies of Bombay-5, *Hornbill*, (1) : 28.
- Chaturvedi, N. and Satheesan S.M. 1981. Butterflies of Bombay-6, *Hornbill*, (2) : 28.
- Chaturvedi, N. and Satheesan S.M. 1981. Butterflies of Bombay-7, *Hornbill*, (3) : 34.
- Chaturvedi, N. and Satheesan S.M. 1981. Butterflies of Bombay-8, *Hornbill*, (4) : 34.
- Chaturvedi, N. and Satheesan S.M. 1982. Butterflies of Bombay-9, *Hornbill*, (1) : 29.
- Chaturvedi, N. and Satheesan S.M. 1982. Butterflies of Bombay-10, *Hornbill*, (2) :
- Chaturvedi, N. and Satheesan S.M. 1982. Butterflies of Bombay-11, *Hornbill*, (4) : 33.
- Chaturvedi, N. and Satheesan S.M. 1983. Butterflies of Bombay-12, *Hornbill*, (1) : 31.
- Chaturvedi, N. and Satheesan S.M. 1984. Butterflies of Bombay-13, *Hornbill*, (1) : 38.
- Chaturvedi, N. and Satheesan S.M. 1985. Butterflies of Bombay-14, *Hornbill*, (3) : 38-40.
- Evans, W.H. 1932. *The Identification of Indian Butterflies*. Bombay Natural History Society, Bombay, pp. 455, 32 pl.
- Goankar, Harish, 1996. Butterflies of the Western Ghats, India (including Sri Lanka) : A Biodiversity Assessment of a Threatened Mountain System. A report submitted to the Centre for Ecological Sciences, Bangalore, India. 86 pp
- Kunte, K. 2000. *Butterflies of Peninsular India*. University Press (India) Limited, Hyderabad, 254 pp.
- Kurhade, S.M. and Kadlag, S. 1995. Butterflies of Bhandardara, taluka : Akole district : Ahmednagar, Maharashtra. *Trends in Life Sciences (India)*, **10**(1) : 31-34.
- Larsen, T.B. 1987. The Butterflies of the Nilgiri Mountains of Southern India (Lepidoptera: Rhopalocera). *J. Bombay Nat. Hist. Soc.*, **84**(1) : 26-54; (2): 291-316; (3) : 560-584.
- Larsen, T. B. 1988. The Butterflies of the Nilgiri Mountains of Southern India (Lepidoptera : Rhopalocera). *J. Bombay Nat. Hist. Soc.*, **85**(1) : 26-43.
- Sharma, R.M. 2008. *Insecta : Lepidoptera : Rhopalocera and Grypocera. Zool. Surv. India, Fauna of Lonar Wildlife Sanctuary, Conservation Area Series*, **37** : 181-190.
- Sharma, R.M. and C. Radhakrishnan 2004. *Insecta: Lepidoptera: Rhopalocera and Grypocera. Zool. Surv. India, Fauna of Pench National Park, Conservation Area Series*, **20** : 251-274
- Sharma, R.M. and C. Radhakrishnan 2005. *Insecta : Lepidoptera : Rhopalocera and Grypocera. Zool. Surv. India, Fauna of Melghat Tiger Reserve, Conservation Area Series*, **24** : 337-400.
- Sharma, R.M. and C. Radhakrishnan 2006a. *Insecta : Lepidoptera : Rhopalocera and Grypocera. Zool. Surv. India, Fauna of Tadoba Andhari Tiger Reserve, Conservation Area Series*, **25** : 255-277.

- Sharma, R.M. and N. Chaturvedi 2006b. Insecta : Lepidoptera : Rhopalocera and Grypocera. *Zool. Surv. India, Fauna of Sanjay Gandhi National Park (Invertebrates), Conservation Area Series*, **26** : 71-124.
- Smetacek, P. 2006. Checklist of South Asian Skipper Butterflies (Lepidoptera : Hesperidae). *Bionotes*, **8**(4) : 92-95.
- Smetacek, P. 2007. Checklist of South Asian Skipper Butterflies (Lepidoptera : Hesperidae). *Bionotes*, **9**(1) : 13-17.
- Talbot, G. 1939. *The Fauna of British India including Ceylon and Burma*, Butterflies Second Edition, Taylor & Francis Ltd., London, 1, pp. 600.
- Talbot, G. 1947. *The Fauna of British India including Ceylon and Burma*, Butterflies Second Edition, Taylor & Francis Ltd., London, 2, pp. 506.
- Varshney, R.K. 2006. An estimate of the Numbers of Butterfly species in the Indian Region. *Bionotes*, **8**(3) : 61-63.
- Wynter-Blyth, M.A. (1957). *Butterflies of the Indian Region*. Bombay Natural History Society, Bombay pp. 523.

INSECTA : TRICHOPTERA (CADDISFLIES)

R.M. SHARMA and KAILASH CHANDRA*

Zoological Survey of India, Western Regional Centre, Pune-411044

INTRODUCTION

Small to moderate sized moth-like insects are commonly called 'caddisflies'. Their eruciform larvae popularly referred as 'caddis worms' are capable of constructing silky cases to live in. Adults bear setaceous antennae, densely hairy membranous wings with a very few cross veins and are kept roof-like over the back at rest. Forewings are elongate and hindwings broader with folded anal area. Wings with very few crossveins.

World's extant valid species of Trichoptera are 12,627, accommodated in 46 extant families (Morse, 2009). As per world checklist (Morse, 2009) the Maharashtra fauna of caddisflies is known by following 39 valid species of 17 genera under 9 families. The studies conducted in the past on this group from the state are restricted to a few places like Khandala and Mumbai thus it can safely be said that the entire state remains by and large unexplored as far as trichopterans are concerned.

Order TRICHOPTERA W. Kirby, 1813

Superfamily HYDROPSYCHOIDEA

J. Curtis, 1835

Family DIPSEUDOPSIDAE G. Ulmer, 1904

Subfamily DIPSEUDOPSINAE G. Ulmer, 1904

1. *Dipseudopsis bicolorata* Martynov 1935

Maharashtra

2. *Dipseudopsis onychophora* Navas 1935

Maharashtra

3. *Dipseudopsis recta* (Martynov 1935)

Maharashtra (Mumbai)

4. *Dipseudopsis triclavata* Martynov 1935

Maharashtra, Assam

Subfamily HYALOPSYCHINAE J.A. Lestage,
1925

5. *Hyalopsyche similis* Martynov 1935

Maharashtra, Bihar

Family ECNOMIDAE G. Ulmer, 1903

6. *Ecnomus pusanus* Mosely 1932

Maharashtra, Bihar

Family HYDROPSYCHIDAE J. Curtis, 1835

Subfamily DIPLECTRONINAE G. Ulmer, 1951

7. *Diplectrona indica* (Mosely 1931)

Maharashtra

8. *Diplectrona salai* Navas 1932

Maharashtra

Subfamily HYDROPSYCHINAE J. Curtis, 1835

9. *Cheumatopsyche chlorogastra* (Navas 1932)

Maharashtra, (Khandala)

10. *Cheumatopsyche indica* (Novas 1932)

Maharashtra, (Khandala)

11. *Cheumatopsyche stenocyta* Navas 1932

Maharashtra, (Khandala)

12. *Cheumatopsyche suffusa* Navas 1932

Maharashtra, (Khandala)

13. *Hydromanicus spatulatus* (Martynov 1935)

Maharashtra

- Family PSYCHOMYIIDAE F Walker, 1852
Subfamily PSYCHOMYIINAE F Walker, 1852
14. *Psychomyiella acuta* (Navas 1934)
Maharashtra
Subfamily TINODINAE Y.J.Li & J.C. Morse, 1997
15. *Tinodes pullulans* Navas 1932
Maharashtra (Khandala), Meghalaya, Mizoram, Manipur, Karnataka, Madhya Pradesh
- Superfamily LEPTOCEROIDEA W.E. Leach, 1815
Family CALAMOCERATIDAE G. Ulmer, 1905
Subfamily ANISOCENTROPODINAE J.A. Lestage, 1936
16. *Anisocentropus kempii* Martynov 1963
Maharashtra
Subfamily CALAMOCERATINAE G. Ulmer, 1905
17. *Ganonema flexuosum* (Martynov 1936)
Maharashtra
Family LEPTOCERIDAE W.E. Leach, 1815
Subfamily LEPTOCERINAE W.E. Leach, 1815
Tribe **Leptocerini** W.E. Leach, 1815
18. *Leptocerus chatadalaja* Schmid 1987
Maharashtra, Karnataka
19. *Leptocerus posticus* (Banks 1911)
Maharashtra, Bengal Orissa, Kerala, Andhra Pradesh, Tamil Nadu, Karnataka
Tribe **Oecetini** A.J. Silfvenius, 1905
20. *Oecetis fimbriata* Navas 1935
Maharashtra
21. *Oecetis hyagriva* Schmid, 1995
Maharashtra, (Mumbai)
22. *Oecetis insignis* (Banks 1911)
Maharashtra, (Mumbai)
23. *Oecetis punctulata* Navas 1932
Maharashtra
24. *Oecetis rufescens* Navas 1932
Maharashtra
Tribe **Setodini** J.C. Morse, 1981
25. *Setodes bhimachringa* Schmid 1987
Maharashtra, Kerala, Karnataka
26. *Setodes dantavarna* Schmid 1987
Maharashtra, Kerala, Tamil Nadu, Karnataka
27. *Setodes furcatus* Navas 1932
Maharashtra, (Khandala)
28. *Setodes parisamchuddha* Schmid 1987
Maharashtra, Karnataka, Tamil Nadu
29. *Setodes tejasvin* Schmid 1987
Maharashtra, Madhya Pradesh
30. *Setodes tenuifalcatus* Martynov 1936
Maharashtra, Madhya Pradesh, Bihar
31. *Setodes viridellus* Navas 1932
Maharashtra, (Khandala)
32. *Trichosetodes atiharini* Schmid 1987
Maharashtra
33. *Trichosetodes karapatradhara* Schmid 1987
Maharashtra, Karnataka, Tamil Nadu
- Superfamily LIMNEPHILOIDEA F. Kolenati, 1848
Family GOERIDAE G. Ulmer, 1903
Subfamily GOERINAE G. Ulmer, 1903
34. *Goera nigricornis* Navas 1932
Maharashtra
Superfamily PHILOPOTAMOIDEA J.F. Stephens, 1829
Family PHILOPOTAMIDAE J.F. Stephens, 1829
Subfamily CHIMARRINAE P. Rambur, 1842
35. *Chimarra bicolor* Navas 1932
Maharashtra
36. *Chimarra pilosella* Navas 1931
Maharashtra (Mumbai)
37. *Chimarra pulla* Navas 1932
Maharashtra (Mumbai)
- Family STENOPSYCHIDAE A.V. Martynov, 1924
Subfamily STENOPSYCHINAE A.V. Martynov, 1924
38. *Stenopsyche benaventi* Navas 1934
Maharashtra, Bihar
39. *Stenopsyche splendida* Martynov 1935
Maharashtra (Mumbai) Andhra Pradesh

SUMMARY

The present paper embodies a list of 39 species

of caddisflies under 17 genera spread over 9 families recorded from Maharashtra State.

REFERENCES

- Higler, L.W.G. 1992. A check-list of the Trichoptera recorded from India and a larval key to the families. *Oriental Insects*, **26** : 67-106.
- Morse, J.C. (Ed.). 2009. Trichoptera World Checklist <http://entweb.clemson.edu/database/trichopt/index.htm> (Accessed on 21st May, 2009).
- Martynov, A.B. 1935. On a collection of Trichoptera from the Indian Museum. Part I. Annulipalpia. *Rec. Indian Mus.*, **37** : 93-209.
- Martynov, A.B. 1936. On a collection of Trichoptera from the Indian Museum. Part II.-Integripalpia. *Rec. Indian Mus.*, **38** : 239-306.
- Saini, M.S., Kaur, M. and Bajwa, P.K. 2001. An updated check-list of the Indian Trichoptera along with an illustrated key to its families. *Rec. zool. Surv. India*, **99**(1-4) : 201-256.
- Schmid, F. 1995a. Les *Oecetis* du groupe d'eburnea en Inde (Trichoptera : Leptoceridae). *Faberies*, **20**(2) : 41-56.
- Schmid, F. 1995b. Les *Oecetis* du groupe de testacea en Inde (Trichoptera : Leptoceridae). *Faberies*, **20**(2) : 57-78.
- Schmid, F. 1995c. Le genre *Oecetis* en Inde (Trichoptera : Leptoceridae). *Faberies*, **20**(4) : 113-151.

INSECTA : HYMENOPTERA : VESPOIDEA : FORMICIDAE

SHEELA, S. and CHATTOPADHYAY, A.

Zoological Survey of India, M-Block, New Alipore, Kolkata-700 053, India

INTRODUCTION

Ants belonging to the family Formicidae is one of the most dominant group of insects. They are familiar to all, ecologically important, highly intelligent and well organized social insects. Most of them express high degree of polymorphism which is an obstacle in the study of their systematics. Most important contribution to the study of Formicidae of India was contributed by Bingham (1903). Forel (1902, 1903) reported 45 species from Maharashtra. Aravind *et al.*, 2011 published 34 species from Amravati district (Maharashtra). This study shows that a total of 100 species and 10 subspecies belonging to 33 genera exist in the state of Maharashtra.

Only ants collected in this study are treated in detail here. Other species listed here are compiled from the literature. Keys are mainly based on workers and only for the taxa of Maharashtra.

LIST OF FORMICIDAE

1. *Aenictus ambiguus* Shuckard–Gujarat, Maharashtra, Sikkim, Uttar Pradesh, W. India.
2. *Aenictus aitkeni* Forel–W. India, Kerala, Maharashtra
3. *Aenictus aratus* Forel–Himachal Pradesh, Karnataka, Kerala, Maharashtra, Tamil Nadu.
4. *Aenictus brevicornis* (Mayr)–Assam, Karnataka, Kerala, Maharashtra, Meghalaya, UP, W. Bengal.
5. *Aenictus ceylonicus* (Mayr)–Karnataka,

Maharashtra, Australia, Indonesia, New Guinea, Sri Lanka, Taiwan.

6. *Aenictus clavatus* Forel–Gujarat, Karnataka, Maharashtra, Sikkim.
7. *Aenictus dentatus* Forel–Maharashtra.
8. *Aenictus latiscapus* Forel–Maharashtra, Rangoon, Myanmar.
9. *Aenictus pachycerus* (Smith)–Himachal Pradesh, Karnataka, Kerala, Maharashtra, Tamil Nadu.
10. *Aenictus punensis* Forel (1900)–W. India, Maharashtra.
11. *Aenictus wroughtonii* Forel–Kerala, Madhya Pradesh, Maharashtra, Prinsnen Island.
12. *Anochetus graeffei* Mayr–Bengal, Belgaum, Nilgiris, Pune, Sikkim, S. & W. India, Sri Lanka, Myanmar.
13. *Anochetus taylori* Forel–Belgaum, Nilgiris, Maharashtra, W. India.
14. *Aphaenogaster beccarii* Emery–Karnataka, Maharashtra, W. India, Sumatra.
15. *Aphaenogaster rothneyi* Forel–Madhya Pradesh, Sikkim, Tamil Nadu, Uttar Pradesh, W. Bengal.
16. *Aphaenogaster schurri* (Forel)–Maharashtra, Meghalaya, C. India, Myanmar.
17. *Camponotus angusticollis* (Jerdon)–Andaman, Assam, Meghalaya, Orissa, Sikkim, W. Bengal, Myanmar.
18. *Camponotus compressus*–Throughout India,

- Nepal, Sri Lanka, Philippines, Arabia, Borneo, Africa, Russia.
19. *Camponotus misturus* Smith—Maharashtra, Borneo, Myanmar.
 20. *Camponotus parius* Emery—Throughout India, China, Malacca, Myanmar, Sri Lanka, Siam.
 21. *Camponotus sericeus* Fabricius—Delhi, Karnataka, Tamil Nadu, Orissa, W. Bengal, Manipur, Meghalaya, Myanmar, Sri Lanka.
 22. *Camponotus barbatus taylori* Fab.—N.W. Himalayas, Sikkim, Orissa, Pune, Nilgiris, Arabia, Tropical Africa, Egypt, Indochina, Myanmar, Sri Lanka.
 23. *Camponotus wasmanni* Emery—Sikkim, Meghalaya, Assam, UP, Myanmar.
 24. *Cardiocondyla nuda* Mayr—Andaman, Meghalaya, Sikkim, W. Bengal, Africa, Australia, Egypt, New Guinea, Polynesia, Sri Lanka.
 25. *Cardiocondyla parvinoda* Forel—Western Ghat, Karnataka.
 26. *Cardiocondyla wroughtonii* Forel—Maharashtra, W. India. Sri Lanka, Nepal, Taiwan, Japan, Hawaii, Thailand, Singapore, W. Malaysia, Brunei, Indonesia, Papua New Guinea, Australia, Tanzania, Florida, Louisiana.
 27. *Cerapachys longitarsus* Mayr—Karnataka, Kerala, Maharashtra, Meghalaya, Tamil Nadu, W. Bengal, Sumatra, Philippines.
 28. *Crematogaster aberrans* Forel—Arunachal Pradesh, Karnataka, Maharashtra, W. India.
 29. *Crematogaster brunnea contemta* Mayr—Delhi, W. India, W. Bengal, Sri Lanka.
 30. *Crematogaster diffusa* (Jerdon)—Through out India.
 31. *Crematogaster ebenina* Forel—Maharashtra, Sikkim, Kanara, Tenasserim.
 32. *Crematogaster perelegans* Forel—Punjab, Himalaya, Pune.
 33. *Crematogaster rogenhoferi* Mayr—Andaman and Nicobar Is., Assam, Maharashtra, Manipur, Meghalaya, Kerala, Tamil Nadu, W. Bengal, Myanmar, Sri Lanka, Sumatra.
 34. *Crematogaster rothneyi* Mayr—Bhavnagar, Gujarat, Maharashtra, Meghalaya, Sikkim, Orissa, Tamil Nadu, W. Bengal.
 35. *Crematogaster soror* Forel—Maharashtra, W. India. Myanmar.
 36. *Crematogaster* sp
 37. *Crematogaster travencorensis* Forel—Kerala, Meghalaya.
 38. *Crematogaster wroughtonii* Forel—Maharashtra, Tamil Nadu, W. Bengal.
 39. *Diacamma rugosum* Le. Guill.—Through out India, Borneo, China, New Guinea, Indonesia, Java, Philippines, Singapore, Sri Lanka, Sumatra.
 40. *Diacamma sculptum* (Jerdon)—Andaman & Nicobar Is., Arunachal Pradesh, Karnataka, Maharashtra, Kerala, Tamil Nadu, Sikkim, W. Bengal, Borneo, Philippines, Singapore, Sri Lanka, Taiwan.
 41. *Diacamma vagans* Smith—Maharashtra, Orissa, Sikkim, W. Bengal, Nepal.
 42. *Dorylus labiatus* Shuckard—Delhi, Gujarat, Himachal Pradesh, Maharashtra, Manipur, Orissa, Sikkim, UP., W. Bengal.
 43. *Dorylus orientalis* Westwood—Throughout India.
 44. *Iridomyrmex anceps* Roger—Throughout India, Java, Malaysia, Myanmar, Sri Lanka.
 45. *Lasius fuliginosus* Latr.—Maharashtra.
 46. *Lepisiota capensis* Mayr—Himalaya, Meghalaya, Central India, Sri Lanka, N. E. Africa, Aden.
 47. *Lepisiota frauenfeldi* (Mayr)—Throughout India, N. Africa, S. Europe.
 48. *Lepisiota opaca pulchella* Forel— Maharashtra, W. India.
 49. *Leptogenys chinensis* Mayr—Maharashtra, W. Bengal.
 50. *Leptogenys dentilobis* Forel—W. Ghats, Karnataka, Kerala, Maharashtra.
 51. *Leptogenys diminuta* (Smith)—Through out India, Borneo, China, Myanmar, Malacca, New Guinea, Philippines, Sri Lanka, Sumatra.

52. *Leptogenys processionalis* (Jerdon)—Kerala, Meghalaya, Orissa, Tamil Nadu, W. Bengal, Sri Lanka, Vietnam.
53. *Leptogenys* sp.
54. *Lophomyrmex quadrispinosus*—Karnataka, Kerala, Meghalaya, Orissa, Sikkim, Tamil Nadu, Uttar Pradesh, W. Bengal, Myanmar, Sri Lanka,
55. *Meranoplus bicolor* (Guer.)—Through out India, Indonesia, Bhutan, China, Malaysia, Myanmar, Nepal, Pakistan, Singapore, Sri Lanka, Thailand, Vietnam.
56. *Monomorium atomum* Forel—Assam, Maharashtra, Orissa, W. Bengal.
57. *Monomorium atomum integrium* Forel—Maharashtra, Himalaya.
58. *Monomorium criniceps* (Mayr)—Maharashtra, Karnataka.
59. *Monomrium dichroum* Forel—S. India.
60. *Monomorium effractor* (Bolton)—Maharashtra.
61. *Monomorium glabrum clarum* Forel—Maharashtra, Siwalik.
62. *Monomorium glabrum glabrocriniceps* Forel—Maharashtra, Karnataka.
63. *Monomorium floricola* Jerdon—Throughout India, Sri Lanka.
64. *Monomorium indicum* Forel—Andhra Pradesh, Maharashtra, Punjab, Tamil Nadu, Hawaii Is..
65. *Monomorium latinode* Mayr—Throughout India, Borneo, Japan, Madagascar, Malagasy, Myanmar, Sri Lanka.
66. *Monomorium pharaonis* (Linn.)—Worldwide.
67. *Monomorium wroughtoni* Forel—W. India, Karnataka, Maharashtra.
68. *Myrmecaria brunnea* Saund.—Orissa, Kerala, Tamil Nadu, Meghalaya, W. Bengal, Myanmar, Indonesia, Sri Lanka, Indochina, Sumatra.
69. *Myrmecina pilicornis* Smith—Maharashtra.
70. *Nylanderia indica* (Forel)—Arunachal Pradesh, Maharashtra.
71. *Nylanderia yerburyi*—S. India, Sri Lanka.
72. *Oecophylla smaragdina* (Fab.)—Through out India, Sri Lanka, Myanmar, China, New Guinea, Australia, Philippines.
73. *Pachycondyla rubiginosa* (Emery)—Pune, Tamil Nadu, W. India, China, Myanmar.
74. *Pachycondyla sulcata* Mayr—Andhra, Orissa, Tamil Nadu, W. Bengal, C. & W. India.
75. *Pachycondyla wroughtonii* Forel—Maharashtra.
76. *Paratrechina longicornis* Latr.—Distributed throughout tropics.
77. *Pheidole ghatika* Forel—Pune.
78. *Pheidole grayi* Forel—Pune, Sikkim, W. India.
79. *Pheidole hoogwerfi* Forel—Karnataka, Maharashtra.
80. *Pheidole lamellinoda* Forel—Delhi, Meghalaya, Maharashtra, C. & W. India.
81. *Pheidole latinoda* Roger—Maharashtra, W. Bengal, Sri Lanka.
82. *Pheidole multicens* Forel—Maharashtra, W. India.
83. *Pheidole naoraji* Forel—Maharashtra, W. India.
84. *Pheidole parva* Mayr—Arunachal Pradesh, Maharashtra, Meghalaya, W. India, Myanmar, Sri Lanka.
85. *Pheidole parva decanica* Forel—Belgaum, Karnataka, Kerala, Maharashtra, Sri Lanka.
86. *Pheidole sulcaticeps punensis* Forel—Maharashtra.
87. *Pheidole sharpi* Forel—Karnataka, Maharashtra, Tamil Nadu.
88. *Pheidole sharpi hoogwerfi*—Maharashtra.
89. *Pheidole sykesii* Forel—Maharashtra.
90. *Pheidole wood-masoni* Forel—Maharashtra, Orissa, Tamil Nadu, Uttarakhand, W. Bengal, Sri Lanka.
91. *Pheidole wroughtonii* Forel—Ahmadnagar, Karnataka, Maharashtra.
92. *Pheidologeton affinis* (Jerdon)—Arunachal Pradesh, Assam, Karnataka, Maharashtra, W.

- Bengal, W. India, Australia, Indonesia, Myanmar, Philippines, Sri Lanka, Sulawesi.
93. *Pheidologeton diversus* Jerdon—Arunachal Pradesh, Karnataka, Kerala, Maharashtra, Sikkim, W. India, Malaysia, Myanmar.
 94. *Plagiolepis exigua* Forel—Maharashtra.
 95. *Plagiolepis jerdonii* Forel—Maharashtra, Travencore.
 96. *Polyrhachis hauxwelli* Bingham—Myanmar.
 97. *Polyrhachis lacteipennis* Smith—Throughout India.
 98. *Polyrhachis lacteipennis obsoleta* Forel—Maharashtra.
 99. *Polyrhachis* sp.
 100. *Recurvidris recurvispinosa* Forel—Assam, Kerala, Tamil Nadu, Uttarakhand, W. Bengal, Maharashtra, China, Nepal, Japan.
 101. *Rhoptromyrmex mayri* Forel—Maharashtra.
 102. *Simopone emeryi* Forel—Maharashtra, Madagascar.
 103. *Solenopsis geminata* (Fab.)—Through out the world.
 104. *Tapinoma indicum* Forel—Throughout India.
 105. *Tetramorium guineense* (Fab.)—W. India, Karnataka, Kerala, Maharashtra.
 106. *Tetramorium lanuginosum* (Mayr)—Arunachal Pradesh, Assam, Gujarat, Kerala, Maharashtra, Orissa, Sikkim, W. Bengal, Australia, Borneo, England, Japan, Germany, Lebanon, Malaysia, Mauritius, Mexico, Nepal, New Guinea, Philippines, Seychelles, Singapore, Sri Lanka, Tunisia.
 107. *Tetramorium obesum* (Er. Andr)—Karnataka, Maharashtra, W. Bengal.
 108. *Tetramorium smithi* Mayr—Assam, Kerala, Maharashtra.
 109. *Tetraponera rufonigra* (Jerdon)—Through out India, China, Malagasy, Myanmar, Nicobar Is., Seychelles, Sri Lanka, Vietnam.
 110. *Tetraponera nigra* (Jerdon)—Karnataka, Kerala, Maharashtra, Sikkim, Tamil Nadu, W. Bengal Malayan subregion, Myanmar, Sri Lanka.

MATERIALS AND METHODS

Ants were mostly collected by hand picking. A few number of specimens were collected using pit fall traps and also by sweep net. Specimens were dried and set, pinned on triangular card and identified using SZX9 Wild Stereozoom Microscope.

Key to subfamilies of FORMICIDAE

1. Body with a single node2
 - Body with two nodes6
2. Acidopore present on the apex of gaster, usually guarded by fringe hairs
 - FORMICINAE
 - Acidopore absent; sting may or may not be present3
3. Pygideum or epipygium with peg like teeth or short spines4
 - Both hypopygium and pygideum unarmed ..
 - DOLICHODERINAE
4. Gastral spiracles 3-5 exposed; metapleural gland orifice concealed from above by a circular flange5
 - Gastral spiracles 3-5 concealed; metapleural gland orifice not concealed by a flange
 - PONERINAE
5. Pro-mesonotal suture distinct; Pygideum with a single pair of posteriorly directed short spines DORYLINAE
 - Promesonotal suture not distinct; Pygideum with a row of short spines or teeth
 - CERAPACHYINAE (part)
6. Pygideum transversely flattened or impressed and armed with a row of teeth
 - CERAPACHYINAE (part)
 - Pygideum transversely rounded, not armed7
7. Antennal sockets exposed; eyes absent
 - AENICTINAE
 - Antennal sockets usually concealed; eyes present except in a few genera8

8. Promesonotal suture conspicuous; hind tibia with a pectinate spur; posterior margin of median portion of clypeus not projecting back between antennal sockets
..... PSEUDOMYRMECINAE

- Promesonotal suture not always conspicuous; hind tibia without a pectinate spur; posterior margin of median portion of clypeus projecting back between antennal sockets
..... MYRMICINAE

Key to genera of Cerapachyinae

- Tibial spurs absent from middle legs; tarsal claws with a single pre apical tooth; hind basitarsus with a longitudinal impression or groove, which may be glandular on its ventral surface close to tibia *Simopone*
- Tibial spurs present on middle legs; pretarsal claws simple; hind basitarsus without a longitudinal impression *Cerapachys*

Remarks : No materials from this subfamily are collected in this study.

Subfamily AENICTINAE

Genus *Aenictus* Schuckard

1840. *Aenictus* Schuckard *Ann. Mag. Nat. Hist.*, 5 : 268
(Type species : *A. ambiguus* Schuckard, by monotypy).

Diagnostic features : Antennal sockets exposed and very close to anterior margin of head; frontal lobes eyes and pro-mesonotal suture absent; meso-metanotal suture conspicuous; pedicel two jointed.

Key to species of *Aenictus*

1. Males 9
- Workers 2
2. Mandibles narrow with three or four teeth ..
..... 3
- Mandibles broad with an apical and a preapical tooth followed by four or more smaller teeth or denticles 4
3. Anterior clypeal border entire and convex with six teeth *brevicornis* (Mayr)

- Anterior clypeal border emarginate, without teeth *ceylonicus* (Mayr)
4. Postero-lateral portions of head with pale yellow spots *laeviceps* (Smith)
- Postero-lateral portions of head without spots 5
5. Small in size; anterior clypeal border dentate *wroughtonii* Forel
- Large in size; anterior clypeal border not dentate 6
6. Occiput constricted to a narrow but distinct collar; propodeal angle longer in profile than maximum width of propodeal spiracle and far overhanging the declivitous face
..... *dentatus* Forel
- Occiput not constricted to a collar; propodeal angle not longer than maximum width of propodeal spiracle; not overhanging declivitous face 7
7. Pronotum densely microreticulate and opaque *aratus* Forel
- Pronotum smooth and shining 8
8. Longitudinal rugae present in propodeal dorsum; propodeal junction lower and more rounded *punensis* Forel
- Longitudinal rugae absent in propodeal dorsum *pachycerus* (Smith)
9. Scape of antennae cylindrical
..... *ambiguus* Schuck
- Scape of antennae compressed 10
10. Posterior border of hypopygium broadly emarginated *clavatus* Forel
- Posterior border of hypopygium entire
..... *laticapus* Forel

Aenictus punensis Forel

1901. *Aenictus punensis* Forel, 476, W., India.

1964. *Aenictus punensis*, Wilson.

Materials examined : 5W. Bhandara, 24.x.1971, V.D. Srivastava; 1W. Gunjepara, 24.x.1971, V.D. Srivastava.

Distribution : W. India Maharashtra.

Key to species of *Dolichoderinae*

- Petiole in profile a simple transversely flattened strip, overhung by gaster.....
..... *Tapinoma*
- Petiole in profile a conspicuous erect node
..... *Iridomyrmex*

Genus *Tapinoma* Forster

1850. *Tapinoma* Forster, *Hym. Stud.*, 1 : 43. (Type species: *Tapinoma collina* Forster by monotypy.

Diagnostic features : Mandibles with apical two or three teeth large followed by a row of denticles; anterior border of clypeus mostly emarginated; petiole reduced, overhung by the first gastral tergite and not visible from dorsal side; five gastral tergites visible on dorsal view.

Tapinoma indicum Forel

1895. *Tapinoma indicum* Forel, 472, W., India.

Materials examined : 2W. Bhandara, 23.x.1971, V.D. Srivastava.

Distribution : Throughout India.

Elsewhere : Vietnam.

Subfamily DORYLINAЕ

Genus *Dorylus* Fabricius

1793. *Dorylus* Fabricius, *Ent. Syst.*, 2 : 365. (Type species : *Vespa helvola* Linnaeus, 1764 by designation of Schuckard 1840.

Diagnostic features : Mandibles with apical tooth long and acute, inner margin with a single or more teeth; antennal sockets exposed; antennae 9, 10 or 11 segmented; eyes absent; pro-mesonotal suture present; meso-metanotal suture absent; pedicel one segmented; first gastral segment smaller than second one; pygideum armed at each side with a tooth or spine.

Key to species of *Dorylus*

- Antennae with nine segments *orientalis*
- Antennae with 10 segments in worker minor and 11 in worker major *labiatus*

Dorylus labiatus Shuckard

1840. *Dorylus labiatus* Shuckard, 319, M., India.

Materials examined : 4W. Bhandara, 24.x.1971, V.D. Srivastava, 3W. Gunjepar, 24.x. 1971, V.D. Srivastava.

Distribution : Delhi, Gujarat, Himachal Pradesh, Maharashtra, Manipur, Orissa, sikkim, Uttar Pradesh, W. Bengal.

Subfamily FORMICINAE

Key to genera of Formicinae

1. Antenna with 11 segments2
- Antenna with 12 segments4
2. Propodeum and petiole with spines or tubercles
..... *Lepisiota*
- Propodeum and petiole unarmed3
3. Mesometanotal suture deep *Plagiolepis*
- Meso-metanotal suture not deep
..... *Anoplolepis*
4. Antennal sockets situated close to the posterior clypeal margin5
- Antennal sockets situated away from the posterior clypeal margin7
5. Mandibles with more than 5 teeth6
- Mandibles with 5 teeth *Paratrechina*
6. Mandibles with 6-7 teeth; setae on thorax arranged in pairs *Nylanderia*
- Mandibles with 7 or more teeth; setae on thorax not paired *Lasius*
7. Mandibles with 10 or more teeth or denticles; petiole reduced to an elongate low node
..... *Oecophylla*
- Mandibles with 5-7 teeth; petiole an erect node or scale8
8. First gastral tergite covers more than half length of gaster *Polyrhachis*
- First gastral tergite covers less than half of gaster *Camponotus*

Genus 1. *Camponotus* Mayr

1861. *Camponotus* Mayr, *Europ Formicid.*; 35. Wien (Type species: *Formica ligniperda* Latreille, 1802, *Fourmis*: 88, by designation of Bingham, 1903.

Diagnostic features : Clypeus with median portion projecting as a truncated lobe; palp formula 6,4; antennae inserted at a certain distance from posterior clypeal margin; thorax unarmed.

Key to species of *Camponotus*

1. Thorax regularly curved2
- Thorax not regularly curved3
2. Curve of thorax interrupted at mesometanotal suture, propodeum raised, rounded above....
..... *wasmanni*
- Curve of thorax interrupted at meso-metanotal suture, dorsum of propodeum flat or concave and apex excavate *sericeus*
3. Tibiae of legs channeled5
- Tibiae of legs not channeled4
4. Tibiae of legs cylindrical; brownish in colour;
..... *barbatus taylori*
- Tibiae compressed; black in colour with the gaster bearing a dense yellow pubescence
..... *paria*
5. Head posteriorly constricted to form a collar
..... *angusticollis*
- Head posteriorly not constricted
..... *compressus*

1. *Camponotus angusticollis* (Jerdon)

1851. *Formica angusticollis* Jerdon, 120, W.Q., India.
1863. *Camponotus angusticollis* Roger.

Materials examined : 3W, Nagpur, Ranido, 22.i.2009, Sheela, S. and Party.

Distribution : Andaman, Assam, Meghalaya, Orissa, Sikkim, W. Bengal.

Elsewhere : Myanmar.

2. *Camponotus compressus* (Fabricius)

1787. *Formica compressa* Fabricius, 307, W. India.

Materials examined : Several specimens from all over the regions.

Distribution : All over India.

Elsewhere : Africa, Arabia, Borneo, China, Nepal, Philippines, Sri Lanka.

3. *Camponotus misturus* (Smith)

1857. *Formica mistura* Smith, F. 1857, 53, Q. Borneo.

Materials examined : 3W. Jalgaon, Girish Kumar, 14.ix.2007.

Distribution : India (Maharashtra), Borneo.

Elsewhere : Myanmar.

4. *Camponotus sericeus* (Fabricius)

1798. *Formica sericea* Fab., 279, W. Senegal.

1862. *Camponotus sericeus* Mayr.

Materials examined : 6W. Chandrapur, Pathanpura, 25.i.2009; 3W.Yavatmal, Laded, 27.i.2009; 2W. Amravati, 29.i.2009, 2W. Wardha, 1.ii.2009, Sheela, S. and Party.

Distribution : India (Delhi, Karnataka, Manipur, Meghalaya, Orissa, Tamil Nadu, W. Bengal).

Elsewhere : Myanmar, Sri Lanka.

5. *Camponotus* sp.

Materials examined : 3W. Nagpur, Mogarkaza, 28.ix.2009.

Genus 2. *Lepisiota* Santschi

1861. *Acantholepis* Mayr, *Europ. Formic.*, 42. (Type species : *Hypoclinea frauenfeldi* Mayr, 1855 by monotypy.

1926. *Lepisiota* Santschi, *Ann. Soc. Ent. France*, 95 : 15
Type species : *Plagiolepis rothneyi* Forel, 1894, by original designation.

1989. *Baroniurbana* Pagliano et Scaramozzino, *Mem. Soc. Entomol. Ital.*, 68 : 4.

Diagnostic features : Antennae 11 jointed; propodeum bidentate or bituberculate; petiole a scale with dorsal margin bispinose, bidentate or emarginated.

Key to species of *Lepisiota*

1. Scape of antennae very long, extending for more than half its length beyond head.....
.....*frauenfeldi*
- Scape not as long as *frauenfeldi* 2
2. Petiole with long acute spines
..... *opaca pulchella*
- Petiole with short thick teeth *capensis*

Lepisiota frauenfeldi Mayr

1855. *Hypoclinea frauenfeldi* Mayr : 378(W) Yugoslavia.
1861. *Acantholepis frauenfeldi* Mayr, 42.
1992. *Lepisiota frauenfeldi* Urbani *et al.*

Materials examined : 4W. Chandrapur, 25.i.2009, Sheela, S. and Party; 4W. Amravati, Pohara, 29.i.2009; 2W. Yavatmal, Parva, 26.i.2009; Sheela, S. & Party.

Distribution : Throughout India.

Elsewhere : N. Africa, S. Europe.

Genus 3. *Nylanderia* Emery

1906. *Nylanderia* Emery *Ann. Soc. Ent. Belg.*, 50 : (Type-species : *Formica vividula* Nylander 1846 by original designation).
2010. *Nylanderia* La Polla, *et al.* 126.

Diagnostic features : Palp formula 6, 4. Mandible with 6 or 7 teeth; eyes placed mid-laterally; usually with abundant setae on body; dorsal mesonotal setae arranged loosely in pairs.

Key to species of *Nylanderia*

- Clypeus convex, as broad as long; base of propodeum short, node of pedicel low, flat and transverse *indica* Forel
- Clypeus less convex, broader, base of propodeum long, node of pedicel less conspicuous *yerburyi* Forel

Nylanderia yerburyi (Forel)

1894. *Prenolepis yerburyi* Forel, 409, W. Q. M., Sri Lanka.
1916. *Prenolepis* (*Nylanderia*) *yerburyi* Viehmeyer, 147.

1921. *Paratrechina* (*Nylanderia*) *yerburyi* Wheeler, 112.

2010. *Nylanderia yerburyi* LaPolla, Brady & Shattuck, 127.

Materials examined : 6W. Chandrapur, Shivani, 24.ii.2009, Sheela, S. and party; 3W. Jalgaon, 14.ix.2002, Girish Kumar.

Distribution : India (Maharashtra).

Elsewhere : Sri Lanka.

Genus 4. *Oecophylla* F. Smith

1860. *Oecophylla* F. Smith, *J. Proc. Linn. Soc.*, 5 : 101.
(Type species : *Formica smaragdina* Fabricius, 1775
Syst. ent., 828 by monotypy.

Diagnostic features : Mandibles elongate, triangular; palp formula 5,4; clypeus large, convex, its anterior margin overhanging basal borders of mandibles; thorax strongly constricted in the meso-metanotal region; petiole elongate and narrow in dorsal view, forming a low rounded node in profile.

Oecophylla smaragdina (Fabricius)

1775. *Formica smaragdina* Fabricius, 828, Q, India.
1860. *Oecophylla smaragdina*, Smith, F., 102.

Materials examined : Several examples from throughout the regions.

Distribution : Throughout India.

Elsewhere : Australia, China, Myanmar, New Guinea, Philippines, Sri Lanka.

Genus 5. *Paratrechina* Motschulsky

1863. *Paratrechina* Motschulsky, *Bull. Soc. Nat. Moscou*, 36(3) : 13. Type species : *Paratrechina currens* Motschulsky, 1863, op. cit. : 14 (= *Formica longicornis* Latreille, 1802, *Fourmis*, : 113), by designation of Wheeler, 1911.

Diagnostic features : Mandibles narrow, armed with five or six teeth, weakly or not overhung by clypeus; antennae inserted close to the posterior clypeal margin; thorax and pedicel unarmed; pedicel- a reduced scale overhung by first gastral segment; dorsum of head, thorax and gaster with distinctly paired coarse setae.

***Paratrechina longicornis* Latr.**

1802. *Formica longicornis* Latreille, 113, W., Senegal.

1921. *Paratrechina longicornis* Wheeler, W. M. 112.

Materials examined : Several examples from all over the regions.

Distribution : All over India and through out tropical regions.

Genus 6. *Plagiolepis* Mayr

1861. *Plagiolepis* Mayr, *Europ. Formicid.* : 52. wien. Type species : *Formica pygmaea* Latreille, (1798), *Essai Fourmis de la France* : 45. by monotypy.

Diagnostic features : Mandibles with five teeth; clypeus projecting over basal borders of mandibles; antennae 11-segmented; thorax weakly constructed between pronotum and propodeum; thorax and pedicel unarmed; pedicel a reduced scale, inclined forwards and overhung by the first gastral segment.

Key to species of *Plagiolepis*

- Brownish yellow; head punctured *exigua*
- Black, head smooth *jerdonii*

No specimens of this genus were collected.

Genus 7. *Polyrhachis* F. Smith

1857. *Polyrhachis* F. Smith, *J. Proc. Linn. Soc.*, 2 : 58. Type species : *Formica bihamata* Drury, 1773, *Illust. Nat. Hist.* vol., 2 : 73, by original designation.

1858. *Hoplomyrmus* Gerstaecker, *Mber. Dt. Akad. Wiss. Berl.*, : 262. Type species : *Hoplomyrmus schistacea* Gerstaecker, 1858, loc. cit., by monotypy.

Diagnostic features : Median portion of clypeus projecting as a lobe; antennae inserted behind the posterior clypeal margin; eyes strongly protruding; thorax and pedicel usually with spines or teeth.

Key to species of *Polyrhachis*

1. Thorax with spines or teeth 2
 - Thorax without spines or teeth *rastellata*
2. Node of pedicel with two small teeth in the middle and two long lateral spines *hauxwelli*

- Node of pedicel with only lateral spines, no median teeth *lacteipennis*

Polyrhachis lacteipennis obsoleta is excluded from key for want of details.

1. *Polyrhachis hauxwelli* Bingham

1903. *Polyrhachis hauxwelli* Bingham, 394, 133, W. Myanmar.

Materials examined : 2W. Kolhapur, 23.xii.1971, V.D. Srivastava; 1W. Bhandara, 24.x.1971, V.D. Srivastava, 7W. Chandrapur, Pathanpura, 25.i.2009, 4W. Amravati, Dhamangudi, 29.i.2009.

Distribution : India (Maharashtra).

Elsewhere : Myanmar.

2. *Polyrhachis lacteipennis* Smith, F.

1858. *Polyrhachis lacteipennis* Smith, F. 60, Q. India.

1862. *Polyrhachis simplex* Mayr Q. India (Synonymy by Bolton, 1974 : 177).

Materials examined : 3W. Wardha, Pownar, 01.ii.2009; Amravati, Pohara, 29.i.2009; Yavatmal, Parva, 26.i.2009, Sheela, S. and party.

Distribution : Through out India.

3. *Polyrhachis* sp.

Materials examined : 2W. Muzafarpur, 05.vi.2009, S.I. Kazmi and Party.

Key to genera of Myrmicinae

1. Post-petiole situated on dorsal surface of gaster; gaster heart shaped .. *Crematogaster*
- Post-petiole situated on anterior surface of first gastral tergite, gaster not heart shaped 2
2. Antenna with 7 segments *Meranoplus*
- Antenna with 10 to 12 segments 3
3. Antenna with 10 segments *Solenopsis*
- Antenna with 11-12 segments 4
4. Antenna with 11 segments 5
- Antenna with 12 segments 7

5. Propodeal spines curved upwards; gaster ventrally with a triangular shape *Recurvidris*
 – Characters different 6
6. Pronotum anteriorly with a pair of spine or at least angulate *Lophomyrmex*
 – Pronotum not spinose or angulate as in the alternate 7
7. Propodeum with small spines *Pheidologeton*
 – Propodeum without spines *Monomorium*
8. Sting with an apicodorsal hyaline appendage 9
 – Sting without any appendage 10
9. Head heart shaped; ventral margin of petiole convex and keel like; anterior margin of petiole strongly arcuate *Rhoptromyrmex*
 – Head not heart shaped; ventral margin of petiole not keel like, anterior margin of clypeus not strongly arcuate *Tetramorium*
10. Ventrolateral margin of head delineated by a sharp longitudinall carina on each side *Myrmecina*
 – Ventrolateral margin of head without lateral carina 11
11. Mandible edentate or masticatory margin with third tooth from apex smaller than the fourth one (major workers) *Pheidole*
 – Masticatory margin of mandible dentate with the apical portion bearing three or more teeth or denticle; third tooth larger than the fourth one 12
12. Club of flagellum of antennae weakly thickened *Aphaenogaster*
 – Club of flagellum of antennae strongly thickened 13
13. Propodeum with a pair of teeth or spines ...
 *Cardiocondyla*
 – Propodeum unarmed *Monomorium*

Genus 1. *Aphaenogaster* Mayr

1853. *Aphaenogaster* Mayr, *Verh. Zool-bot. Ver. Wien.*, 3 : 107. Type species *Aphaenogaster sardoa* Mayr by subsequent designation of Bingham 1903 : 270.

Diagnostic features : Head usually posteriorly elongated to a neck; antennal and clypeal hollows confluent; antenna without a distinct club; propodeum armed with spines; hairs on body usually abundant and strong.

Key to species of *Aphaenogaster*

1. Head posteriorly constricted to form a neck *beccarii* Emery
 – Head posteriorly not constricted 2
2. Pronotum distinctly laterally tuberculate
 *rothneyi* Forel
 – Pronotum not tuberculate *schurri* Forel

Aphaenogaster beccarii Emery

1887. *Aphaenogaster beccarii* Emery, 456, W.Q.M., Sumatra.

Materials examined : 4W. Mahabaleswar, 14.iii.1962, K.V.L. Narayana.

Distribution : Karnataka, Maharashtra, W. India.

Elsewhere : Sumatra.

Genus 2. *Cardiocondyla* Emery

1869. *Cardiocondyla* Emery *Annali. Accad. Aspir. Nat. Napoli*, (2) : 20. Type species : *Cardiocondyla elegans* Emery, by monotypy.

Diagnostic features : Palp formula 5,3; clypeus with flattened and prominent lateral portions which projects over the mandibles; posterior margin of clypeus broadly inserted between frontal lobes; antennae with 11 to 12 segments; pro-mesonotal dorsum flattened to evenly convex in profile, without distinct sutures; propodeum un armed or bispinose.

Key to species of *Cardiocondyla*

1. Posterior margin of head rounded *nuda*

- Posterior margin of head transverse2
- 2. Post petiole broader than long
..... *wroughtonii*
- Post petiole as broad as long *parvinoda*

***Cardiocondyla parvinoda* Forel**

1902. *Cardiocondyla parvinoda* Forel, 213, W. India.

Materials examined : 3W. Amravati, Dhamangudi, 29.i.2009, Sheela, S and Party.

Distribution : India (Karnataka, Western Ghats).

Genus 3. *Crematogaster* Lund

1831. *Crematogaster* Lund, *Annls Sci. nat.*, **23** : 132. Type species : *Formica scutellaris* Olivier, 1971. *Encyl. Method. Histoire Naturelle. Insectes*, **6** : 497, by designation of Bingham, 1903.

Diagnostic features : Antennae 10 or 11 segmented; mesometanotal groove deep; propodeum usually with a pair of spines or teeth; petiole dorso-ventrally flattened without a node; dorsal surface weakly convex to weakly concave; post-petiole often with a median longitudinal groove; post petiole attached to the dorsum of first gastral segment; gaster heart shaped.

Key to species of *Crematogaster*

- 1. Head smooth and shining2
- Head sculptured7
- 2. Club of antennae with four segments
..... *wroughtonii*
- Club of antennae with 3 segments3
- 3. Pronotum smooth and shining4
- Pronotum sculptured *brunnea contemta*
- 4. Head anteriorly truncate *aberrans*
- Head normally developed5
- 5. Pro-mesonotal suture not distinct.....
..... *travencorensis*
- Promesonotal suture well marked6

- 6. Cheeks finely striate *soror*
- Cheeks smooth *ebenina*
- 7. Propodeal spines shorter than propodeum ...
..... *rothneyi*
- Propodeal spines longer8
- 8. Pronotum reticulate *rogenhoferi*
- 9. Pronotum longitudinally striate
..... *perelegans*

Crematogaster diffusa Jerdon is not included in the key for want of details.

1. *Crematogaster aberrans* Forel

1892. *Crematogaster aberrans* Forel, 532, Q.W. India.

Materials examined : 3W. Amravati, Pohara, 29.i.2009, Sheela, S and party.

Distribution : India (Arunachal Pradesh, Karnataka, Maharashtra, W. India).

2. *Crematogaster brunnea contemta* Mayr

1879. *Crematogaster contemta* Mayr, 685, W. India.

1902. *Crematogaster subnuda contemta* Forel, 208.

1928. *Crematogaster laboriosa contemta* Santschi, 33.

1922. *Crematogaster brunnea contemta* Emery, 150.

Materials examined : Several examples from Amravati, Pohara, 29.i.2009; Wardha, Pownar, 1.ii.2009, Sheela, S. and Party, Chandrapur, Shivani, 24.ii.2009, Sheela, S and party.

Distribution : India (Delhi, W. India, W. Bengal).

Elsewhere : Sri Lanka.

3. *Crematogaster rothneyi* Mayr

1879. *Crematogaster rothneyi* Mayr, 685, W. India.

Materials examined : 5W. Amravati, Pohara, 29.i.2009, 3W. Nagpur, Sillari, 21.i.2009, 4W. Wardha, Pownar, 1.ii.2009, Sheela, S. and Party.

Distribution : India (Bhavnagar, Gujarat, Maharashtra, Meghalaya, Sikkim, Tamil Nadu, W. Bengal).

4. *Crematogaster travencorensis* Forel

1902. *Crematogaster travencorensis* Forel, 200, W., India.

Materials examined : 6W. Chandrapur, Shivani, 24.ii.2009, Sheela, S and party.

Distribution : India (Maharashtra, W. India).

Elsewhere : Myanmar.

5. *Crematogaster wroughtonii* Forel

1902. *Crematogaster wroughtonii* Forel, 206, W, Q., India.

Materials examined : 3W. Chandrapur, 24. i.2009, Sheela, S and Party.

Distribution : India (Maharashtra, Tamil Nadu, W. Bengal).

Genus 4. *Lophomyrmex* Emery

1892. *Lophomyrmex* Emery, *Ann. Mus. Nat. Gen.*, 114.

Type species : *Oecodoma quadrispinosa* Jerdon 1851, *Madras J. Lit. Sci.*, 111 by monotypy.

Diagnostic features : Palp formula 2,2; clypeus with a protruding blunt tooth at middle; antennae 11-segmented; anterior pronotal angles with spines or tooth; propodeum bispinose.

Lophomyrmex quadrispinosus (Jerdon)

1851. *Oecodoma quadrispinosa* Jerdon, 111, W. India.

1892. *Lophomyrmex quadrispinosus* Emery, 114.

Materials examined : 3W. Nagpur, Mogarkaza, 28.ix.2007, S. I. Kazmi and Party; 3W. Wardha, Bardham, 25.xii.2007, Girish Kumar; 4W. Wardha, Pownar, 1.ii.2009.

Distribution : India (Karnataka, Kerala, Meghalaya, Orissa, Sikkim, Tamil Nadu, Uttar Pradesh, W. Bengal).

Elsewhere : Myanmar.

Genus 5. *Meranoplus* F. Smith

1854. *Meranoplus* F. Smith, *Trans. Ent. Soc. Lond.*, (2) : 224. Type species; *Cryptocerus bicolor* Guerin, 1845, *Iconog. Regn. Anim.*, 7 : 425, by designation of Bingham 1903.

Diagnostic features : Antennae 9 jointed; eyes large, prominent and situated towards the posterior

end of the scrobe on its ventral border; promesonotum fused, strongly margined all round and projecting posteriorly as a shelf, overhanging the propodeum which is vertical or nearly so; body covered with abundant hairs.

Meranoplus bicolor (Guerin.)

1844. *Cryptocerus bicolor* Guerin., 425, W., India.

1853. *Meranoplus bicolor*, Smith, F., 224.

Materials examined : 6W. Yavatmal, Ladheda, 27.i.2009; 2W. Chandrapur, Lohara, 24.i.2009; 3W. Nagpur, Ranido, 22. i. 2009.

Distribution : Throughout India.

Elsewhere : Bhutan, China, Indonesia, Malaysia, Myanmar, Nepal, Pakistan, Sri Lanka, Taiwan, Thailand, Singapore, Vietnam.

Genus 6. *Monomorium* Mayr

1855. *Monomorium* Mayr, *Verh. Zool.-bot. Ges. Wien.*, 5 : 452. Type species : *Monomorium minutum* Mayr, 1855 by monotypy.

Diagnostic features : Median portion of clypeus with two distinct longitudinal carinae; palp formula 1,2 or 2,2; antenna 11 or 12 segmented; promesonotal suture absent; meso-metanotal suture distinct; propodeum unarmed.

Key to species of *Monomorium*

1. Anterior margin of clypeus dentate 11
- Anterior margin of clypeus not dentate 2
2. Head smooth and shining 3
- Head sculptured 6
3. Head as broad as long *aberrans*
- Head longer than broad 4
4. Antennae 11-jointed 9
- Antennae 12-jointed 5
5. Size 1.5 to 2 mm; post-petiole slightly broader than petiole *floricola*
- Size 3-3.7 mm; post petiole much broader than petiole 7

6. Post-petiole and petiole subequal..... *indicum*
 – Post-petiole broader than petiole8
7. Yellow, abdomen posteriorly black9
 – Brown in colour *wroughtoni*
8. Head posteriorly emarginated; size 1.5 to 2 mm *dichroum*
 – Head posteriorly not emarginated, size 2.5 to 3 mm *pharaonis*
9. Meso-metanotal suture deeply impressed
 *atomum*
 – Meso-metanotal suture not deeply impressed
 *atomum integrium*
10. Head with numerous curved sub decumbent hairs and punctures; thorax with numerous outstanding hairs *criniceps* (Mayr)
 – Head with sparse short pubescence and sparse punctures; thorax without outstanding hairs
 *glabrum* (Andre)

Monomorium effractor is excluded from the key for want of details.

1. *Monomorium dichroum* Forel

1902. *Monomorium dichroum* Forel, 212, W.Q., India.

Materials examined : 2W. Jalgaon, Deopimpri Reserve Forest, Girish Kumar, 14.ix.2007, 3W. Amravati, Chikaldhara, 29.i.2009.

Distribution : S. India, Maharashtra.

2. *Monomorium floricola* (Jerdon)

1851. *Atta floricola* Jerdon, 107. W. India.

1879. *Monomorium floricola* Mayr, 671.

Materials examined : Several examples from throughout the regions.

Distribution : Throughout India.

Elsewhere : Sri Lanka.

4. *Monomorium indicum* Forel

1902. *Monomorium salomonis indicum* Forel, 213, W.Q.M., India.

Materials examined : Several examples from throughout the regions.

Distribution : India (Andhra Pradesh, Maharashtra, Punjab, Tamil Nadu).

Elsewhere : Hawaii Islands.

Remarks : This species was found dominating all over the regions.

4. *Monomorium latinode* Mayr

1872. *Monomorium latinode* Mayr, 152, W. Borneo.

Materials examined : 5W. Amravati, Dhamangudi, 29.i.2009, Sheela, S and Party.

Distribution : Throughout India.

Elsewhere : Borneo, Japan, Madagascar, Malagasy, Myanmar, Sri Lanka.

5. *Monomorium pharaonis* (Linnaeus)

1758. *Formica pharaonis* Linnaeus, 580, W., Egypt.

1862. *Monomorium pharaonis*, Mayr, 752.

Materials examined : 3W. Amravati, Chikaldhara, 29.i.2009, Sheela, S and Party. Several other examples from Yavatmal, Nagpur, Chandrapur and Wardha.

Distribution : Worldwide.

Genus 7. *Myrmecaria* Saunders

1841. *Myrmecaria* Saunders, *Trans. Ent. Soc. Lond.*, 3 : 57. Type species : *Myrmecaria brunnea* Saunders, 1841 by monotypy.

Diagnostic features : Palp formula 3,3; antennae 7-segmented; antero-lateral angles of pronotum drawn out into a tooth on each side; pro-mesonotal suture indistinct; mesonotum bluntly bituberculate behind, sharply angled, posterior portion more or less vertical; metanotal groove deep; propodeum bispinose; petiole with a long peduncle in front; whole body with long coarse setae.

Myrmecaria brunnea Saunders

1842. *Myrmecaria brunnea* Saunders, 57, M., India.

Materials examined : 2W. Nagpur, Mogarkaza,

28.ix.2007, S. I. Kazmi and Party, 6W. Yavatmal, Laded, 27.i.2009, 2W. Amravati, Pohara, 29.i.2009, Sheela, S and Party.

Distribution : Orissa, Kerala, Meghalaya, Tamil Nadu, W. Bengal.

Elsewhere : Myanmar, Indonesia, Indochina, Sri Lanka, Sumatra, Vietnam.

Genus 8. *Pheidole* Westwood

1840. *Pheidole* Westwood, *Ann. Mag. Nat. Hist.*, 6 : 87.
Type species : *Atta providens* Sykes, 1835. *Trans. Ent. Soc. Lond.*, 1 : 103, by designation of Bingham, 1903.

Diagnostic features : Dimorphic, rarely with intermediates; major worker (soldier) with massive head; occipital margin deeply impressed in the middle; mandibles large, heavy, strongly curved, each usually armed with three teeth, of which two are situated apically and one basally on masticatory margin and separated by a diastemma; palp formula 2,2; antennae 12 segmented; pro-mesonotal suture usually absent; metanotal groove deeply impressed; propodeum armed with a pair of spines or teeth; petiole usually emarginated above.

Key to species of *Pheidole*

1. Subpetiolar process present2
- Subpetiolar process absent7
2. Head posteriorly smooth *lamellinoda*
- Head posteriorly sculptured3
3. Frontal grooves inconspicuous *grayi*
- Frontal grooves conspicuous4
4. Occipital lobes punctate *naorojii*
- Occipital lobes reticulate5
5. Gaster completely distinctly striate *sharpi*
- Gaster partially striate6
6. Post-petiole more than twice as broad as long *latinoda sharpi*
- Post-petiole less than twice as broad as long *hoogwerfi*

7. Pro-mesonotum continuously convex8
- Pro-mesonotal convexity interrupted by furrow or ridge10
8. Head as broad as long *sykesi*
- Head longer than broad9
9. Occipital furrow smooth and shining *wood-masoni*
- Occipital furrow sculptured *parva*
10. Mesonotum bidentate *multidens*
- Mesonotum edentate11
11. Frontal grooves indistinct *wroughtoni*
- Frontal grooves distinct12
12. Vertex of head with distinct transverse impression *sulcaticeps*
- Vertex of head with transverse impression not very distinct13
13. Basal one third of gaster striate *striativentris*
- Gaster reticulate, punctate; not striate *ghatica*

1. *Pheidole grayi* Forel

1902. *Pheidole grayi* Forel, 167, S. W., India.

Materials examined : 3W. Chandrapur, Pathanpura, 25.i.2009, Sheela, S and Party.

Distribution : India (Maharashtra, Sikkim, W. India).

2. *Pheidole lamellinoda* Forel

1902. *Pheidole lamellinoda* Forel, 186, S., W., Q., M. India.

Materials examined : 2W. Bhandara, 23.x.1971, V.D. Srivastava.

Distribution : India (Delhi, Maharashtra, Meghalaya, C & W. India).

3. *Pheidole wroughtonii* Forel

1902. *Pheidole wroughtonii* Forel, 176, S. W. Q. M., India.

Materials examined : 3W. Amravati, Chikaldhara, 29.i.2009, 5W. Chandrapur, Lohara,

23.i.2009 Sheela, S and Party; 2W. Bhandara, 24.xi.1971, V.D. Srivastava.

Distribution : India (Ahmadnagar, Karnataka, Maharashtra).

Genus 9. *Pheidologeton* Mayr

1862. *Pheidologeton* Mayr, *Verh. Zool.-bot. Ges. Wien.*, **12** : 750. Type species : *Oecodoma diversa* Jerdon, 1851, *Madras J. Lit. & Sci.*, **17** : 109, by designation of Bingham, 1903.

Diagnostic features : Polymorphic. Mandibles of major workers edentate or with reduced teeth; minor workers with 5 or 6 teeth; palp formula 2,2; antennae 11 segmented with a 2 segmented club; pro-mesonotal suture absent in minor workers, becoming increasingly developed with increased worker size; metanotal groove impressed; propodeum bispinose.

Key to species of *Pheidologeton*

- Ocellus present on head *diversus*
- Ocellus absent on head *affinis*

Pheidologeton affinis (Jerdon)

1851. *Oecodoma affinis* Jerdon, 110, S. W. India.

1861. *Pheidologeton affinis* Roger, 30.

Materials examined : 4W. Ratnagiri, 9.i.1963, B.K. Tikader.

Distribution : Arunachal Pradesh, Assam, Karnataka, Kerala, Maharashtra, Tamil Nadu, W. Bengal.

Elsewhere : Australia, Indonesia, Myanmar, Philippines, Sri Lanka, Sulawesi.

Genus 10. *Solenopsis* Westwood

1841. *Solenopsis* Westwood, *Ann. Mag. Nat. Hist.*, **6** : 87. Type species : *Solenopsis mandibularis* Westwood, 1841. [= *Atta geminata* Fabricius, 1804, *Syst. Piez.*, : 243] by monotypy.

Diagnostic features : Monomorphic or polymorphic. Mandibles with 3 or 4 teeth; palp formula 1,2; maxillary palp geniculate; clypeus strongly longitudinally bicarinate, the median area sharply elevated and deeply inserted between the

frontal carinae; antennae 10 segmented with a 2 segmented club; pro-mesonotal suture absent; metanotal groove distinct; propodeum unarmed.

Solenopsis geminata (Fabricius)

1804. *Atta geminata* Fabricius, 423, Q. Central America.

1863. *Solenopsis geminata* Mayr, 453.

Materials examined : Several examples from throughout the regions.

Distribution : Through out the world.

Genus 11. *Tetramorium* Mayr

1855. *Tetramorium* Mayr, *Verh. Zool.-bot. Ges. Wien.*, **5** : 423. Type species : *Formica caespitum* Linnaeus, 1758, *Syst. Nat. ed.*, **10** : 581 by designation of Girard, 1879.

Diagnostic features : Palp formula 4,3; posterior margins of lateral portions of clypeus raised in to a ridge bordering the antennal insertions; antennae 12 segmented with a 3 segmented club; antero-lateral angles of pronotum sharply angulate, giving a square shouldered appearance in dorsal view; sutures on thorax dorsally absent; metanotal groove impressed; propodeum armed with a pair of spines or teeth; metapleural lobes acute; sting with an apico-dorsal lamelliform appendage.

Key to species of *Tetramorium*

1. Body with simple as well as branched hairs 2
- Body with only simple hairs, no branched hairs 3
2. Mandibles smooth with scattered punctures; base of first gastral tergite with *trifid hairs* *obesum*
- Mandibles striate, base of first gastral tergite without trifid hairs *lanuginosum*
3. Antennae with 12 joints *guineense*
- Antennae with 11 joints *smithi*

No specimens were collected from this genus.

Key to genera of Ponerinae

1. Mandibles long and linear, placed in the middle of the anterior margin of head; with two to three teeth, vertically arranged *Anochetus*
- Mandibles triangular ; placed at the sides of the head 2
2. Tarsal claws pectinate or dentate *Leptogenys*
- Tarsal claws normal 3
3. Thorax laterally with a pocket like excavation; petiole with a pair of spines *Diacamma*
- Thorax laterally without a pocket like excavation; petiole either multidentate or without any teeth *Pachycondyla*

Genus 1. *Diacamma* Mayr

1862. *Diacamma* Mayr, *Verh. zool.-bot. Ges. Wien.*, 12 : 718. Type species : *Ponera rugosa* Le Guillou, 1841, by subsequent designation of Bingham 1903.

Diagnostic features : Mandibles large, with 7-8 teeth; clypeus anteriorly laminate; posteriorly narrowed in between frontal lobes; pro-mesonotal suture distinct; propodeum unarmed; petiole with a pair of spines.

Key to species of *Diacamma*

- Spines on node thick at base; projecting in continuation of the upper surface of the node *rugosum*
- Spines short and slender; projecting at an angle from upper surface of node *rugosum sculptum*

***Diacamma rugosum* Le Guillou**

1842. *Ponera rugosa* Le Guillou, 318, W., Borneo.

1862. *Diacamma rugosa* Mayr.

Materials examined : 5W. Muzafarpur, 5.vi.2009, S. I. Kazmi and Party, 2W. Wardha, 25.xi.2007. 5W. Amravati, Dhamangudi, 29.i.2009; 2W. Yavatmal, Ladkhed, 27.i.2009;

3W. Chandrapur, Shivani, 26.i.2009; 6W. Nagpur, Sillari, 21.i.2009.

Distribution : Throughout India.

Elsewhere : Borneo, China, Java, New Guinea, Indonesia, Singapore, Philippines, Sri Lanka, Sumatra.

Genus 2. *Leptogenys* Roger

1861. *Leptogenys* Roger, *Berl. Ent. Z.* 5 : 41. Type species : *Leptogenys falcigera* Roger, by designation of Bingham 1903.

Diagnostic features : Mandibles with 1 or 2 teeth; clypeus medially carinate; palp formula 4,4; middle and hind tibiae with one large pectinate spur in addition to the simple spur; claws usually pectinate.

Key to species of *Leptogenys*

1. Petiole squamiform, longitudinally compressed, its upper margin narrow 2
- Petiole elongate with sloping curve from back to front and posteriorly vertically truncate 3
2. Anterior clypeal margin dentate *dentilobis* Forel
- Anterior clypeal margin not dentate *ocellifera* Roger
3. Head striate *diminuta* (Smith)
- Head not striate, smooth and shining *chinensis* Mayr

1. *Leptogenys processionalis* (Jerdon)

1851. *Ponera processionalis* Jerdon, 118, W. India.

1911. *Leptogenys ocellifera* Emery 105.

Materials examined : Several workers from Nagpur, Sillari, 21. i.2009, Yavatmal Parva, 26.i.2009, Amravati, Melghat, 30.i.2009, Sheela, S and Party.

Distribution : India (Kerala, Meghalaya, Orissa, Tamil Nadu, W. Bengal).

Elsewhere : Sri Lanka, Vietnam.

2. *Leptogenys* sp.

Materials examined : 6W. Chandrapur, Pathanpura, 25.i.2009, Sheela, S and Party.

Genus 3. *Pachycondyla* F. Smith.

1858. *Pachycondyla* Smith, F. 105. Type-species : *Formica crassinoda* Latreille, 1802, by subsequent designation of Emery, 1901.
1862. *Bothroponera* Mayr, : 717. Type-species : *Ponera pumicosa*, by subsequent designation of Emery, 1901 : 42.
1867. *Ectomomyrmex* Mayr, *Tjdr. Ent.*, 2 : 83. Type-species : *Ectomomyrmex javanus*, by subsequent designation of Bingham, 1903.
1900. *Pseudoponera* Emery, : *Term. Fuz.*, 23 : 314 [as subgenus of *Pachycondyla*]. Type-species : *Ponera quadridentata* (junior synonym of *Formica stigma*), by monotypy.
1900. *Mesoponera* Emery, *Ann. Mus. Civ. Nat. Gen.*, 20 : 668 [as subgenus of *Euponera*]. Type-species : *Ponera melanaria*, by monotypy.
1900. *Brachyponera* Emery, *Term. Fuz.*, 23 : 315 [as subgenus of *Euponera*]. Type-species : *Euponera (Brachyponera) croceicornis*, by monotypy.

Diagnostic features : Mandibles with 7 or more teeth; clypeus narrow, transverse, usually carinate in the middle; antennal sockets placed well behind the anterior clypeal margin; frontal lobes close together; hind tibia with a simple and a pectinate spur; apex of propodeum obliquely truncate and submargined.

Key to species of *Pachycondyla*

- Node of pedicel almost as long as broad, mandibles smooth and shining; clypeus weakly carinate *sulcata*
- Node of pedicel broader than long; mandibles opaque, punctured, clypeus distinctly carinate *rubiginosa*

Pachycondyla wroughtoni is excluded from key for want of details.

Pachycondyla sulcata (Mayr)

1867. *Bothroponera sulcata* Mayr, 441, W.

Materials examined : 3W., Bhandara, 24.x.1971, V.D. Srivastava.

Distribution : Andhra Pradesh, Orissa, Tamil Nadu, W. Bengal, Central and Western India..

Subfamily PSEUDOMYRMICINAE

Genus *Tetraponera* F. Smith

1852. *Tetraponera* F. Smith, *Ann. Mag. Nat. Hist.*, (2) 9 : 44. Type species : *Tetraponera atrata* F. Smith, (= *Eciton nigrum* Jerdon, 1851, *Madras J. Lit. Sci.*, 17 : 111) by designation of Wheeler, 1911.
1863. *Sima* Roger *Berl. Ent. Z.*, 7 : 178. Type species : *Sima compressa* Roger, [= *Pseudomyrma ? allaborans* Walker, 1860] by monotypy.

Diagnostic features : Anterior margin of clypeus crenulate; mandibles linear; eyes very large; pro-mesonotal suture indistinct; meso-metanotal suture deep tibial spurs pectinate; petiole and in most cases post petiole also with peduncle in front.

Key to species of *Tetraponera*

- Large in size with colour a combination of red and brown *rufonigra*
- Comparatively small with black colour *nigra*

Tetraponera rufonigra (Jerdon)

1851. *Eciton rufonigrum* Jerdon, 111, W. India.
1877. *Tetraponera rufonigra* Smith, F., 68.

Materials examined : 4W. Muzafarpur, Basara Bajar, 05.vi.2009, S.I. Kazmi & Party. 2W. Nagpur, Sillari, 21.i.2009; 2W. Chandrapur, Lohara, 29.i.2009; 2W. Yavatmal, Parva, 26.i.2009.

Distribution : Throughout India.

Elsewhere : China, Malagasy, Myanmar, Nicobar Is., Seychelles, Sri Lanka, Vietnam.

ACKNOWLEDGEMENTS

The authors are grateful to the Director, Zoological Survey of India for the facilities provided for this work. The encouragement and suggestions of Entomology division-in-Charge Dr. Kailash Chandra is gratefully acknowledged here. Thanks are due to Sri. P. Mishra of Lepidoptera section for sorting and setting most

of the specimens of this study. Last but not the least, authors are indebted to Dr. S.I. Kazmi, Officer-in-charge, and Dr. Girish Kumar, Hymenoptera section, and all staffs of Central Entomology Laboratory, Kolkata for their helps in various stages of this study.

REFERENCES

- Baroni Urbani, C., Bolton, B. and Ward, P.S. 1992. The internal phylogeny of Ants. *Systematic Entomology*, **17** : 301-329.
- Bingham, C.T. 1903. *Fauna of British India*, Hymenoptera, Vol. 2, Ants and Cuckoo Wasps, 506pp.
- Chavhan, A. and Pawar, S.S. 2011. Distribution and Diversity of Ant Species (Hymenoptera : Formicidae) in and Around Amravati City of Maharashtra, India. *World Journal of Zoology*, **6** (4) : 395-400.
- Emery, C. 1887. Catalog delle formiche esistenti nelle collezioni del Museo Civico di Genova. Parte terza Formiche della regione Indo-Malese e dell' Australia. *Ann. Mus. Nat. Gen.* (2). **5**[25] : 427-473.
- Emery, C. 1892. Scopra alcune formiche raccolte dall'Ingegnere L. Bricchetti Robecchi nel paese dei Somali. *Ann. Mus. Civ. Stor. Nat. Gen.*, (2) **12** : 110-122.
- Emery, C. 1901. Notes sur les sous-familles des dorylines et ponerines. *Ann. Soc. Ent. Belg.*, **45** : 32-54.
- Emery, C. 1906. Note sur *Prenolepis vividula* Nyl. Et sur la classification des especes du genre *Prenolepis*. *Ann. Soc. Ent. Belg.*, **50** : 130-134.
- Emery, C. 1911. In Wytsman, P. *Genera Insectorum*. Hymenoptera. Fam. Formicidae. Subfam. Ponerinae. *Fasc.*, **118** : 124pp.
- Emery, C. 1922. In Wytsman, P. *Genera Insectorum*. Hymenoptera. Fam. Formicidae. Subfam. Myrmicinae. *Fasc.*, **174B** : 95-206.
- Fabricius, J.C. 1775. *Systema Entomologiae*, sistens insectorum classes, ordines, genera, species, adiectis synonymis, locis, descriptionibus, observationibus : 832pp.
- Fabricius, J.C. 1787. *Mantissa Insectorum*, **1** : 348 pp.
- Fabricius, J.C. 1798. *Supplementum Entomologiae Systematicae*, : 572 pp.
- Fabricius, J.C. 1804. *Systema Piezatorum*, : 439pp.
- Forel, A. 1892. Nouvelles especes de formicides de Msdagascar. *Ann. Soc. Ent. Belg.*, **36** : 516-535.
- Forel, A. 1894. Les formicides de l'Empire des Indes et de Ceylan. Part 4. Adjonction aux genres *Camponotus* Mayr, et *Polyrhachis* Shuck. *J. Bombay Nat. Hist. Soc.*, **8** : 396-420.
- Forel, A. 1895. Les Formicides de l'Empire des Indes et de Ceylan. Part 5. Adjonction aux Camponotinae. *J. Bombay. Nat. Hist. Soc.*, **9** : 433-472.
- Forel, A. 1901. Les Formicides de l'Empire des Indes et de Ceylan. Part 8. Sous famille Dorylinae. *J. Bombay. Nat. Hist. Soc.*, **13** : 462-477.
- Forel, A. 1902. Myrmicinae nouveaux de l'Inde et Ceylan. *Rev. Suiss. Zool.*, **10** : 165-249.
- Forel, A. 1903. Les Formicides De L'empire des Indes et de Ceylan. *J. Bombay. Nat. Hist. Soc.*, **10** : 679-715.

- Girard, M. 1879. *Traite elementaire d'entomology*, 2 : 1028pp.
- Guerin-Meneville, F. E. 1844. Iconographie du regne animal de G. Cuvier, ou representation d'apres nature de l'une des especes les plus remarquables et souvent no figurees de chaque genre d'animaux. Insectes 576pp.
- Jerdon, T.C. 1851. A Catalogue of the species of ants found in southern India. *Madras J. Lit. Sci.*, 17 : 103-127.
- LaPolla, J.S., Brady, S.G., and Shattuck, S.O. 2010. Phylogeny and taxonomy of the *Prenolepis* genus group of ants (Hymenoptera : Formicidae). *Syst. Ent.*, 35 : 118-131.
- Latreille, P.A. 1802. *Histoire Naturelle des Fourmi, et recuiteil de memoires et d'observations sur les abeilles, les araignees, les faucheurs, et autres insects*, : 445 pp.
- Le Guillou, E.J.F. 1842. Catalogue raisonne des insects hymenopteres recueillis dans le voyage de circumnavigation des corvettes l'Astrolabe et La Zelee. *Ann. Soc. Ent. France*, 10(1841) : 311-324.
- Linnaeus, C. 1764. *Museum Sae Rae Mtis Ludovicae Ulrica Reginae Svecorum, Gothorum, Vandalorumque*. In quo animalia rariora, exotica, imprimis. Insecta & Conchilia describuntur & determinantur. Prodrumi instar : 719pp.
- Linnaeus, C. 1758. *Systema Naturae per regna tria naturae. Secundum classes, ordines, genera, species, cum characteribus, differentilis, synonymis, locis*, Editio, 10. 1 : 823 pp.
- Mayr, G. 1855. Formicina austriaca. Beschreibung der bisher im osterreichischen Kaiserstaate aufgefundenen Ameisen nebst Hinzufugung jener in Deutschland, in der Schweiz und in Italien Vorkommenden Ameisen. *Ver. Zool. Bot. Vien.*, 5 : 273-478.
- Mayr, G. 1861. Die Europdischen Formiciden. (Ameisen) : 80 pp. Wien.
- Mayr, G. 1862. Myrmecologische Studien. *Verh. Zool. Bot. Ges. Wien.*, 12 : 649-776.
- Mayr, G. 1863. Formicidarum index synonymicus. *Verh. Zool.-bot. Ges. Wien.*, 13 : 385-460.
- Mayr, G. 1867. Adnotationes in monographiam formicidarum Indo-Neerlandicarum. *Tjdr. Ent.*, (2) 2[10] : 33-117.
- Mayr, G. 1872. Formicidae Borneenses collectae a J. Doria et O. Beccari in territorio Sarawak annis 1865-1867. *Ann. Mus. Civ. Stor. Nat. Genova*, 2 : 133-155.
- Mayr, G. 1879. Beitrage zur Ameisen-Fauna Asiensw. *Verh. Zool. Bot. Ges. Wien*, 28 : 645-686.
- Nylander, W. 1846. Adnotationes in monographiam formicarum borealium Europae. *Acta Soc. Sci. Fenn.*, 2 : 875-944.
- Pagliano, G. & Scaramozzino, P. 1989. Elenco dei generi di Hymenoptera del mundo. *Mem. Soc. Ent. Ital.*, 68 : 3-210.
- Roger, J. 1861. Myrmicologische Nachlese. *Berl. Ent. Zeit.*, 5 : 163-174.
- Roger, J. 1863. Verzeichniss der Formiciden- Gattungen und Arten. *Berl. Ent. Zei.*, 7 : 1-65.
- Santschi, F. 1928. Nouvelles fourmis de Chine et du Turkestan Russe. *Bull Ann. Soc. Ent. Belg.*, 68 : 31-46.
- Saunders, W.W. 1842. Descriptions of two hymenopterous insects from northern India. *Trans. Ent. Soc. Lon.*, 3 : 57-58 (1841).

- Schuckard, W. E. 1840. Monograph of the Dorylidae, a family of the Hymenoptera Heterogyna. *Ann. Nat. Hist.*, **5** : 315-328.
- Smith, F. 1853. Monograph of the genus *Cryptocerus*, belonging to the group Cryptoceridae- family Myrmicidae- division Hymenoptera Heterogyna. *Trans. Ent. Soc. Lon.* (2), **2** : 213-228.
- Smith, F. 1857. Catalogue of the hymenopterous insects collected at Sarawak, Borneo, Mount Ophir, Malacca and at Singapore by A. R. Wallace. *J. Proc. Linn. Soc. Lond.*, Zoology, **2** : 42-88.
- Smith, F. 1858. *Catalogue of Hymenopterous insects in the collection of the British Museum*, **6** : Formicidae : 216 pp. London
- Smith, F. 1860. Catalogue of hymenopterous insects collected by Mr. A. R. Wallace in the islands of Bachian, Kaisaa, Amboyna, Gilolo and at Dory in New Guinea. *J. Proc. Linn. Soc. Zool.*, **5** : 93-143.
- Smith, F. 1877. Descriptions of new species of the genera *Pseudomyrma* and *Tetraponera* belonging to the family Myrmicidae. *Trans. Ent. Soc. Lond.*, (4)**10** : 57-72.
- Viehmeier, H. 1916. Ameisen von Singapore. Beobachtet und gesammelt von H. Overbeck. *Arch. Nat.*, **81** : 108-168.
- Wheeler, W.M. 1911. A list of the type species of the genera and subgenera of the Formicidae. *Ann. N. Y. Acad. Sci.*, **21** : 157-175.
- Wheeler, W.M. 1921. Chinese ants collected by Prof. C. W. Howard. *Psyche*, **28** : 110-115.
- Wilson, E.O. 1964. The true army ants of the Indo-Australian area. *Pacific Insects*, **6** : 427-483.

INSECTA : HYMENOPTERA : CHALCIDOIDEA : ENCYRTIDAE : ENCYRTINAE

S.I. KAZMI and P. GIRISH KUMAR

Zoological Survey of India, M-Block, New Alipore, Kolkata-700 053, India

INTRODUCTION

Encyrtidae is one of the largest cosmopolitan family, next only to Pteromalidae in the number and structurally most diverse among Chalcidoidea families, especially in structure of the head and antennae. The family currently includes in India 144 genera and 510 species placed in 2 subfamilies i.e. Encyrtinae and Tetracneminae. It contains relatively small forms, usually 1-2 mm long, and may range up to 4 mm. The majority of encyrtids are primary endoparasitoids of insects. A number of genera are hyperparasitoids, whereas a few are polyembryonic, in which case the hosts are usually Lepidoptera, but occasionally also aculeate Hymenoptera. They are found throughout the world in all habitats, and are extremely important as biological control agents. This subfamily includes a diversified group which is divided into 17 Indian tribes and 19 subtribes (Hayat, 2006). Under subfamily Encyrtinae 21 genera and 31 species recorded from Maharashtra.

Abbreviation used in the text :

F : Female. M : Male. BMNH : The Natural History Museum, London. BPBM : Bernice P. Bishop Museum, Honolulu, Hawaii, U.S.A. EUM : Entomological Laboratory, Ehime University, Matsuyama, Japan. FCNM : Facultad de Ciencias Naturales y Museo, La Plata, Argentina. FRI : Forest Research Institute, Dehra Dun, India. IEUN : Instituto de Entomologia Agraria, Universita degli di Napoli, Portici, Italy. NPCI : National Pusa Collection, Division of Entomology, Indian

Agricultural Research Institute, New Delhi, India. QMB : Queensland Museum, Brisbane, Australia. USNM : United States National Museum of Natural History, Washington DC, U.S.A. ZDAMU : Department of Zoology, Aligarh Muslim University, Aligarh, India. ZIASP : Zoological Institute, Academy of Sciences, St. Petersburg, Russia. ZSI = (NCZSI) : Zoological Survey of India, Kolkata, India.

Diagnosis of the subfamily Encyrtinae : Mandibles usually broad at apex or if with two or three sharp teeth, then one tooth strongly receding and mandibles curved and sickle shaped; Paratergites absent even if the hypopygium is prominent and extends to or beyond apex of gaster and third valvulae absent or fused with second valvifers; third valvula free, articulated with second valvifer, rarely absent or fused with second valvifer; forewing with linea calva clearly longer than discal setae beyond linea calva and provided with one or more thick, modified spine-like setae arranged in a line along its distal margin, forming the filum spinosum.

CLASSIFICATION

Only Indian genera are shown against each tribe.

Subfamily ENCYRTINAE Walker, 1837

Tribe **Encyrtini** Walker, 1837—*Anagyrodes*, *Carabunia*, *Encyrtus*, *Eugahania*, *Neocladia*, *Paracladella*, *Prionomastix*.

Tribe **Amirini** Girault, 1913—*Amira*.

Tribe **Bothriothoracini** Howard, 1895—*Amicencyrtus*, *Bothriothorax*, *Brachyplatycerus*, *Cerchysiella*, *Cowperia*, *Gentakola*, *Hemencyrtus*, *Hemileucoceras*, *Ixodiphagus*, *Maniscocephalus*, *Pentacladocerus*, *Pentelicus*, *Rhytidothorax*, *Tachinaephagus*, *Trjapitzinellus*.

Tribe **Copidosomatini** Hoffer, 1955—*Ageniaspis*, *Coelopencyrtus*, *Copidosoma*, *Copidosomopsis*, *Ethoris*, *Nathismusia*, *Paratetracnemoidea*.

Tribe **Aphycini** Hoffer, 1954—*Acerophagus*, *Aphycus*, *Astymachus*, *Copidosomyia*, *Homalotyloidea*, *Homalotylus*, *Indaphucus*, *Isodromus*, *Mashhoodiella*, *Prochiloneurus*.

Tribe **Habrolepidini** Hoffer, 1955—*Adelencyrtus*, *Caenohomalopoda*, *Coccidencyrtus*, *Comperiella*, *Epitetracnemus*, *Plagiomerus*, *Xenostyxis*.

Tribe **Cerapterocerini** Hoffer, 1955—*Anicetus*, *Bolangera*, *Cerapteroceroides*, *Cerapterocerus*, *Diversinervus*, *Lakshaphagus*.

Tribe **Ectromatini** Ashmead, 1900—*Achalcerinys*, *Cheiloneurella*, *Cheiloneuromyia*, *Cheiloneurus*, *Coagerus*, *Ectroma*, *Mahencyrtus*, *Pasulinia*, *Zaomma*.

Tribe **Cercobelini** Hoffer, 1953—*Cercobelus*.

Tribe **Trechnitini** Hoffer, 1955—*Blastothrix*, *Cerchysius*, *Psyllaephagus*, *Trechnites*.

Tribe **Discodini** Hoffer, 1954—*Aloencyrtus*, *Agarwalencyrtus*, *Avetianella*, *Bothriophryne*, *Coccidoctonus*, *Comperia*, *Diaphorencyrtus*, *Epiblatticida*, *Erencyrtus*, *Exoristobia*, *Forcipestricis*, *Haligra*, *Helegonatopus*, *Hesperencyrtus*, *Lamennaisia*, *Metaphycus*, *Microterys*, *Neastymachus*, *Ooencyrtus*, *Parablatticida*, *Paraphaenodiscus*, *Parechthrodryinus*, *Philosindia*, *Psyllaphycus*, *Saucrencyrtus*, *Syrphophagus*, *Tachardiaephagus*, *Tassonia*, *Teleterebratus*, *Trichomasthus*, *Tyndarichus*.

Tribe **Arrhenophagini** Ashmead, 1900—*Arrhenophagus*.

Tribe **Thomsoniscini** Hoffer, 1956—*Thomsonisca*.

Tribe **Protyndarichoidini** Hayat, 2006—*Protyndarichoides*.

Tribe **Mayridiini** Hoffer, 1955—*Kataka*, *Mayridia*, *Neperpolia*.

Tribe **Proleurocerini** Trjapitzin, 1973b—*Proleurocerus*.

Tribe **Proleuroceroidiini** Hayat, 2006—*Proleuroceroides*.

Tribe **Amirini** Girault, 1913

Genus *Amira* Girault, 1913

Amira Girault, 1913 : 93. Type species *Amira fabrei* Girault, by monotypy and original designation.

Bregmencyrtus Annecke, 1974 : 369. Type species *Eucomys durantae* Risbec, by monotypy and original designation. Synonymy by Noyes, 1977 : 49.

Hosts : Parasitoids of eggs of spider (Araneida).

Species and Distribution : World 03 species ; 01 species from India and Maharashtra.

Amira fabrei Girault, 1913

Amira fabrei Girault, 1913 : 93. F. M. Lectotype F [designated by Dahms & Gordh, 1997 : 40] : Australia, Nelson, Crain (QMB).

Diagnosis : Forewing long usually beyond the apex of gaster; mandible minute; antennal clava strongly obliquely truncate; marginal vein puntiform; F1 quadrate, rest of funicle segments broader than long; scape about 4.5X as long as broad.

Hosts : Indet. spider eggs.

Distribution : India : Maharashtra, Uttar Pradesh.

Tribe **Proleurocerini** Trjapitzin, 1973

Genus *Proleurocerus* Ferriere, 1935

Proleurocerus Ferriere, 1935 : 402. Type species *Proleurocerus fulgoridis* Ferriere, by monotypy and original description.

Arachnosinis Compere & Zinna, 1955 : 112. Type species *Arachnosinis zululandiae* Compere & Zinna, By monotypy and original designation. Synonymy by Hayat, 1972 : 212.

Hosts : Parasitoids of eggs of Eurybrachidae (Homoptera) and spiders, eggs of Lepidoptera.

Species and Distribution : 04 species; 02 species from India and 01 species from Maharashtra.

***Proleurocerus fulgoridis* Ferriere, 1935**

Proleurocerus fulgoridis Ferriere, 1935 : 402-403, F. Syntype : India, Bangalore and Closepet (BMNH).

Anicetus ceylonensis Howard : Saraswat and Mukerjee, 1975 : 45-46, F. Pechiparai, Figure 6A-G Misidentification.

Diagnosis : All funicle segments broader than long, funicle with only F6 white; scape with maximum expansion in distal half; first valvifer smaller, about 0.2X of second valvifer and relatively shorter than third valvula.

Hosts : Eggs of *Eurybrachys tomentosa*, eggs of cutworms on mulberry.

Distribution : India : Maharashtra, Andhra Pradesh, Kerala, Tamil Nadu.

Tribe Proleuroceroidiini Shafee, Alam & Agarwal, 1975

Genus *Proleuroceroides* Shafee, Alam & Agarwal, 1975

Proleuroceroides Shafee, Alam & Agarwal, 1975 : 42. Type species *Proleuroceroides pyrillae* Shafee, Alam & Agarwal, by monotypy and original designation.

Hosts : Parasitoids of eggs of Lophopidae (Homoptera).

Species and Distribution : One species only from India.

***Proleuroceroides pyrillae* (Crawford), 1999**

Ooencyrtus pyrillae Crawford, 1916 : 102, F, M, Holotype F : India, Nagpur (USNM).

Proleuroceroides pyrillae Shafee, Alam & Agarwal, 1975 : 42-44, F, M. Holotype F : India, Udaipur (ZDAMU). [Preoccupied by *pyrillae* (Crawford, 1916)]. Synonymy by Hayat, 1999 : 392.

Proleuroceroides pyrillae (Crawford) : Noyes & Hayat, 1984 : 327, tax., *pyrillae* Shafee *et al.* 1975.

Proleuroceroides neopyrillae Fatima & Shafee, 1994 : 18. [Unnecessary replacement name for *pyrillae* Shafee *et al.*]. Synonymy by Hayat, 1999 : 392.

Diagnosis : Head at least partly yellow, orange or orange brown, not metallic; mandible bidentate; clava apically obliquely truncated and 3-segmented; notaular lines absent; forewing hyaline; mesoscutum axillae or scutellum at least partly yellow, orange or orange brown.

Hosts : Eggs of *Pyrilla* spp. on *Saccharum officinarum* (Shafee *et al.*, 1975); eggs of *P. lycoides* (Crawford, 1916).

Distribution : India : Maharashtra, Rajasthan.

Tribe Copidosomatini Hoffer, 1955

Genus *Copidosoma* Ratzeburg, 1844

Copidosoma Ratzeburg, 1844 : 157. Type species *Copidosoma boucheanum* Ratzeburg, by monotypy.

Litomastix Thomson, 1876 : 171. Type species *Encyrtus chalconotus* Dalman, by designation of Ashmead, 1900 : 363. Synonymy by Peck, 1951 : 481.

Pentacnemus Howard, 1892 : 366. Type species *Pentacnemus bucculatricis* Howard, by monotypy. Synonymy by Noyes & Hayat, 1984 : 257.

Parapsilophrys Howard, 1898 : 232. Type species *Parapsilophrys gelechia* Howard, by monotypy. Synonymy by Trjapitzin & Gordh, 1978 : 651.

Berencyrtus Howard, 1898 : 237. Type species *Berencyrtus bakeri* Howard, by monotypy. Synonymy through Synonymy of *Berencyrtus* by Peck, 1951 : 481.

Pseudencyrtella Girault, 1913 : 113. Type species *Pseudencyrtella fasciata* Girault, by monotype and original designation. Synonymy by Noyes & Hayat, 1984 : 257.

Zaomencyrtus Girault, 1915 : 107. Type species *Zaomencyrtus lepidopterophagus* Girault, by monotypy and original designation. Synonymy by Noyes & Hayat, 1984 : 257.

Paracaenocercus Girault, 1915 : 116. Type species *Paracaenocercus perseveranus* Girault, by monotypy. Synonymy by Noyes & Hayat, 1984 : 257.

Paracopidosomopsis Girault, 1916 : 49. Type species *Berencyrtus floridanus* Ashmead, by monotypy and original designation. Synonymy by Peck, 1951 : 481.

Verdunia Mercet, 1917 : 203. Type species *Verdunia gloriosa*

Mercet, by monotypy and original designation. Synonymy by Mercet, 1921 : 465.

Paralitomastix Mercet, 1921 : 438. Type species *Encyrtus varicornis* Nees, by monotypy and original designation.

Litomastiellus Mercet, 1921 : 443. Type species *Litomastix claviger* Mercet, by designation of Peck, 1951 : 481. Synonymy by Peck, 1951 : 481.

Limastotix Mercet, 1921 : 443. Type species *Limastotix hispanicus* Mercet, by monotypy. Synonymy by Peck, 1951 : 481.

Angeliconana Girault, 1922 : 150. Type species *Angeliconana eja* Girault, by monotypy. Synonymy by Noyes & Hayat, 1984 : 257.

Parasteropaesus Girault, 1923 : 50. Type species *Parasteropaesus lotae* Girault, by monotypy. Synonymy by Noyes & Hayat, 1984 : 257.

Neocopidosoma Ishii, 1923, 101. Type species *Neocopidosoma komabae* Ishii, by monotypy. Synonymy by Ishii, 1928 : 112.

Mesocopidopsomyia Girault, 1925 : 93. Type species *Mesocopidopsomyia variventris* Girault, by monotypy. Synonymy by Noyes & Hayat, 1984 : 257.

Mesencyrtus Timberlake, 1941 : 228. Type species *Mesencyrtus insularis* Timberlake, by monotypy and original designation. Synonymy by Noyes & Hayat, 1984 : 257.

Berecynthiscus Ghesquiere, 1946 : 368. [Unnecessary replacement name for *Berecynthus* Howard]. Synonymy by Peck, 1951 : 481.

Arrenoclavus Doutt, 1948 : 145. Type species *Copidosoma koehleri* Blanchard, by monotypy and original designation. Synonymy by Peck, 1951 : 481.

Hosts : Polyembryonic parasitoids of larvae of Lepidoptera.

Species and Distribution : World 185 species; 25 species from India and 01 species from Maharashtra.

***Copidosoma koehleri* Blanchard, 1940**
[Introduced species]

Copidosoma koehleri Blanchard, 1940 : 107, F. Lectotype F [designated by Annecke & Minhardt, 1974 : 32] : Argentina, Tandil (FCNM).

Copidosoma uruguayensis Tachikawa, 1968 : 115, F, M. Holotype F : Japan, Kobe lab. culture (EUM). Synonymy by Annecke & Mynhardt, 1974 : 32.

Diagnosis : Funicle segment slightly longer than broad, F2 about 1.5X as long as broad; third segment of clava longer than second segment or both subequal in length; posterior ocellus separated from eye margins by about ½ diameter of an ocellus; postmarginal vein about as long as marginal vein; mid leg dark brown, with apex of the femur, base and apical fourth or so of tibia and tarsal segments 1-3 whitish.

Hosts : Introduced to control of *Phthorimaea operculella*.

Distribution : India : Maharashtra, Karnataka.

Tribe Aphycini Hoffer, 1954

Genus *Homalotylus* Mayr, 1876

Homalotylus Mayr, 1876 : 752. Type species *Encyrtus flaminus* Dalman, by designation of Ashmead, 1900 : 377.

Nobrimus Thomson, 1876 : 116. Type species *Encyrtus flaminus* Dalman, by designation of Timberlake 1919 : 134. Synonymy of *Homalotylus* by Masi, 1919 : 295.

Mendozaniella Brethes, 1913 : 97. Type species *Mendozaniella mirabilis* Brethes, by monotypy. Synonymy by Timberlake 1919 : 134.

Hemaenasioidea Girault, 1916 : 307. Type species *Hemaenasioidea oculata* Girault, by monotypy. Synonymy by Timberlake, 1919 : 134.

Anisotylus Timberlake, 1919 : 170. Type species *Homalotylus similis* Ashmead, by original designation, Synonymy by Noyes & Hayat, 1984 : 287.

Lepidaphycus Blanchard, 1936 : 13. Type species *Lepidaphycus bosqi* Blanchard, by monotypy. Synonymy by Blanchard, 1941 : 41.

Neoaenasioidea Agarwal, 1966 : 71. Type species *Neoaenasioidea indica* Agarwal, by monotypy and original designation. Synonymy by Hayat, Alam & Agarwal, 1975 : 64.

Hosts : Parasitoids of larvae of lady bird beetle (Coleoptera : Coccinellidae).

Species and Distribution : World 40 species; 12 species from India and 02 species from Maharashtra.

***Homalotylus eytelweinii* (Ratzeburg), 1969**

Encyrtus eytelweinii Ratzeburg, 1844 : 210, M (type lost see Graham 1969).

Homalotylus eytelweinii (Ratzeburg) : Graham, 1969 : 234, tax.

Neoaenasioidea nigratus Agarwal, 1970 : 27, F, Holotype F : India, Aligarh (ZDAMU). Synonymy by Anis & Hayat, 1998 : 199.

Echthroplexis tumkurensis Shafee & Fatma, 1984 : 375, F, Holotype F : India, Karnt, Tumkur (ZDAMU part present). Synonymy by Anis & Hayat, 1998 : 199

Diagnosis : Head in front view, longer than broad; pedicle at least 2X as long as broad; F1 at least 1.5X as long as broad; F1-6 dark brown to black, clava white; postmarginal vein shorter than stigma vein; hind tarsi brown to dark brown.

Hosts : *Adonia variegata*; *Brumoides suturalis*; *Chilocorus* sp.; *C. bijugus*; *Chilomenes* sp.; *Menochilus sexmaculata*; *Rodolia* sp.; *R. cardinalis*; *R. fumida*; *R. guerni*; *Drosicha stebbengi*; *Icerya purchasi*; *I. pilosa nordi*; *Lecanium* sp. on Jack; *Artocarpus heterophyllus*; *Nipaecoccus viridis* on *Citrus medica*.

Distribution : India : Maharashtra, Uttar Pradesh, Himachal Pradesh, Karnataka, Delhi, Tamil Nadu.

***Homalotylus ferrierei* Hayat, Alam & Agarwal, 1975**

Homalotylus ferrierei Hayat, Alam & Agarwal, 1975 : 65, 67, F, Holotype F, India, Maharashtra, Nasik (ZDAMU).

Echthroplexis ferrierei (Hayat, Alam & Agarwal) : Shafee & Fatma, 1984 : 373.

Diagnosis : Scape, pedicle, F1-3 brown, F4-6, clava white; pedicle as long as F1 and F2 combined; body not completely dark brown; part of head, axillae and scutellum and sides of thorax yellow or yellow brown; hind legs excluding tarsi not completely dark brown.

Hosts : *Cerococcus* sp. on *Hibiscus* sp. (Hayat et al., 1975); *C. hibisci* (= *indicus*) (Avasthi & Shafee, 1978).

Distribution : India : Maharashtra.

Genus *Prochiloneurus* Silvestri, 1915

Prochiloneurus Silvestri, 1915 : 350. Type species *Prochiloneurus pulchellus* Silvestri, by monotypy and original designation.

Achrysopophagus Girault, 1915 : 89. Type species *Achrysopophagus oviductus* Girault, by original designation. Synonymy by Viggiani, 1966 : 91.

Parachrysopophagus Agrawal, 1965 : 65. Type species *Achrysopophagus insolitus* Alam, by original designation.

Neoprochiloneurus Viggiani, 1966 : 95. Type species *Prochiloneurus bolivari* Mercet, by monotypy and original designation. Synonymy by Noyes, 1978 : 222.

Prochiloneuroides Hayat, Alam & Agarwal, 1975 : 61. Type species *Prochiloneuroides comperei* Viggiani, by original designation. Synonymy by Hayat, 1981 : 22.

Hosts : Hyperparasitoids on Homoptera (Coccidae and Pseudococcidae).

Species and Distribution : World 29 species; 09 species from India and 03 Species from Maharashtra.

***Prochiloneurus testaceus* (Agarwal), 1965**

Acrysopophagus testaceus Agrawal, 1965 : 66, 68-69, F, Holotype F : India, Aligarh (ZDAMU).

Prochiloneurus hayati Shafee, Alam & Agrawal, 1975 : 49, 53-55, F, Holotype F : India, Nabha (ZDAMU). Synonymy by Hayat, 1999 : 391.

Prochiloneurus testaceus (Agrawal) : Shafee, Alam & Agrawal, 1975 : 49, 53, F, key, Guntur and Aligarh rec.

Diagnosis : Funicle segments (F1-6) whitish to pale yellow, except clava and base of pedicle; scutellum with sub apical brush of short, dark bristles, usually arranged in two rows; fore wing relatively broad, less than 3X as long as broad, and with the apical hyaline area with uniformly brown setae in middle part.

Hosts : *Coccus viridis*; *Nipaecoccus* sp.; *Nipaecoccus viridis*; *Rastrococcus iceryoides*.

Distribution : India : Maharashtra, Uttar Pradesh, Andaman & Nicobar Is., Tamil Nadu, Punjab, Andhra Pradesh.

***Prochiloneurus pulchellus* Silvestri, 1915**

Prochiloneurus pulchellus Silvestri, 1915 : 351-352, F, Eritrea, Nefasit (IEUN)

Cheiloneurus latiscapus Compere, 1938 : 328, 329, F, Holotype F : South Africa, Natal (BMNH). Synonymy by Hayat, 2006 : 98.

Achrysopophagus insolitus Alam, 1961 : 235, 236-238, F.
Holotype F : India, Bihar, Pusa (ZDAMU).
Synonymy by Hayat, 2006 : 98.

Achrysopophagus metallicus Agrawal, 1965 : 66-68, F.
Holotype F : India, Aligarh (ZDAMU). Synonymy
with *insolitus* by Hayat, 2006 : 98.

Prochiloneurus insolitus (Alam) : Viggiani, 1970 : 68.

Cheiloneurus laticapus (Compere) : Viggiani, 1970 : 68.

Chiloneurus comperei Annecke & Insley, 1971 : 9.
Synonymy by Hayat, 2006 : 98.

Chiloneurus comperei Hayat, 1972 : 212. Synonymy with
comperei Annecke & Insley by Subba Rao, 1976 :
688. Synonymy by Hayat, 2006 : 98.

Diagnosis : Antennal scape flattened and
expanded beneath, not more than 2.5X as long as
broad; clava not longer than funicle; infuscated
area of forewing with a distinct, nearly club-
shaped, hyaline transverse streak; body not wholly
dark brown and metallic; most of head, pronotum
except a brown patch on meson, yellowish; distal
1/3 to 1/2 of mesoscutum dark brownish; thorax
largely yellowish; ovipositor sheath yellowish.

Hosts : *Centroccus* spp. on *Leucas
cephalotus*, *Pupalia lappacea* and *Wittania
somnifera*, *C. insolita*; *Ferrisia virgata*; *Icerya
aegyptica*; *Nipaecoccus* spp.

Distribution : India : Maharashtra, Uttar
Pradesh, Tamil Nadu, Bihar, Punjab, Gao,
Haryana, Karnataka, Kerala, Andhra Pradesh.

***Prochiloneurus javanicus* (Ferriere), 1951**

Achrysopophagus javanicus Ferriere, 1951 : 188, F. Syntypes!
: Indonesia, Java, Batavia (?).

Prochiloneurus javanicus (Ferriere) : Noyes & Hayat, 1984
: 327.

Prochiloneurus aegyptiacus (Mercet) : Shafee, Alam &
Agarwal, 1975 : 49, 52, F, Budampadu (Guntur).
Mani, 1989 : 1951, des., Misidentification.

Diagnosis : Antenna dark brown; forewing with
width of apical hyaline area 1/4 to 1/3 of the
width of infuscate area; mesothoracic dorsum dark
metallic.

Hosts : *Anagyrus kamali*, through coccids on
Hibiscus rosasinensis (Sureshan & Narendran,
2005); indet. Pseudococcid (Hayat, 1999).

Distribution : India : Maharashtra, Andhra
Pradesh, Kerala.

Tribe Habrolepidini Hoffer, 1955

Genus *Comperiella* Howard, 1906

Comperiella Howard, 1906 : 121. Type species *Comperiella
bifasciata* Howard, by monotypy.

Pseudanusia Girault, 1915 : 155. Type species *Pseudanusia
pia* Girault, by monotypy and original designation.
Synonymy by Girault, 1917 : 37.

Habrolepistia Mercet, 1921 : 668. Type species *Habrolepistia
cerapterocera* Mercet, by monotypy and original
designation. Synonymy by Mercet, 1926 : 320.

Hosts : Parasitoids of Homoptera (Diaspididae).

Species and Distribution : World 09 species;
05 species from India and 01 species from
Maharashtra.

***Comperiella lemniscata* Compere & Annecke, 1961**

Comperiella lemniscata Compere & Annecke, 1961 : 32-33,
F. Syntypes : India, Bombay (USNM).

Diagnosis : Forewing with two fasciae strongly
divergent, the lower fascia extending to wing
margin; collar of pronotum with two submedian
white patches, occasionally brownish patch
separating two white patches faint or even absent
so that a single white patch is seen; scape
subtriangular; Posterior ocelli less than two ocellar
diameters apart; mesoscutum with a median
longitudinal bluish green band not interrupted by
cupreous band along mid- line; clava slightly
narrow than F1 and strongly narrow to apex; mid
tibial spur subequal in length to basitarsus.

Hosts : *Aonidiella orientalis*.

Distribution : India : Maharashtra, Uttar
Pradesh, Jharkhand, Rajasthan.

Tribe Cerapterocerini Hoffer, 1955

Genus *Anicetus* Howard, 1896

Anicetus Howard, in Howard & Ashmead, 1896 : 639. Type
species *Anicetus ceylonensis* Howard, by monotypy.

Asteropaues Howard, 1898 : 231. Type species *Asteropaues
primus* Howard, by monotypy. Synonymy by Girault,
1917 : 6.

Habrolepterygis Girault, 1915 : 86. Type species *Habrolepterygis felix* Girault, by monotypy and original designation. Synonymy by Girault, 1915 : 302.

Paraceraptocherus Girault, 1920 : 184. Type species *Paraceraptocherus africanus* Girault, by monotypy and original designation. Synonymy by Mercet, 1925 : 53.

Krishnieriella Mani, 1935 : 421. Type species *Krishnieriella ceroplastodis* Mani, by monotypy and original designation. Synonymy by Hayat, 1976 : 49.

Hosts : Parasitoids of Homoptera (Coccidae).

Species and Distribution : World 41 species; 13 species from India and 01 species from Maharashtra.

Anicetus ceroplastodis (Mani), 1989

Krishnieriella ceroplastoidis Mani, 1935 : 422-423, F. Holotype F : India, Coimbatore ZSI (= NCZSI).

Anicetus tibimaculatus Anasthi & Shafee, 1983 : 182-184, F. Holotype F : India, Coimbatore (ZDAMU). Synonymy by Hayat, 1999 : 359.

Anicetus ceroplastodis (Mani) : Mani, 1989 : 892-894, des.

Diagnosis : Ocellar triangle with apical angle a right angle or slightly obtuse angle; F1 narrower than pedicel; clava with sutures complete; forewing basal triangle with about 50 setae, marginal vein at most equal in length to stigma vein; ovipositor 2.6-2.8X as long as third valvulae, outer plate broad.

Hosts : *Ceroplastodes* sp. on *Achyranthes aspera*, *Rhynchasia ruinima*; *C. cajani*, same hosts on *Abutilon indicum*; *Drepanococcus chiton* on *Zizyphus mauritana*, *Psidium guajava*; *Parasaissetia nigra*.

Distribution : India : Maharashtra, Assam, Kerala, Karnataka, Tamil Nadu.

Genus *Lakshaphagus* Mahdihassan, 1931

Lakshaphagus Mahdihassan, 1931 : 170. Type species *Microterys hautefeuillei* Mahdihassan, by monotypy and original designation.

Cheilonicetus Shafee, Alam & Agarwal, 1975 : 55. Type species *Cheilonicetus daulai* Shafee, Alam & Agarwal, by monotypy and original designation. Synonymy by Hayat, 1981 : 21.

Hosts : Parasitoids of Kerridae and Asterolecaniidae (Homoptera).

Species and Distribution : World 8 species; 03 species from India and 01 species from Maharashtra.

Lakshaphagus fusiscapus (Agarwal), 1965

Cheiloneurus fusiscapus Agarwal, 1965 : 62, 63-65, F. Holotype F : India, Aligarh (ZDAMU).

Cheiloneurus nepalensis Khan & Agarwal, 1978 : 23, F. Holotype F : Nepal, Dhangari (ZDAMU, lost). Synonymy by Hayat, 1999, 370, tax.

Mayrencyrtus fusiscapus (Agarwal) : Hayat, 1979b : 319-320, F, tax.

Lakshaphagus fusiscapus (Agarwal) : Hayat, 1981 : 22-23, tax.

Diagnosis : Funicle segments quadrate to slightly longer than broad, occasionally F1-3 broader than long; F1-3 brownish, F4-6 whitish; mid and hind tibia without brownish band; gaster shiny dark brown.

Hosts : *Cerococcus* sp.; *Ceroplastodes* sp.; *Planococcus citri*.

Distribution : India : Maharashtra, Uttar Pradesh, Madhya Pradesh, Tamil Nadu, Rajasthan, Karnataka.

Tribe Ectromatini Ashmead, 1900

Genus *Cheiloneurus* Westwood, 1833

Cheiloneurus Westwood, 1833 : 343. Type species *Encyrtus elegans* Dalman, by monotypy.

Chrysopophagus Ashmead, 1894 : 245. Type species *Chrysopophagus compressicornis* Ashmead, by monotypy. Synonymy by Trjapitzin & Gordh, 1978 : 365.

Blatticida Ashmead, 1904 : 305. Type species *Blatticida pulchra* Ashmead, by monotypy and original designation. Synonymy by Trjapitzin & Gordh, 1978a : 366.

Echthrogonatopus Perkins, 1906 : 256. Type species *Echthrogonatopus exitiosus* Perkins, by designation of Graham & Fagan, 1923 : 48. Synonymy by Guerrieri & Viggiani, 2005 : 306.

Saronotum Perkins, 1906 : 259. Type species *Saronotum australiae* Perkins, by original designation. As synonym of *Chrysopophagus* by Girault, 1924 : 4.

Cristatithorax Girault, 1911 : 169. Type species *Cristatithorax pulcher* Girault, by monotypy and original designation. Synonymy by Mercet, 1921 : 637

Eusemionella Girault, 1915 : 78. Type species *Eusemionella cristata* Girault, by monotypy and original designation. Synonymy by Noyes & Hayat, 1984 : 249.

Crysopophagoides Girault, 1915 : 90. Type species *Crysopophagoides westwoodi* Girault, by monotypy. Synonymy by Noyes & Hayat, 1984 : 249.

Paracheiloneurus Girault, 1915 : 119. Type species *Cheiloneurus perpulcher* Girault, by monotypy and original designation. Synonymy by Noyes & Hayat, 1984 : 249.

Epicheiloneurus Girault, 1915 : 173. Type species *Epicheiloneurus albicoxa* Girault, by monotypy and original designation. Synonymy by Noyes & Hayat, 1984 : 249.

Eusemionopsis Girault, 1918 : 3. Type species *Eusemionopsis centaurus* Girault, by monotypy and original designation. Synonymy by Noyes & Hayat, 1984 : 249.

Procheiloneurus Girault, 1920 : 39. Type species *Procheiloneurus triguttatipennis* Girault, by monotypy and original designation. Synonymy by Dahms & Gordh, 1997 : 113.

Hypergonatopus Timberlake, 1922 : 142. Type species *Echthrogonatopus hawaiiensis* Perkins, by original designation. Synonymy by Guerrieri & Viggiani, 2005 : 306.

Raphaelana Girault, 1926 : 66. Unnecessary replacement name for *Procheiloneurus* Girault. Synonymy with *Procheiloneurus* by Noyes & Hayat, 1984 : 326.

Bekilyia Risbec, 1952 : 41. Type species *Bekilyia metallica* Risbec, by monotypy. Synonymy by Noyes & Prinsloo, 1998 : 78.

Metacheiloneurus Hoffer, 1957 : 336. Type species *Metacheiloneurus moestus* Hoffer, by monotypy and original designation. Cited as synonym with *Cheiloneurus* by Garham, 1969 : 273. Synonymy by Noyes, 1980 : 185.

Lepidoneurus Hoffer, 1957 : 339. Type species *Cheiloneurus kollari* Mayr, by monotypy [As subgenus of *Cheiloneurus*].

Hosts : Hyperparasitoids of Coccidae and Pseudococcides (Homoptera) via other chalcidoids (Hymenoptera).

Species and Distribution : World 125 species; 33 species from India and 05 species from Maharashtra.

Cheiloneurus quadricolor (Girault), 1915

Cristatithorax quadricolor Girault, 1915 : 157. F, Holotype F : Australia (QMB).

Cheiloneurus yasumatsui Trjapitzin, 1971 : 123. F, Holotype F : Afganistan, Baglan (ZIASP).

Cheiloneurus brevipennis Fatima & Shafee, 1994 : 28, 29-30, F, Holotype F : India, Aligarh (ZDAMU). As synonym of *yasumatsui* by Anis & Hayat, 2002 : 148.

Cheiloneurus quadricolor (Girault) : Hayat & Subba Rao, 1981 : 110, catlg.

Diagnosis : Funicle segments at most slightly broader than long, clava at most as long as funicle and not or very slightly obliquely truncate; only F₆ and basal segment of clava brown to dark brown, rest of flagellum pale yellow to brownish yellow; mandible rarely sharply 3 dentate; forewing with infuscation normal, not enclosed sub-apically by a darker curved band; third valvula free.

Hosts : Unknown.

Distribution : India : Maharashtra, Uttar Pradesh, Andhra Pradesh, Andaman & Nicobar Islands, Delhi, Himachal Pradesh, Rajasthan, Karnataka, Kerala, Tamil Nadu, Uttrakhand.

Cheiloneurus chrysopae Fullaway, 1946

Cheiloneurus chrysopae Fullaway, 1946 : 207, F, M. Mariana Island, Merizo (USNM).

Diagnosis : Head as long as broad; mandible with two pointed teeth and dorsal truncation; clava longer than funicle segments; all funicle segments broader than long; scape pale brown dorsal margin; pedicel brown; funicle pale yellow; thorax finely longitudinally reticulate in anterior two third, posterior third finely polygonally reticulate; scutellum with raised reticulate sculpture; forewing 2.6X as long as broad; gaster shorter than thorax.

Hosts : Larvae of *Mallada boninensis* and *Chrysopa*.

Distribution : India : Maharashtra, Karnataka.

Cheiloneurus axillaries Hayat, Alam & Agarwal, 1975

Cheiloneurus axillaries Hayat, Alam & Agarwal, 1975 : 47, 55-56, F, Holotype F : India, Maharashtra, Lonavala (BMNH).

Diagnosis : Antennal scape brown with apical white area; pedicel yellow; funicle brown; clava dark brown; F5-6 quadrate, F1-4 longer than broad; pedicel shorter than F1 and F2 combined; gaster shorter than thorax.

Hosts : *Icerya* sp. on *Mangifera indica*.

Distribution : India : Maharashtra.

***Cheiloneurus hadrodorys* Anis & Hayat, 2002**

Cheiloneurus hadrodorys Anis & Hayat, 2002 : 173-175, F, M. Holotype F : Nepal, Bardia (BMNH).

Diagnosis : Antennal scape yellowish; pedicel, F1, F2 and largely F6 brownish; F6 broader than long; F1-5 longer than broad; pedicel shorter than F1 and F2 combined; forewing with linea calva closed posteriorly by several line of setae; basal cell setose, without a base triangular area; stigma vein thin, running almost parallel to anterior wing margin; ovipositor with second valvifer basally enlarged.

Hosts : *Saccharicoccus sacchari*.

Distribution : India : Maharashtra, Tamil Nadu.

***Cheiloneurus exitiosus* (Perkins), 1906**

Echthrogonatopus exitiosus Perkins, 1906 : 256. F. Australia (BPBM).

Metapterencyrtus nigricornis Hayat, 1980 : 643, 644-645, F. Holotype F : India, Aligarh (BMNH). Synonymy by Guerrieri & Viggiani, 2005 : 314.

Echthrogonatopus nigricornis (Hayat) : Hayat, 1980 : 645.

Cheiloneurus exitiosus (Perkins) : Guerrieri & Viggiani, 2005 : 314, hosts, dist., tax, rec.

Diagnosis : Head width about 4.5X of frontovertex; antenna black; F1 slightly longer than broad, rest of funicle segments quadrate to slightly broader than long; postmarginal vein about 1/3 of stigma vein; mid tibial spur slightly shorter than basitarsus.

Hosts : Unknown.

Distribution : India : Maharashtra, Uttar Pradesh, Andhra Pradesh, Assam, Bihar, Karnataka, Kerala, Meghalaya, Mizoram, Tamil Nadu.

Genus *Mahencyrtus* Masi, 1917

Mahencyrtus Masi, 1917 : 157. Type species *Mahencyrtus occultans* Masi, by monotypy.

Tyndarichoides Mercet, 1921 : 649. Type species *Tyndarichoides metallicus* Mercet, by monotypy and original designation. Synonymy by Noyes & Hayat, 1984 : 294.

Protyndarichus Mercet, 1923 : 479. [Replacement name for *Tyndarichoides* Mercet]. Synonymy by Noyes & Hayat, 1984 : 294.

Hosts : Possibly hyperparasitoids of homopteran insects via other chalcids (Hymenoptera).

Species and Distribution : World 12 species, 4 species from India and 01 species from Maharashtra.

***Mahencyrtus ranchiensis* (Fatima & Shafee), 1994**

Tyndarichus ranchiensis Fatima & Shafee, 1994 : 74, 75-76, F. Holotype F : India, Ranchi (ZDAMU).

Mahencyrtus ranchiensis (Fatima & Shafee) : Hayat, 1999 : 375, tax.

Diagnosis : Legs with coxae and femora except bases and apices, dark brown; mid tibia usually with a brown to dark brown patch in basal half; scape 6.0X as long as broad; pedicel as long as F1-3 combined; marginal vein slightly less than 1.5X as long as stigmal vein.

Hosts : Unknown.

Distribution : India : Maharashtra, Uttar Pradesh, Jharkhand, Goa, Kerala, Tamil Nadu, Uttarakhand.

Tribe *Trechnitini* Hoffer, 1955

Genus *Psyllaephagus* Ashmead, 1900

Psyllaephagus Ashmead, 1900 : 382. Type species *Encyrtus pachysyllae* Howard, by original designation.

Microcerus Ashmead, 1904 : 309. Type species *Microcerus peyela* Ashmead, by monotypy and original designation. Synonymy by Trjapitzin & Gordh, 1978 : 636.

Calocerineloides Girault, 1913 : 111, Type species *Calocerineloides ramosa* Girault, by monotypy and original designation. Synonymy by Noyes & Hayat, 1984 : 330.

Epanagyrus Girault, 1915 : 160. Type species *Epanagyrus punctatiscutum* Girault, by monotypy and original designation. Synonymy by Noyes & Hayat, 1984 : 330.

Neanagyrus Girault, 1915 : 180. Type species *Neanagyrus capitatus* Girault, by original designation. Synonymy by Dahms & Gordh, 1997 : 305.

Anagyropsis Girault, 1917 : 136. Type species *Anagyropsis purpureus* Girault, by original designation. Synonymy by Noyes & Hayat, 1984 : 330.

Metaprionomitus Mercet, 1921 : 260. Type species *Metaprionomitus intermedius* Mercet, by original designation. Synonymy by transfer of type species to *Psyllaephagus* by Trjapitzin, 1967 : 192.

Shakespeareia Girault, 1928 : 3. Type species *Shakespeareia flabellate* Girault, by monotypy. Synonymy by Riek, 1962 : 685.

Psyllencyrtus Tachikawa, 1955 : 63. Type species *Psyllencyrtus syntomozae* Tachikawa, by monotypy and original designation. Synonymy by transfer of type species to *Psyllaephagus* by Trjapitzin, 1967 : 191.

Calluniphilus Erdos, 1961 : 413. Type species *Calluniphilus vendicus* Erdos, by monotypy and original designation. Synonymy by Graham, 1969 : 248.

Anisodromus Riek, 1962 : 283. Type species *Anisodromus tarsius* Riek, by original designation. Synonymy by Dahms & Gordh, 1997 : 305.

Ooencytoides Hoffer, 1963 : 568. Type species *Ooencyrtus albopilosus* Hoffer, by original designation. [As subgenus of *Ooencyrtus*]. Synonymy by Graham, 1969 : 248.

Propsyllaephagus Blanchard in De Santis, 1964 : 235. Type species *Propsyllaephagus trellesi* Blanchard, by monotypy and original designation. Synonymy by Noyes, 1979 : 165.

Mercetia Bakkendorf, 1965 : 139. Type species *Copidosoma lusitanicum* Mercet, by monotypy and original designation. Synonymy by Graham, 1969 : 248.

Kaszabicyrtus Szelenyi, 1971 : 389. Type species *Kaszabicyrtus acutigastris* Szelenyi, by monotypy and original designation. Synonymy by Trjapitzin & Gordh, 1978 : 636.

Hosts : Parasitoids or hyperparasitoids of nymph of Psyllidae (Homoptera).

Species and Distribution : World 200 species, 10 species from India and 01 species from Maharashtra.

***Psyllaephagus mycopsyllus* Singh, 1996**

Psyllaephagus mycopsyllus Singh, 1996 : 157-160, F, M. Holotype F : India, Aizawl (FRI)

Diagnosis : F1 clearly shorter than pedicle and F2, F1-5 longer than broad, F6 broader than long; pedicle basal half, F1 dorsal half, F2-6 in basal half and clava brownish, remaining parts of pedicle and funicle segments whitish; stigma vein clearly longer than postmarginal vein.

Hosts : *Mycopsylla* sp. on *Ficus religiosa*.

Distribution : India : Maharashtra, Goa, Mizorum.

Genus *Trechnites* Thomson, 1876

Trechnites Thomson, 1876 : 118. Type species *Trechnites fuscitarsis* Thomson, by monotypy.

Psylledontus Crawford, 1910 : 88. Type species *Psylledontus insidiosus* Crawford, by monotypy and original designation. Synonymy by Ferriere, 1961 : 39.

Metallonella Girault, 1915 : 77. *Metallonella australiensis* Girault, by original designation. Synonymy by Ferriere, 1961 : 39.

Hosts : Parasitoids of nymphs of Psyllidae (Homoptera).

Species and Distribution : World 18 species, 4 species from India and 01 species from Maharashtra.

***Trechnites silvestries* Kazmi & Hayat, 2009**

Trechnites silvestries Kazmi & Hayat, 2009 : 111-113, F. Holotype F : India, Maharashtra, Jalgaon, Jamneri Reserv Forest (NCZSI).

Diagnosis : Malar space with slightly raised elongate reticulation and 0.4X of eye length; mandible with two teeth with rounded dorsal tooth; funicle segment relatively slender, F3 distinctly shorter than F4, funicle segments, except F2, longer than broad; scutellum with raised reticulate sculpture, much deeper than mesoscutum; forewing 2.5X as long as broad.

Hosts : Unknown.

Distribution : India : Maharashtra.

Tribe **Discodini** Hoffer, 1955Genus ***Psyllaphycus*** Hayat, 1972

Psyllaphycus Hayat, 1972 : 207. Type species *Psyllaphycus diaphorinae* Hayat, by monotypy and original designation.

Hosts : Parasitoids of nymphs of Psyllidae (Homoptera).

Species and Distribution : One species, India only.

Psyllaphycus diaphorinae Hayat, 1972

Psyllaphycus diaphorinae Hayat, 1972 : 208-209, F. M. Holotype F : India, Punjab, Maur ZSI (=NCZSI).

Diagnosis : Body completely yellow, except a black dot in centre of pronotum; frontovertex and dorsum of thorax clothed in conspicuous dark setae; mandible with one tooth and a broad truncation; pedicle longer than F1-2 combined; F4 and F6 longer than broad; clava 3-segmented and longer than preceding 3 funicle segments; stigma vein slightly longer than postmarginal vein.

Hosts : *Diaphorina cardiae* on *Cardia ruyxa* (Hayat, 1972; 1979); *Diaphorina* sp. (Hayat, 1972).

Distribution : India : Maharashtra, Punjab.

Genus ***Neastymachus*** Girault, 1915

Neastymachus Girault, 1915 : 86. Type species *Neastymachus auraticorpus* Girault, by monotypy.

Nikolskiella Trjapitzin, 1962 : 560. Type species *Micriterys luteus* Nikol'skaya, by original designation. Synonymy by Noyes & Hayat, 1984 : 304.

Pseudmicroterys Shafee, Alam & Agarwal, 1975 : 71. Type species *Pseudmicroterys burksi* Shafee, Alam & Agarwal, by original designation. Synonymy by Noyes & Hayat, 1984 : 304.

Hosts : Parasitoids of- Acleridae and Asterolecaniidae (Homoptera).

Species and Distribution : World 10 species, 6 species from India and 01 species from Maharashtra.

Neastymachus angustiferons (Shafee, Alam & Agarwal), 1984

Pseudmicroterys angustiferons Shafee, Alm & Agarwal, 1975 : 73, 76-78, F. Holotype F : India, Maharashtra, Nasik (ZDAMU).

Nikolskiella angustiferons (Shafee, Alam & Agarwal) : Hayat & Subba Rao, 1981 : 117, tax., catlg.

Neastymachus angustiferons (Shafee, Alam & Agarwal) : Noyes & Hayat : 1984 : 304, tax.

Diagnosis : Frontovertex about 0.2X of head width; ocellar triangle with apical angle acute; clava dark brown; pedicle longer than F1; F1-4 longer than broad, F5-6 broader than long; forewing basal triangle with a large bare area; gaster usually sub-equal in length to thorax, apically rounded, and with a cercal plates situated in about middle of gaster.

Hosts : *Anomalococcus cremastogasteri* on *Prosopis spicegera* (Shafee *et al.*, 1975); *Cerococcus hibisci* on *Hibiscus rosasinensis* (Shafee *et al.*, 1975);

Distribution : India : Maharashtra, Andhra Pradesh.

Genus ***Tachardiaephagus*** Ashmead, 1904

Tachardiaephagus Ashmead, 1904 : 503. Type species *Tachardiaephagus thoracicus* Ashmead, by monotypy and original designation.

Lissencyrtus Cameron, 1913 : 99. type species *Lissencyrtus troupe* Cameron, by monotypy. Synonymy by Ferriere, 1928 : 171.

Tachardiaephagus Girault, 1916 : 43. Type species *Tachardiaephagus thoracicus* Girault, by monotypy and original designation.

Hosts : Parasitoids of Lacciferidae (Homoptera).

Species and Distribution : World 05 species, 01 species from India and Maharashtra.

Tachardiaephagus tachardiae (Howard), 1896

Encyrtus tachardiae Howard, In Howard & Ashmead, 1896 : 641, M. Sri Lanka, Pundaluoya (USNM).

Tachardiaephagus thoracicus Ashmead, 1904 : 503, F. Synonymy by Ferriere, 1928 : 171.

Lissencyrtus troupe Cameron, 1913 : 100-101, F. India, Dehra Dun (BMNH). Synonymy by Ferriere, 1928 : 171.

Lassencyrtus somervilli Mahdihassan, 1923 : 71, F. India, Karnataka. Synonymy implied by Ferriere 1935.

Tachardiaephagus somervilli (Mahdihassan) : Ferriere, 1928 : 171, tax., Namkum rec.

Tachardiaephagus tachardiae (Howard) : Ferriere, 1928 : 171, Namkum rec.

Tachardiaephagus tachardiae var *somervilli* (Mahdihassan) : Ferriere, 1935 : 396, tax.

Tachardiaephagus tachardiae somervilli (Mahdihassan) : Varshney, 1976 : 61-62, emendation.

Tachardiaephagus flavipodus Kaul & Agarwal, 1986 : 36, F. Lectotype F [designated by Hayat, 1999 : 397] : India, Hyderabad (ZDAMU). Synonymy by Hayat, 1999 : 397.

Tachardiaephagus hyderabadensis Kaul & Agarwal, 1986 : 36, F. Lectotype F [designated by Hayat, 1999 : 397] : India, Hyderabad (ZDAMU). Synonymy by Hayat, 1999 : 397.

Tachardiaephagus kashmirensis Kaul & Agarwal, 1986 : 35, 36-39, F, M. Holotype F : India, Srinagar (ZDAMU). Synonymy by Hayat, 1989 : 283.

Diagnosis : Antennal scrobes long, deeply impressed, reaching to at least three quarters distance from toruli to anterior ocellus; intertorular prominence dorsally sharply margined and pointed and clearly separated from frontovertex; funicle segment longer than broad except F6; stigma vein longer than postmarginal vein.

Hosts : *Kerria albizziae*; *K. chinensis*; *K. communis*; *K. lacca*.

Distribution : India : Maharashtra, Andhra Pradesh, Bihar, Jammu & Kashmir, Jharkhand, Karnataka, Uttar Pradesh, Uttarakhand, West Bengal.

Genus *Metaphycus* Mercet, 1917

Aenasioidea Girault, 1911 : 171. Type species *Aenasioidea latiscapus* Girault, by monotypy. Synonymy with *Metaphycus* by Noyes & Woolley, 1994 : 1329.

Metaphycus Mercet, 1917 : 138. Type species *Aphycus zebratus* Mercet, by monotypy. [As subgenus of *Aphycus*].

Tyndarichoides Girault, 1920 : 189. Type species *Tyndarichoides mexicanus* Girault, by monotypy. Synonymy by Noyes & Woolley, 1994 : 1329.

Mercetiella Dozier, 1926 : 98. Type species *Mercetiella reticulate* Dozier, by monotypy and original designation. Synonymy by Trjapitzin & Gordh, 1978b : 636.

Oaphycus Girault, 1932 : 5. Type species *Aphycus sanguinithorax* Girault, by monotypy and original designation. Synonymy by Noyes & Hayat, 1984 : 298.

Melanaphycus Compere, 1947 : 5. Type species *Pseudococcobius fumipennis* Timberlake, by original designation. Cited as synonymy of *Metaphycus* by Noyes, 1980 : 212. by De Santis, 1981 : 14.

Erythrphycus Compere, 1947 : 7. Type species *Erythrphycus argyrocomus* Compere, by original designation. Synonymy by Noyes & Woolley, 1994 : 1329.

Mesaphycus Sugonjaev, 1960 : 370. Type species *Aphycus picearum* Erdos, by original designation. Synonymy by Guerrieri & Noyes, 2000 : 148.

Anaphycus Sugonjaev, 1960 : 372. Type species *Aphycus nitens* Kurdjumov, by monotypy and original designation. Synonymy by Trjapitzin, 1971a : 68.

Notoencyrtus De Santis, 1964 : 211. Type species *Notoencyrtus guttofasciatus* De Santis, by monotypy and original designation. Synonymy by Noyes, 1980 : 212.

Xenaphycus Trjapitzin, 1978 : 295. Type species *Paraphycus flavovarius* Mercet, by subsequent designation of Trjapitzin, 1982a : 38. Synonymy by Guerrieri & Noyes, 2000 : 148.

Aenigmaphycus Sharkov & Voynovich, 1988 : 826. Type species *Aenigmaphycus paluster* Sharkov & Voynovich, by original designation. Synonymy by Guerrieri & Noyes, 2000 : 148.

Hosts : Parasitoids of mainly soft scale insects (Homoptera : Coccidae).

Species and Distribution : World more than 400 species, 15 species from India and 02 species from Maharashtra.

Metaphycus maculatus Agarwal, 1965

Metaphycus maculatus Agarwal, 1965 : 89-91, F, M. Holotype F : India, Aligarh (ZDAMU).

Metaphycus patnagerensis Kaul & Agarwal, 1986 : 28. Lectotype F [designated by Hayat, 1999 : 378] : India, Uttaranchal [=Uttarakhand], Pantnagar (ZDAMU). Synonymy by Hayat, 1999 : 378.

Aphycus (Metaphycus) maculatus (Agarwal) : Mani, 1989 : 847-849, des.

Diagnosis : Forewing normally developed, reaching at least to apex of gaster; Scape nearly 3.0X as long as broad; F1-4 dark brown; third valvula as long as mid tibial spur, second valvifer longer than mid tibia.

Hosts : *Ceroplastes* sp. on *Citrus aurantifolia* (Agarwal, 1965); *Coccus viridis* *Pulvinaria* sp. (Shafee *et al.*, 1975); *Saissetia coffeae*.

Distribution : India : Maharashtra, Rajasthan, Uttar Pradesh, Karnataka, Uttarakhand, Himachal Pradesh.

***Metaphycus fuscidorsum* (Gahan), 1984**

Aphycus fuscidorsum Gahan, 1919 : 521, F. Holotype F : India, Coimbatore (USNM).

Euaphycus crotolariae Shafee, Alam & Agarwal, 1975 : 82, 85-88, F, M. Holotype F : India, Andhra Pradesh, Mangalagiri (ZDAMU). Synonymy by Zeya & Hayat, 1993 : 196.

Metaphycus crotolariae (Shafee, Alam & Agarwal) : Hayat & Subba Rao, 1981 : 115, tax, catlg.

Aphycus (*Euaphycus*) *crotolariae* (Shafee, Alam & Agarwal) : Mani, 1989 : 844-845, des.

Aphycus (*Aphycus*) *fuscidorsum* Gahan : Mani, 1989 : 838-839, des.

Metaphycus fuscidorsum (Gahan) : Noyes & Hayat, 1984 : 298, tax.

Diagnosis : Frontoververtex about 0.25X of head width; scape about 3.0X as long as wide; pedicel shorter than F1 and F2 combined; ovipositor slightly shorter than mid tibia; wings hyaline; legs yellow with two incomplete brown bands in all tibiae.

Hosts : *Cerococcus indicus* on *Hyptis suaveolem* (Zeya & Hayat, 1993); *Ceroplastodes* sp. (Shafee *et al.*, 1975; Zeya & Hayat, 1993).

Distribution : India : Maharashtra, Andhra Pradesh, Kerala, Tamil Nadu, Karnataka.

Genus *Diaphorencyrtus* Hayat, 1981

Diaphorencyrtus Hayat, 1981 : 18. Type species *Aphidencyrtus aligarhensis* Shafee, Alam & Agarwal, by original designation.

Hosts : Parasitoids of nymph of Psyllidae (Homoptera).

Species and Distribution : World 02 species, 01 species from India and Maharashtra.

***Diaphorencyrtus aligarhensis* (Shafee *et al.*), 1975**

Aphidencyrtus aligarhensis Shafee, Alam & Agarwal, 1975 : 91-93, F, M. Holotype F : India, Aligarh (ZDAMU).

Aphidencyrtus sacchari Kaul & Agarwal, 1986 : 6, F.

Lectotype F [designated by Hayat, 1999 : 367] : India, Hyderabad (ZDAMU). Synonymy by Hayat, 1999 : 367.

Diaphorencyrtus aligarhensis (Shafee *et al.*) : Hayat, 1981a : 19, F, M. tax, Aligarh, Manmad, Bhatida, Mau rec.

Syrphophagus aligarhensis (Shafee, Alam & Agarwal) : Fatima & Shafee, 1994 : 84, 84 tax.

Diagnosis : Frontoververtex slightly more than a third of head width; mandible with two teeth with truncation; antenna short; pedicel longer than F1 and F2 combined; funicle segments not longer than wide; clava 3-segmented and shorter than preceding four segments.

Hosts : *Diaphorina* sp. *D. cardiae*, *Psylla* sp.

Distribution : India : Maharashtra, Uttar Pradesh, Punjab, Andhra Pradesh, Rajasthan.

Genus *Lamennaisia* Girault, 1922

Lamennaisia Girault, 1922 : 40. Type species *Lamennaisia quadridentata* Girault, by monotypy.

Mercetencyrtus Trjapitzin, 1963 : 886. Type species *Encyrtus ambiguous* Nees, by monotypy and original designation. Synonymy by Noyes & Hayat, 1984 : 292.

Sabirella Agrawal, Agrawal & Khan, 1980 : 30. Type species *Sabirella indica* Agrawal, Agrawal & Khan, by monotype and original designation. Synonymy by Noyes & Hayat, 1984 : 292.

Negeniaspidius Trjapitzin, 1982 : 39. Type species *Encyrtus nobilis* Nees, by original designation. Synonymy by Hayat, 2003a : 195.

Hosts : Unknown.

Species and Distribution : World four species, three species from India (one species from Maharashtra).

***Lamennaisia indica* (Agarwal), 2003**

Syrphophagus indicus Agarwal, 1962 : 246, F, M, Holotype F : India Bombay[=Mumbai] (ZDAMU).

Negeniaspidius indicus (Agarwal) : Hayat, 1989 : 281, tax.

Lamennaisia indica (Agarwal) : Hayat, 2003 : 196, tax, Mukkal rec.

Diagnosis : Mesoscutum slightly elongate reticulate sculpture in middle to nearly lineolate reticulate on sides; scutellum with fine, lineolate-

reticulate sculpture, the lines closely spaced; forewing with fewer setae in basal third proximal of linea calva.

Hosts : Indt. syrphid puparia (Agarwal 1962).

Distribution : India : Maharashtra, Kerala.

Genus *Ooencyrtus* Ashmead, 1900

Ooencyrtus Ashmead, 1900 : 381. Type species *Encyrtus clisiocampae* Ashmead, by original designation.

Echthrodryinus Perkins, 1906 : 252. Type species *Echthrodryinus destructor* Perkins, by monotypy. Synonymy by Noyes & Hayat, 1984 : 309.

Ectopiognatha Perkins, 1906 : 254. Type species *Ectopiognatha minor* Perkins, by designation of Gahan & Fagan, 1923 : 49. Synonymy by Huang & Noyes, 1994 : 9.

Schedius Howard, 1910 : 2. Type species *Schedius kuvanae* Howard, by monotypy and original designation. Synonymy by Mercet, 1925c : 324.

Tetracnemella Girault, 1915 : 170. Type species *Tetracnemella australiensis* Girault, by original designation. Synonymy by Noyes & Hayat, 1984 : 309.

Xesmatia Timberlake, 1920 : 242. Type species *Xesmatia flavipes* Timberlake, by monotype and original designation. Synonymy by Noyes & Hayat, 1984 : 309.

Pseudolitomastix Risbec, 1954 : 1068. Type species *Litomastix creona* Risbec, by original designation. Synonymy by Annecke & Mynhardt, 1973 : 211.

Hosts : Oophagous, parasitoids of eggs of various insects, notably Lepidoptera and Heteroptera. Also hyperparasitoids of Lepidoptera and Auchenorrhyncha (Homoptera) via other Hymenoptera.

Species and Distribution : World over 120 species, 29 species from India and 03 species from Maharashtra.

Ooencyrtus acus Huang & Noyes, 1994

Ooencyrtus acus Huang & Noyes, 1994 : 11, 19-21, F, M. Holotype F : India, Maharashtra, Dadh (BMNH).

Hosts : Hyperparasitoid of prepupa or pupae of *Epiricania melanoleuca*.

Distribution : India : Maharashtra, Uttar Pradesh, Gujarat, Orissa.

Ooencyrtus guamensis Fullaway, 1946

Ooencyrtus guamensis Fullaway, 1946 : 205-206, F, M. Holotype F : Guam, Piti (USNM).

Psyllaephagus faridabadensis Fatima & Shafee, 1994 : 53, 54, F. Holotype F : India, Haryana, Faridabad, Batkal (ZDAMU). Synonymy by Hayat, 1999 : 386.

Hosts : Pupal parasitoids of Syrphidae (Diptera); *Paragus auritus*; *Asarkira pura*; *Ischiodon scutellaris*.

Distribution : India : Maharashtra, Andhra Pradesh, Bihar, Delhi, Haryana, Jharkhand, Karnataka, Kerala, Rajasthan, Tamil Nadu, Uttarakhand, Uttar Pradesh.

Ooencyrtus manii Huang & Noyes, 1994

Ageniaspis pyrillae Mani, 1939 : 72, F, M. Holotype F : India, New Delhi (NPCI).

Ooencyrtus manii Huang & Noyes, 1994 : 15, 67-68, F, M. tax. des., hosts, distr.

Hosts : Eggs of *Pyrilla perpusilla*.

Distribution : India : Maharashtra, Delhi, Haryana, Punjab, Tamil Nadu, Uttar Pradesh.

Genus *Tassonia* Girault, 1921

Tassonia Girault, 1921 : 2. Type species *Tassonia gloriae* Girault, by monotypy.

Hosts : Parasitoids of Aphididae (Homoptera).

Species & Distribution : World 03 species, 03 species from India and 01 species from Maharashtra.

Tassonia gloriae Girault, 1921

Tassonia gloriae Girault, 1921 : 2, F. Holotype F : Australia, Wynnum (QMB).

Neblatticida tassoniaeformis Girault, 1921 : 3, F. Holotype F : Australia, Queensland, Babinda (QMB). Synonymy by Noyes & Hayat, 1984 : 341.

Leiocyrtus aphidivorus Shafee, Alam & Agarwal, 1975 : 93-95, F. Holotype F : India, Guntur, Nidubrolu (ZDAMU). Synonymy by Hayat, 2003 : 202.

Aphidencyrtus mangiclavus Hayat & Subba Rao, 1981 : 108. [Replacement name for *L. aphidivorus* Shafee et al.]. Synonymy by Noyes & Hayat, 2003 : 202.

Tassonia magniclava (Hayat & Subba Rao) : Noyes & Hayat, 1984 : 341, tax.

Adelencyrtus mangiclavatus Fatima & Shafee, 1994 : 69, 71-72, F. Holotype F : India, Aligarh (ZDAMU).
Synonymy by Hayat, 2003 : 202.

Tassonia aphidivora (Shafee, Alam & Agarwal) : Fatima & Shafee, 1994 : 90.

Diagnosis : Scape at least slightly flattened beneath, not more than 3.5X as long as broad; F2-4 transverse, F6 broader than long; clava longer than funicle segments; postmarginal vein shorter than stigma vein; distal 1/4 scape pale yellow or white; mid tibia dark brown in basal third to fourth.

Hosts : *Hysteroneura setariae*; *Longiunguis sacchari*; *Myzus persicae*.

Distribution : India : Maharashtra, Andhra

Pradesh, Bihar, Goa, Himachal Pradesh, Jharkhand, Karnataka, Kerala, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh, Uttarakhand, West Bengal.

Remarks : New record from Maharashtra (India).

ACKNOWLEDGEMENTS

The authors are grateful to Director, Zoological Survey of India, Kolkata, for providing facilities. We are also thankful to Dr. Kailash Chandra, Scientist-F and Divisional In-Charge Z.S.I. Kolkata for his useful suggestions in the preparation of the manuscript.

REFERENCES

- Agarwal, M.M. 1965. Taxonomy of encyrtid parasites (Hymenoptera : Chalcidoidea) of Indian coccoidea. *Acta Hymenopterologica*, **10** : 37-97.
- Alam, S.M. 1972. New species of Encyrtidae (Hymenoptera : Chalcidoidea) recorded from India. *Bulletin of Entomology, New Delhi*, **11** : 131-137.
- Anis, S.B. and Hayat, M. 1998. The Indian species of *Homalotylus* (Hymenoptera : Encyrtidae). *Oriental Insects*, **32** : 191-218.
- Anis, S.B. and Hayat, M. 2002. A revision of Indian species of *Cheiloneurus* Westwood (Hymenoptera : Chalcidoidea : Encyrtidae). *Oriental Insects*, **36** : 129-209.
- Anneck, D.P. and Mynhardt, M.J. 1974. On the identity of *Copidosoma koehleri* Blanchard, 1940 (Hymenoptera : Encyrtidae). *Journal of Entomological Society of Southern Africa*, **37** : 31-33.
- Compere, H. and Annecke, D.P. 1961. Description of parasitic Hymenoptera and comments (Hymenopt : Aphelinidae, Encyrtidae, Eulophidae). *Journal of Entomological Society Southern Africa*, **24** : 17-71.
- Ferriere, C. 1935. The chalcidoid parasites of Lac insects. *Bulletin of Entomological Research*, **22** : 279-295.
- Gahan, A.B. 1919. Report on a small collection of Indian parasitic Hymenoptera. *Proceeding of U. S. National Museum*, **189** : 201-210.
- Girault, A.A. 1915. Australian Hymenoptera Chalcidoidea-VII. The family Encyrtidae with description of new genera and species. *Memoires of Queensland Museum*, **4** : 1-184.
- Graham, M.W.R. de V. 1994. The identify of some species of Chalcidoidea (Hym.) described by Geoffroy (in Fourcroy, 1785) with new synonymy. *Entomologist's Monthly Magazine*, **130** : 121-129.
- Guerrieri, E. and Noyes, J.S. 2000. Revision of European species of genus *Metaphycus* Mercet (Hymenoptera : Chalcidoidea : Encyrtidae), parasitoids of scale insects (Homoptera : Coccoidea). *Systematic Entomology*, **25** : 147-222.

- Guerrieri, E. and Viggiani, G. 2005. A review of the encyrtid (Hymenoptera : Chalcidoidea) parasitoids of Dryinidae (Homoptera : Chrysidoidea) with description of a new species of *Cheiloneurus*. *Systematic and Biodiversity*, 2(3) : 305-317.
- Hayat, M. 1970. New species of Encyrtidae (Hymenoptera : Chalcidoidea) reared from coccids. *Mushi*, 44 : 55-63.
- Hayat, M. 1976. *Krishnieriella* Mani, 1935, a synonymy of *Anicetus* Howard, 1896 (Hymenoptera, Encyrtidae). *Entomologist's Monthly Magazine*, 111 : 49-50.
- Hayat, M. 1979a. Taxonomic notes on Indian Encyrtidae (Hymenoptera : Chalcidoidea) V. *Oriental Insects*, 33 : 349-407.
- Hayat, M. 1979b. Taxonomic notes on Indian Encyrtidae (Hymenoptera : Chalcidoidea) I. *Journal of Natural History*, 13 : 315-326.
- Hayat, M. 1981. Taxonomic notes on Indian Encyrtidae (Hymenoptera : Chalcidoidea) III. *Colemania*. 1(1) : 13-34.
- Hayat, M. 1985. "Family Encyrtidae" In "The Chalcidoidea (Insecta : Hymenoptera) of India and the adjacent countries. Part I." (B.R. Subba Rao & M. Hayat eds.). *Oriental Insects*, 19 : 192-223.
- Hayat, M. 1986. "Family Encyrtidae" In "The Chalcidoidea (Insecta : Hymenoptera) of India and the adjacent countries. Part II." (B.R. Subba Rao & M. Hayat eds.). *Oriental Insects*. 20 : 430 pp.
- Hayat, M. 1989. Taxonomic notes on Indian Encyrtidae (Hymenoptera : Chalcidoidea) IV. *Oriental Insects*, 23 : 275-285.
- Hayat, M. 1999. Taxonomic notes on Indian Encyrtidae (Hymenoptera : Chalcidoidea) V. *Oriental Insects*, 33 : 349-407.
- Hayat, M. 2003. Record and descriptions of Indian Encyrtidae (Hymenoptera : Encyrtidae). *Oriental Insects*, 37 : 187-260.
- Hayat, M. 2004. A review of the classification of Encyrtidae (Hymenoptera : Chalcidoidea). In *Perspective on Biosystematics and Biodiversity* TCN Com. Vol. 349-361.
- Hayat, M. 2006. *Indian Encyrtidae (Hymenoptera : Chalcidoidea)*. Viii+496 pp. Published by M. Hayat, Department of Zoology, Aligarh Muslim University, India.
- Hayat, M. and Kazmi, S.I. 1996. The species of *Proleurocerus* (Hymenoptera : Encyrtidae) from India. *Shashapa* (India), 3(1) : 17-21.
- Hayat, M. and Subba Rao, B.R. 1981. A systematic catalogue of Encyrtidae (Hymenoptera : Chalcidoidea) from Indian subcontinent. *Colemania*, 1 : 103-125.
- Hayat, M., Alam, S.M. and Agarwal, M.M. 1975. Taxonomic survey of encyrtid parasites (Hymenoptera : Encyrtidae) in India. *Aligarh Muslim University Publication (Zoological Serise) on Indian Insect Types*, 9 : 1-112.
- Huang, D.W. and Noyes, J.S. 1994. A revision of the Indo-Pacific species of *Ooencyrtus* (Hymenoptera : Encyrtidae) parasitoids of immature stages of economically important insect species (mainly Hemiptera and Lepidoptera). *Bulletin of Natural History Museum London (Entmology)*, 63(1) : 1-136.
- Kaul, K. and Agarwal, M.M. 1986. Taxonomic studies on encyrtid parasitoids (Hymenoptera : Chalcidoidea) of India. *Aligarh Muslim University Publication (Zoological Serise) on Indian Insect Types*, 13 : viii + 89pp.

- Kazmi, S.I. 2006. A checklist of Encyrtidae (Hymenoptera : Chalcidoidea) from Uttar Pradesh (India). *Record of Zoological Survey of India*, **106**(Part-4) : 73-91.
- Kazmi, S.I. 2008. A checklist of Encyrtidae (Hymenoptera : Chalcidoidea) from Maharashtra, India. *Journal of Experimental Zoology India*, **11**(2) : 489-495.
- Kazmi, S.I. 2008. Record of some Encyrtidae (Hymenoptera : Chalcidoidea) from the Thar Desert of Rajasthan, India. *Columban Journal of Life Science*, **9**(1&2) : 24-29.
- Kazmi, S.I. and Hayat, M. 1995. The species of *Trechnites* (Hymenoptera : Encyrtidae) from India and Sri Lanka. *Shashpa*, **2**(2) : 87-94.
- Kazmi, S.I. and Hayat, M. 1998. Revision of the Indian Copidosomatini (Hymenoptera : Chalcidoidea : Encyrtidae). *Oriental Insects*, **32** : 287-362.
- Mani, M.S. 1939. Descriptions of new and records of some known chalcidoid and other hymenopterous parasites from India. *Indian Journal of Entomology*, **1** : 69-99.
- Mani, M.S. 1941. Studies on Indian parasitic Hymenoptera I. *Indian journal of Entomology*, **3** : 25-36.
- Mani, M.S. 1989. *The fauna of India and the adjacent countries Chalcidoidea (Hymenoptera) Part I. Zoological Survey of India*, 1-1067.
- Noyes, J.S. 1977. The encyrtid genus *Amira*, parasites of spider eggs (Hymenoptera). *Systematic Entomology*, **2** : 49-51.
- Noyes, J.S. 1979. The West Indian species of Encyrtidae described by L.D. Howard, 1894 abd 1897 (Hymenoptera, Chalcidoidea). *Systematic Entomology*, **4** : 143-169.
- Noyes, J.S. 2001. *Interactive catalogue of world chalcidoidea 2001. (CD-Rom). Disk Yu, Bentall centre, Canada.*
- Noyes, J.S. and Chua, T.H. 1977. Description of two new species of *Cheiloneurus* from Malaysia (Hymenoptera : Encyrtidae). *Oriental Insects*, **11** : 541-546.
- Noyes, J.S. and Hayat, M. 1984. A review of genera of Indo-Pacific Encyrtidae (Hymenoptera : Chalcidoidea). *Bulletin of British Museum. (Natural History), Entomology*, **48** : 131-395.
- Noyes, J.S. and Hayat, M. 1994. *Oriental Mealybug parasitoids of Anagyrini (Hymenoptera : Chalcidoidea). CAB Int. Oxon.*
- Shafee, S.A., Alam, S.M. and Agarwal, M.M. 1975. Taxonomic survey of encyrtid parasites (Hymenoptera : Encyrtidae) in India. *Aligarh Muslim University Zoological Publications, Indian Insect Types*, **10** : 125 pp.
- Singh, S. and Agarwal, M.M. 1993. Taxonomic studies on Indian encyrtid parasites (Hymenoptera : Encyrtidae) from North Eastern region. *Aligarh Muslim University Zoological Publications, Indian Insect Types*, **14** : 180pp.
- Subba Rao, B.R. 1957. Some new species of Indian Hymenopter. *Proceeding Indian Academic of Science, (B)* **46** : 376-390
- Timberlake, P.H. 1919. Description of new genera and species of Hawaiian Encyrtid (Hymenoptera). *Proceeding of Hawaiian Entomological. Society*, **4** : 197-231.
- Trjapitzin, V.A. 1971. Encyrtidae (Hymenoptera, Chalcidoidea) collected by E.S. Sugonjaev in

- Afganistan. I. *Entomological Essay to Commemorate the Retirement of Professor Yasumatsu*. Pp. 119-127, Tokyo.
- Trjapitzin, V.A. 1973a. The Classification of parasitic Hymenoptera of family Encyrtidae (Hymenoptera : Chalcidoidea). Part I. Survey of the system of classification. The subfamily Tetracneminae Howard 1892 [In Russian]. *Entomologicheskoe Obozrenie*, **52** :163-175.
- Trjapitzin, V.A. 1973b. The Classification of parasitic Hymenoptera of family Encyrtidae (Hymenoptera : Chalcidoidea). Part II. The subfamily Encyrtinae Walker, 1873 1892 [In Russian]. *Entomologicheskoe Obozrenie*, **52** : 416-429.
- Trjapitzin, V.A. and Gordh, G. 1978. Review of the genera of Nearctic Encyrtidae (Hymenoptera : Chalcidoidea).I. *Entomologicheskoe Obozrenie* [In Russian], **57** : 364-385.
- Zeya, S.B. and Hayat, M. 1993. A review of the Indian species of *Metaphycus* (Hymenoptera : Encyrtidae). *Oriental Insects*, **27** : 185-210.

INSECTA : HYMENOPTERA : CHALCIDOIDEA : ENCYRTIDAE : TETRACNEMINAE

S.I. KAZMI and P. GIRISH KUMAR

Zoological Survey of India, M-Block, New Alipore, Kolkata-700 053, India

INTRODUCTION

Almost all species belonging to the Tetracneminae are parasitoids of Pseudococcidae, while species of encyrtinae are known to be parasitoids of a wide variety of coccoids and Pseudococcidae and other insects, mites, ticks and spiders (Tachikawa, 1981). The subfamily Tetracneminae which is divided into 06 Indian tribes (Hayat, 2006) contains 14 genera and 27 species from Maharashtra.

Abbreviation used in the text : F : Female. M : Male. BMNH : The Natural History Museum, London. BPBM : Bernice P. Bishop Museum, Honolulu, Hawaii, U.S.A. MCNM : Instituto Espanol de Entomologia, Museo Nacional de Ciencias Naturales, Madrid, Spain. NPCI : National Pusa Collection, Division of Entomology, Indian Agricultural Research Institute, New Delhi, India. PPRI : Plant Protection Research Institute, Pretoria, South Africa. SEA : School of Entomology, St. John's College, Agra, India. USNM : United States National Museum of Natural History, Washington DC, U.S.A. ZDAMU : Department of Zoology, Aligarh Muslim University, Aligarh, India. ZMMU : Moscow State University Museum, Moscow, Russia. ZSI (= NCZSI) : Zoological Survey of India, Kolkata, India.

CLASSIFICATION

Only Indian genera are shown against each tribe.

Subfamily TETRACNEMINAE Howard, 1892

Tribe **Tetracnemini** Howard, 1892–*Adektitopus*, *Charitopus*, *Clausenia*, *Eotopus*, *Manicnemus*, *Neocharitopus*, *Paraclausenia*, *Ruanderoma*, *Sakencyrtus*, *Tetracnemoidea*, *Tetracnemus*.

Tribe **Neodusmetiini** Hayat, 2006–*Neodusmentia*.

Tribe **Aenasiini** Kerrich, 1967–*Aenasius*, *Blepyrus*, *Cladiscodes*, *Manmohanencyrtus*, *Metaphaenodiscus*, *Neoplatycerus*.

Tribe **Anagyrini** Hoffer, 1953–*Alamella*, *Anagyrus*, *Anomalencyrtus*, *Anomalicornia*, *Apoleptomastix*, *Callipteroma*, *Cryptanusia*, *Dusmetia*, *Gyranusoidea*, *Hamusencyrtus*, *Leptomastidea*, *Leptomastix*, *Mashhoodia*, *Monstranusia*, *Paranathrix*, *Praleurocerus*, *Rhopus*, *Yasumatsuiola*.

Tribe **Pauridiini** De Santis, 1964–*Coccidoxenoides*.

Tribe **Ericydnini** Hoffer, 1955–*Ericydnus*.

Diagnosis of the subfamily Tetracneminae : Mandibles sharply bidentate with two teeth equal or upper tooth longer or if tridentate, then teeth sharp with middle tooth longer; paratergites present, each paratergite connected to outer plate of the ovipositor by a thin and delicate extension; hypopygium prominent, extending to or beyond apex of gaster; third valvula fused with the second valvifer, or the junction between the two membranous; rarely the third valvula free; fore

wing with the linea calva with undifferentiated margins, and filum spinosum always absent.

Tribe **Tetracnemini** Howard, 1892

Genus **Adektitopus** Noyes & Hayat, 1984

Adektitopus Noyes & Hayat, 1984 : 221. Type species *Adektitopus gordhi* Noyes & Hayat, by original designation.

Hosts : Parasitoids of mealybugs (Homoptera : Pseudococcidae).

Species and distribution : 02 species all from India and 01 species from Maharashtra.

Adektitopus gordhi Noyes & Hayat, 1984

Adektitopus gordhi Noyes & Hayat, 1984 : 222-223, F, M. Holotype F : India, Madhumalai Animal Sanctuary (BMNH).

Diagnosis : Forewing slightly less than 3X as long as broad, with pale longitudinal infuscate streak on disc beyond venation; gaster not completely dark brown; legs honey yellow, with fore coxa and largely mid coxa dark brown.

Hosts : Unknown.

Distribution : India : Maharashtra, Tamil Nadu..

Genus **Charitopus** Foerster, 1856

Charitopus Foerster, 1856 : 31. Type species *Charitopus fulviventris* Foerster, by monotypy through subsequent reference of Foerster, 1860 : 112.

Leptorhopala Motschulsky, 1863 : 60. Type species *Leptorhopala cupriformis* Motschulsky, by monotypy. Synonymy by transfer of type species to *Charitopus* by Trjapitzin, 1964 : 242.

Eupelmomorpha Girault, 1915 : 43. Type species *Eupelmomorpha quadricolor* Girault, by designation of Gahan & Fagan, 1923 : 60. Synonymy by Noyes & Hayat, 1984 : 248.

Diversicornia Mercet, 1916 : 371. Type species *Diversicornia pinicola* Mercet, by monotypy and original designation. Synonymy by Mercet, 1922 : 54.

Hosts : Unknown.

Species and distribution : World 13 species, 3 species from India and 01 species from Maharashtra.

Charitopus panchgania (Mani & Saraswat), 1974

Diversicornia panchgania Mani & Saraswat, 1974 : 81-83, M. Holotype M : India, Panchgani (USNM).

Ericydnus albipedicellus Shamim & Shafee, 1984 : 25-26, F. Holotype F : India, Bihar, Champaran, Motihari (ZDAMU). Synonymy by Hayat, 1999 : 364.

Charitopus panchgania (Mani & Saraswat) : Hayat, 1979b : 318, tax.

Charitopus albipedicellus (Shamim & Shafee) : Hayat, 1989 : 278, F, Calicut rec.

Diagnosis : Antenna with funicle segments normal, not with dorsal rami, pedicel and apical half of scape white, rest are dark brown; clava slightly more than preceding two funicle segments; mesoscutum with complete notaular lines; scutellum with lineolate reticulate sculpture; legs yellow, excluding coxae, pale yellow; fore and hind coxae largely or completely dark brown.

Hosts : *Icerya pilosa* on *Saccharum officinarum*.

Distribution : India : Maharashtra, Assam, Arunachal Pradesh, Bihar, Kerala, Uttar Pradesh, Orissa, Uttrakhand.

Genus **Manicnemus** Hayat, 1981

Manicnemus Hayat, 1981 : 23. Type species *Tetralophidea indica* Mani & Saraswat, by original designation.

Hosts : Recorded from a diaspidid (Homoptera).

Species and distribution : Only 02 species from world and India and 01 species from Maharashtra.

Manicnemus indicus (Mani & Saraswat), 1974

Tetralophidea indica Mani & Saraswat, 1974 : 77-79, M. Holotype M : India, Maharashtra, Panchgani (USNM).

Parablastothrix indicus Shafee, Alam & Agarwal, 1975 : 104-105, M. Holotype M : India, Karnataka, Yasvantpur (ZDAMU). Synonymy by Hayat, 1979b : 316-320.

Charitopus nigricorpus Shamim & Shafee, 1985 : 36-38, F. Holotype F : India, Ranchi, Khunti (ZDAMU, lost). Synonymy by Hayat, 1989 : 280-281, F, M, Delhi and Calicut.

Parablastothrix Indica (Mani & Saraswat) : Hayat, 1979b : 316, 320-321, M, Aligarh and Jaipur rec.

Manicnemus indicus (Mani & Saraswat) : Hayat, 1981 : 24, F, M, tax., des., Aligarh rec.

Diagnosis : Body dark brown to brownish black, shiny; mesopleura faint violet; gaster with first tergum in anterior half to 2/3 bluish-green, posterior margin mainly bronzy; terga 2-4 mainly bronzy; last tergum faintly to distinctly bluish green; antena dark brown; apex of scape yellowish, rest of scape with greenish shine; legs dark brown, shiny especially on coxae; apex of middle tibia and tarsal segments 1-4 of middle and hind legs yellowish; last tarsal segment of all legs brownish; body sparsely setose, setae brown; head reticulate; mesoscutum with alutaceous sculpture, the cells tend to elongate posteriorly; scutellum with distinct longitudinal reticulation.

Hosts : *Greenaspis divergens*.

Distribution : India : Maharashtra, Assam, Bihar, Jharkhand, Uttar Pradesh, Delhi, Orissa, Kerala, Karnataka, Rajasthan.

Genus *Paraclausenia* Hayat, 1980

Paraclausenia Hayat, 1980 : 637. Type species *Paraclausenia herbicola* Hayat, by monotypy and original description.

Hosts : Mealybugs (Homoptera : Pseudococcidae).

Species and distribution : One species, India only.

Paraclausenia herbicola Hayat, 1980

Paraclausenia herbicola Hayat, 1980 : 639, 642, F, M. Holotype F : India, Aligarh (BMNH).

Clausenia indica Shafee & Avasthi, 1983 : 178-179, F. Holotype F : India, Coimbatore (ZDAMU). Synonymy by Hayat, 1989 : 282.

Diagnosis : Mandible with 3 acute teeth; mesoscutum and scutellum with reticulate sculpture; eyes not over reaching occipital margin; forewing hyaline and at least slightly more than 2.5X as long as broad; postmarginal vein at least a little longer than stigmal vein.

Hosts : *Rastrococcus* sp. on *Acacia moniliformis*.

Distribution : India : Maharashtra, Andhra Pradesh, Assam, Jharkhand, Himachal Pradesh, Rajasthan, Kerala, Uttar Pradesh.

Genus *Tetracnemus* Westwood, 1837

Tetracnemus Westwood, 1837 : 258. Type species *Tetracnemus diversicornis* Westwood, by monotypy.

Tetracladia Howard, 1892 : 367. Type species *Tetracladia texana* Howard, by designation of Ashmead, 1900 : 358. Cited as synonymy of *Tetracnemus* by Peck, 1963 : 347.

Calocerinus Howard, 1892 : 368. Type species *Tetracnemus floridanus* Ashmead, by monotypy. Synonymy by Noyes & Woolley, 1994 : 1330.

Tetralophidea Ashmead, 1900 : 348. Type species *Tetralophidea bakeri* Ashmead, by monotypy and original designation. Synonymy by Trjapitzin & Gordh, 1978 : 365.

Henicopygus Ashmead, 1900 : 355. Type species *Henicopygus subapterus* Ashmead, by monotypy and original designation. Synonymy by Noyes & Woolley, 1994 : 1330.

Tetralophiellus Ashmead, 1900 : 357. Type species *Tetralophiellus brevicollis* Ashmead, by monotypy and original designation. Synonymy by Trjapitzin & Gordh, 1978 : 365.

Paracalocerinus Girault, 1915 : 142. Type species *Paracalocerinus australiensis* Girault, by monotypy and original designation. Synonymy with *Tetracladia* by Erdos, 1955 : 221. Cited as synonym of *Tetracnemus* by Peck, 1963 : 347.

Nebaocharis Girault, 1916 : 45. Type species *Nebaocharis hemipterus* Girault, by monotypy. Synonymy by Noyes & Woolley, 1994 : 1330.

Masia Mercet, 1919 : 470. Type species *Masia bifasciatella* Mercet, by Monotypy and original designation. Synonymy with *Paracalocerinus* by Timberlake, in Dozier, 1933 : 94.

Anusiella Mercer, 1923 : 287. Type species *Anusia heydeni* Mayr, by original designation. Synonymy with *Tetracladia* by Erdos, 1955 : 221. Cited as synonym of *Tetracnemus* by Peck, 1963 : 347.

Placocerus Erdos, 1946 : 1. Type species *Placocerus calocense* Erdos, by monotypy. Synonymy with *Tetracladia* by Erdos, 1955 : 221. Cited as synonym of *Tetracnemus* by Peck, 1963 : 347.

Comperencyrtus De Santis, 1964 : 106. Type species

Comperencyrtus maculipennis De Santis, by monotypy and original designation. Synonymy by Kerrich, 1967 : 152.

Hosts : Parasitoids of mealybugs (Pseudococcidae : Homoptera).

Species and description : World 31 species, 05 species from India and 03 species from Maharashtra.

***Tetracnemus peninsularis* (Mani & Saraswat), 1974**

Tricnemus peninsularis Mani & Saraswat, 1974 : 74-75, M. Holotype M : India, Maharashtra, Mahabaleshwar-Poona Road (USNM).

Tetracnemus peninsularis (Mani & Saraswat) : Hayat, 1981 : 27, tax.

Diagnosis : Antennal clava not longer than funicle; funicle segment variable, but F6 clearly less than 2X as broad as long. Funicle segment 2-4 each with a dorsal ramus, slightly longer than broad to slightly broader than long, F5 at least 2.5X as long as F6; propodeum with 8-12 setae on each side anterior to spiracles; posterior ocelli about one ocellus diameter to eye margin and at least three ocellar diameter to occipital margin.

Hosts : Unknown.

Distribution : India : Maharashtra, Uttar Pradesh, Jharkhand, Kerala, Orissa.

***Tetracnemus heterocornis* Mani & Saraswat, 1974**

Tetracnemus heterocornis Mani & Saraswat, 1974 : 75-76, M. Holotype M : India : Maharashtra, Mahabaleshwar- Satara Road (USNM).

Arrhopoideus [sic] heterocornis (Mani & Saraswat) : Subba Rao, 1976 : 687.

Tetracnemoidea heterocornis (Mani & Saraswat) : Trjapitzin & Gordh, 1980 : 170.

Diagnosis : Funicle segment 2-5 each with dorsal ramus, F6 subequal in length to both F5 and clava; forewing hyaline, at most with a faint infuscation behind venation.

Hosts : Unknown.

Distribution : India : Maharashtra, Tamil Nadu, Kerala, Uttarakhand.

***Tetracnemus deccanensis* (Mani & Kaul), 1976**

Calocerinus indicus Mani & Kaul, 1973 : 66-67, F. Holotype F : India : Maharashtra, Khandala (USNM). [Preoccupied in *Tetracnemus* by *indicus* Ayyar 1932-now in *Tetracnemoidea*]. Synonymy by Hayat, 1979b : 316, 321.

Masia deccanensis Mani & Kaul, 1974 : 65-66, F. Holotype F : India, Khandala (USNM).

Tetracnemus indicus (Mani & Kaul) : Subba Rao, 1976 : 687.

Tetracnemus deccanensis (Mani & Kaul) : Hayat, 1979b : 316, 321-322.

Diagnosis : Antennal clava longer than funicle; all funicle segments transverse, F6 at least about 2X as broad as long; forewing distad of venation with two hyaline spots; propodeum with 2-3 setae on each side anterior to spiracles; posterior ocelli about one ocellus diameter to eye margin and one to slightly more than one diameter to occipital margin.

Hosts : Unknown.

Distribution : India : Maharashtra, Assam, Kerala.

Tribe Aenasiini Kerrich, 1967

Genus *Aenasius* Walker, 1846

Aenasius Walker, 1846 : 181. Type species *Encyrtus hyettus* Walker, by monotypy and original designation.

Chalcaspis Howard, 1895 : 606. Type species *Chalcaspis pergandei* Howard, by monotypy. Synonymy by Noyes & Woolley, 1994 : 1328.

Neodiscodes Compere, 1931 : 272. Type species *Neodiscodes martini* Compere, by monotypy and original designation. Synonymy by Prinsloo, 1988 : 1468.

Pseudanasius Hayat, Alam & Agarwal, 1975 : 21. Type species *Pseudanasius clavus* Hayat, Alam & Agarwal, by monotypy and original designation. Synonymy by Hayat, 1981 : 17.

Hosts : Parasitoids of mealybugs (Homoptera : Pseudococcidae).

Species and distribution : World 37 species, 06 species from India and 02 species from Maharashtra.

***Aenasius advena* Compere, 1937**

Aenasius advena Compere, 1937 : 388, F, M. Holotype F : USA, Hawaii, Oahu (USNM).

Pseudanasius clavus Hayat, Alam & Agarwal, 1975 : 23-24
F[gynandromorphy], M. Holotype F : India,
Shencottah (BMNH). Synonymy by Hayat, 1981 : 17.

Diagnosis : Frontovortex relatively broad, about one-fifth of head width, with thimble like punctures descending between eyes and facial impression; F1-4 testaceous yellow, contrasting with dark F5, F6 and clava; forewing postmarginal vein shorter than stigmal vein.

Hosts : *Ferrisia virgata*.

Distribution : India : Maharashtra, Andaman & Nicobar Islands, Delhi, Goa, Gujarat, Karnataka, Kerala, Madhya Pradesh, Tamil Nadu, Punjab, Uttrakhand, Uttar Pradesh.

Aenasius bambawalei Hayat, 2009

Aenasius bambawalei Hayat, 2009 : 21-26, F, M. Holotype F : India, Maharashtra, Parabani (NPCI).

Diagnosis : Body shiny black; mesoscurum, axillae and scutellum blackish; Mesoscutum with raised reticulate sculpture, and thimble-like punctures small, shallow, widely spaced and largely dull bluish green; antenna with radical black; scape testaceous yellow, with a brownish patch in middle; sometimes patch may be faint or even absent; pedicel, F1-2 black; F3 dark brown, F4 pale brownish yellow; F5-6 testaceous yellow; clava dark brown basally brownish yellow to dark brown; scape cylindrical, about 6X as long as broad; funicle segments all broader than long; clava large, only slightly shorter than pedicel and funicle combined; forewing infuscate in about basal third, infuscation become faint distally, and hyaline in distal half and costal cell; hindwing hyaline.

Hosts : *Phenacoccus solenopsis* Tinsley on cotton and weeds.

Distribution : India : Maharashtra, Delhi, Haryana.

Genus *Blepyrus* Howard, 1898

Blepyrus Howard, 1898 : 233. Type species *Blepyrus mexicanus* Howard, by designation of Ashmead, 1900 : 373.

Euryrhopalus Howard, 1898 : 237. Type species

Euryrhopalus schwarzi Howard, by monotypy. Synonymy by Noyes & Woolley, 1994 : 1328.

Coccophoctonus Ashmead, 1900 : 375. Type species *Coccophoctonus dactylopii* Ashmead, by monotypy and original designation. Synonymy through synonymy of type species by Timberlake, 1981 : 403.

Synaspidia Timberlake, 1924 : 397. Type species *Synaspidia pretiosa* Timberlake, by monotypy and original designation. Synonymy by Noyes, 2000 : 192.

Hosts : Parasitoides of Pseudococcidae (Homoptera).

Species and distribution : World 18 species, one species from India and 01 species from Maharashtra.

Blepyrus insularis (Cameron), 1886

Encyrtus ? *insularis* Cameron, in Blackburn & Cameron, 1886 : 243-245, M. U.S.A. Hawaii (BMNH Type lost).

Blepyrus insularis (Cameron) : Timberlake, 1922 : 167.

Blepyrus longiscapus Kaul & Agarwal, 1986 : 50. Lectotype F : [designated by Hayat, 1999 : 360] : India, Pantnagar (ZDAMU). Synonymy by Hayat, 1999 : 360.

Blepyrus annulobliquus Kaul & Agarwal, 1986 : 49, 50, F. Holotype F : India, Gwalior (ZDAMU). Synonymy by Hayat, 1989 : 278.

Diagnosis : Frontovortex at narrowest, one quarter of head width or less, frontovortex with distinct piliferous (= setigerous) punctures of a thimble like appearance; postmarginal vein longer than stigmal vein; notaular line absent.

Hosts : *Ferrisia virgata* on *Mangifera indica*, *Psidium guajava*, cashew arabica coffee.

Distribution : India : Maharashtra, Karnataka, Kerala, Delhi, Madhya Pradesh, Goa, Tamil Nadu, Orissa, Uttrakhand, Uttar Pradesh, West Bengal.

Tribe *Anagyrini* Hoffer, 1953

Genus *Alamella* Agarwal, 1966

Alamella Agarwal, 1966 : 75. Type species *Alamella flava* Agarwal, by monotypy and original designation.

Hosts : Parasitoids of mealybugs (Homoptera : Pseudococcidae).

Species and distribution : World 05 species, 01 species from India and Maharashtra.

***Alamella flava* Agarwal, 1966**

Alamella flava Agarwal, 1966 : 77-78, F, M. Holotype F : Aligarh (ZDAMU).

Alamella kerrichi Annecke, 1969 : 455-457, F, M. Holotype F : South Africa (PPRI). Synonymy by Noyes & Hayat, 1994 : 238.

Diagnosis : Body robust, generally yellow; occipital margin either not sharp or sharp only between the eyes; funicle with seven segments and clava with two segments; mesoscutum almost always without notaular lines; scutellum without an apical flange, if a flange is present then post marginal vein short; fore wing hyaline normally broad, venation distinct and reaching at least half length of wing.

Hosts : *Eriococcus greeni*; *Maconelliococcus hirsutus*; *Nipaecoccus* sp.; *Nipaecoccus viridis*.

Distribution : India : Maharashtra, Karnataka, Andhra Pradesh, Himachal Pradesh, Haryana, Kerala, Punjab, Tamil Nadu, Uttar Pradesh.

Genus *Anagyrus* Howard, 1896

Anagyrus Howard, in Howard & Ashmead, 1896 : 638. Type species *Anagyrus greeni* Howard, by monotypy.

Heterarthrellus Howard, 1898 : 239. Type species *Heterarthrellus australiensis* Howard by monotypy. Synonymy by Boucek, 1977 : 140.

Epidinocarsis Girault, 1913 : 83. Type species *Epidinocarsis tricolor* Girault, by monotypy and original designation. Synonymy by Girault, 1917 : 2.

Paranusia Brethes, 1913 : 102. Type species *Paranusia bifasciata* Brethes, by monotypy. Synonymy by Noyes, 1980 : 173.

Philoponectroma Brethes, 1913 : 104. Type species *Philoponectroma pectinatum* Brethes, by monotypy and original designation. Synonymy by Noyes, 1980 : 173.

Gyranusia Brethes, 1920 : 137. Type species *Gyranusia porteri* Brethes, by monotypy. Synonymy by Noyes, 1980 : 173.

Doliphoceras Mercet, 1921 : 91. Type species *Pholidoceras integralis* Mercet, by monotypy and original designation. Synonymy by Noyes & Hayat, 1994 : 69.

Gyranusa Mercet, 1921 : 123. Type species *Gyranusa matritensis* Mercet, by original designation. As synonym of *Anagyrus* by Trjapitzin, 1971 : 124.

Protanagyrus Blanchard, 1940 : 115. Type species *Protanagyrus aciculatus* Blanchard, by monotypy. Synonymy by De Santis, 1964 : 56.

Apoanagyrus Compere, 1947 : 18. Type species *Apoanagyrus californicus* Compere, by original designation. Synonymy by Noyes, 2000 : 29.

Anathrix Burks, 1952. Type species *Anathrix argyris* Burks, by monotypy and original designation. Synonymy by Noyes, 2000 : 29.

Rhopomorphus Gesquiere, 1958 : 25. Type species *Rhopomorphus varleyellus* Gesquiere, by monotypy and original designation. Synonymy by Noyes & Hayat, 1994 : 69.

Aglyptoideus De Santis, 1964 : 99. Type species *Aglyptoideus rusticus* De Santis, by monotypy and original designation. Synonymy by Noyes, 2000 : 29.

Xiphomastix De Santis, 1972 : 45. Type species *Xiphomastix bellator* De Santis, by original designation. Synonymy by Noyes, 1979 : 146.

Cremesina Noyes & Hayat, 1984 : 260. Type species *Cremesina aquilonaris* Noyes & Hayat, by original designation. Synonymy by Shamim & Shafee, 1989 : 41.

Tongyus Noyes & Hayat, 1984 : 343. Type species *Tongyus nesus* Noyes & Hayat, by original designation. Synonymy by Noyes & Hayat, 1994 : 69.

Hosts : Parasitoids of mealybugs (Homoptera : Pseudococcidae).

Species and distribution : World about 250 species, 50 species from India and 10 species from Maharashtra.

***Anagyrus alami* Hayat, 1970**

Anagyrus alami Hayat, 1970 : 112, F. Holotype F : India, Nasik ZSI (=NCZSI).

Diagnosis : Body, head yellowish; mouth margin black below antennal toruli; frontovertex with very fine, irregular reticulate sculpture; antennal scape broad and flattened, pedicel short; forewing with at least two lines of setae throughout costal cell ventrally.

Hosts : *Nipaecoccus* sp. on *Acacia* sp. (Hayat, 1979); *Pseudococcus* sp. on *Acacia arabica* (Hayat, 1970).

Distribution : India : Maharashtra, Karnataka.

***Anagyrus aligarhensis* Agarwal & Alam, 1959**

Anagyrus diversicornis Mercet, 1921 : 134-135, F. Lectotype F [designated by Noyes & Hayat, 1981 : 167] : Spain, Fuenterrabia (MCNM). Preoccupied by *diversicornis* (Howard, 1894).

Anagyrus aligarhensis Agrawal & Alam, 1959 : 392, F, M. Holotype F : India, Aligarh (ZDAMU). Synonymy with *diversicornis* Mercet by Noyes & Hayat, 1994 : 109.

Anagyrus punctulatus Agrawal & Alam, 1959 : 392, F, M. Holotype F : India, Aligarh (ZDAMU). Synonymy with *diversicornis* Mercet by Noyes & Hayat, 1994 : 109.

Anagyrus punctulatus Agrawal, 1965 : 46, 50-52, F, M. Redescription as a new species.

Anagyrus aligarhensis Agrawal, 1965 : 46, 52-53, F, M. Redescription as a new species.

Anagyrus micans Noyes, 2000 : 2. [Unnecessary replacement name for *diversicornis* Mercet]. Synonymy by Hayat, 2003 : 189.

Anagyrus swezeyi Timberlake : Subba Rao & Rai, 1970 : 86, 89, F, M. Delhi, Karnal rec. Butani, 1972 : Misidentification.

Diagnosis : Body elongate, dorsoventrally flattened; frontovertex about 0.5X of head width; antennal scape broad and flattened; apical portion of scape and pedicel white; basal to middle scape, basal of pedicel and F1 dark brown; F2 and F3 white to yellow; wings hyaline.

Hosts : *Saccharicoccus sacchari* on sugarcane; *Kiritshenkella sacchari* on sugarcane.

Distribution : India : Maharashtra, Bihar, Delhi, Karnataka, Haryana, Punjab, Tamil Nadu, Nagaland, Orissa, Uttrakhand, Uttar Pradesh.

***Anagyrus dactylopii* (Howard), 1898**

Aphycus dactylopii Howard, 1898 : 242, F. Holotype F : Hong Kong (USNM).

Anagyrus scutomaculatus Agarwal, 1965 : 44, 49, F. Holotype F : India, Aligarh (ZDAMU). Synonymy by Noyes & Hayat, 1994 : 179.

Anagyrus citri Agarwal, 1965 : 44, 48, F. Holotype F : India, Aligarh (ZDAMU). Synonymy by Noyes & Hayat, 1994 : 179.

Anagyrus dactylopii (Howard) : Timberlake, 1924 : 224.

Anagyrus amoenus Compere : Subba Rao & Rai, 1970 : 86, 87, F, Delhi. Misidentification.

Anagyrus kivuensis Compere : Subba Rao & Rai, 1970 : 86, 91, F, Delhi. Misidentification.

Anagyrus bohemani Westwood : Verma, 1977 : 20, Chandigarh rec. Misidentification.

Diagnosis : Body stout; head orange; scape dark brown with a narrow subapical white band; F1 brown rest of funicle segment white; wings hyaline; legs yellowish; gaster brown.

Hosts : *Planococcus citri* on *Citrus medica*; *Pseudococcus* sp. on *Citrus aurantifolia*; *Rastrococcus capparidae*; *Ferrisia virgata* on *Acacia* sp. *Maconellicoccus hirsutus* on *Anona squamosa* and grapes.

Distribution : India : Maharashtra, Andhra Pradesh, Bihar, Andaman & Nicobar Islands, Goa, Delhi, Himachal Pradesh, Karnataka, Kerala, Orissa, Punjab, Tamil Nadu, Uttrakhand, Uttar Pradesh.

***Anagyrus kamali* Moursi, 1948**

Anagyrus kamali Moursi, 1948 : 1-3, F, M, Holotype F : Egypt, Massara (USNM).

Anagyrus flavus Agarwal, 1965 : 45, 49-50, F. Holotype F : India, Aligarh (ZDAMU). [Preoccupied by *flavus* by Ishii, 1928]. Synonymy by Noyes & Hayat, 1994 : 151.

Anagyrus comperei Subba Rao & Rai, 1970 : 86, 91-94, F, M. Holotype F : India, Delhi (NPCI). Synonymy by Noyes & Hayat, 1994 : 151.

Anagyrus nigroradiclatus Subba Rao & Rai, 1970 : 87, 94-96, F. Holotype F : India, Delhi (NPCI). Synonymy by Noyes & Hayat, 1994 : 151.

Anagyrus flavidus Shafee, Alam & Agarwal, 1975 : 20. [Replacement name for *flavus* Agarwal]. Synonymy by Noyes & Hayat, 1994 : 151.

Anagyrus subproximus Silvestri : Hayat & Subba Rao, 1981 : 107. Misidentification.

Diagnosis : Body stout; antennal scape black with a complete subapical white band; F1 dark brown; F2-6 yellowish with indistinct infusate longitudinal streak distally; wings hyaline, apex of forewing devoid of marginal setae; forewing about 2.0X as long as broad; marginal and postmarginal veins shorter than to about as long as stigma vein.

Hosts : *Planococcoides robustus* on *Ficus* sp.;

Ferrisia sp. and *F. virgata* on avenue tree; *Maconellicoccus hirsutus*, *Nipaecoccus* sp. on *Acacia*, *Nipaecoccus* sp.; *N. viridis* on *Zizyphus* sp.; *Pseudococcus* sp. on *Citrus limonum*.

Distribution : India : Maharashtra, Uttar Pradesh, Tamil Nadu, Himachal Pradesh, Karnataka.

Anagyrus gracilis (Hayat), 1970

Doliphoceras gracilis Hayat, 1970 : 114-115, F. Holotype F : India, Aligarh ZSI = (NCZSI).

Doliphoceras biharensis Shamim & Shafee, 1985 : 35-36, F, Holotype F : India, Ranchi, Mesra (ZDAMU). Synonymy by Hayat, 1989 : 280.

Anagyrus gracilis (Hayat) : Noyes & Hayat, 1994 : 75, 95-96, F, M. des., key.

Diagnosis : Body completely dark brown; head thoracic dorsum with shallow reticulate sculpture of shiny appearance; antenna dark brown; scape slightly broadened and flattened; wings hyaline and about 2.5X as long as broad; ventral surface of costal cell with at least two complete lines of setae; gaster longer than head and thorax together.

Hosts : *Coccidohystrix insolita* on *Solanum*.

Distribution : India : Maharashtra, Andaman & Nicobar Islands, Andhra Pradesh, Assam, Delhi, Himachal Pradesh, Jammu & Kashmir, Jharkhand, Karnataka, Kerala, Tamil Nadu, Rajasthan, Uttar Pradesh.

Anagyrus indicus (Subba Rao), 1967

Leptomastidea indica Subba Rao, 1967 : 1-5, F. Holotype F; India, Delhi, Nagpur, Calcutta [Type locality not mentioned in original publication] (NPCI).

Leptanusia indica Hayat, Alam & Agarwal, 1975 : 9-12, F, M. Holotype F : India, Guntur (BMNH). Synonymy by Hayat, 1981 : 23.

Leptanusia indica (Subba Rao) : Hayat, 1981 : 23.

Paranusia indica (Subba Rao) : Kerrich, 1982 : 400.

Anagyrus indicus (Subba Rao) : Noyes & Hayat, 1984 : 229, tax.

Diagnosis : Head and thorax yellowish orange; gaster brown; antennal scape white with black stripes on dorsal and ventral margin; about 2.0X

as long as broad; F1-6 brown; Ventral surface of costal cell of forewing with only a single line of setae; fore wing with a distinct, dark subapical band; filum spinosum absent.

Hosts : *Ferrisia virgata* on guava, *Psidium guajava*; *Planococcus* sp. on *Giricidia sepium*.

Distribution : India : Maharashtra, Andhra Pradesh, Assam, Delhi, Karnataka, Kerala, Tamil Nadu, Punjab, Uttar Pradesh, West Bengal.

Anagyrus mangicola Noyes, 1990

Anagyrus mangicola Noyes, 1990 : 204-206, F, M. Holotype F : India, Bangalore (BMNH).

Hosts : *Rastrococcus invadens* on mango (Noyes, 1990; Noyes & Hayat, 1994).

Distribution : India : Maharashtra, West Bengal, Karnataka.

Anagyrus saccharicola Timberlake, 1932

Anagyrus saccharicola Timberlake, 1932 : 159-162, F. Holotype F : Malaysia, Selangor, Serdang (BPBM).

Hosts : *Ripersia* [= *Kiritshenkella*] *sacchari* (Ahmad, 1942); *Saccharicoccus sacchari* [on sugarcane] (Mani, 1939; Pruthi & Mani, 1940; Puttarudriah, 1954; Usman & Puttarudriah, 1955; Narayanan *et al.*, 1957); *Trionymus sacchari* (Dorge *et al.*, 1968).

Distribution : India : Maharashtra, Haryana, Delhi, Himachal Pradesh, Karnataka, Tamil Nadu.

Anagyrus mirzai Agarwal & Alam, 1959

Anagyrus mirzai Agarwal & Alam, 1959 : 392, F, M. Holotype F : India, Aligarh (ZDAMU).

Anagyrus mirzai Agarwal, 1965 : 43, 46-48. Redescription of *mirzai* as a new species.

Anagyrus delhiensis Subba Rao & Rai, 1970 : 86, 981-98, F. Holotype F; India, Delhi (NPCI). As a synonym of *mirzai* Agarwal by Hayat, 1979 : 315-316. Synonymy by Noyes & Hayat, 1994 : 124.

Anagyrus gunturiensis Shafee, Alam & Agarwal, 1975 : 11, 15, F. Holotype F : India, Guntur (ZDAMU, lost). As synonym of *mirzai* Agarwal by Hayat, 1979 : 315-316. Synonymy by Noyes & Hayat, 1994 : 124.

Gyranusoidea mirzai (Agarwal) : Noyes & Hayat, 1984 : 280, tax.

Diagnosis : Forewing with postmarginal vein a little longer than stigma vein; ventral surface of costal cell with at least two lines of setae, occasionally the line nearest submarginal vein a little interrupted medially; discal setae of forewing with uniformly coloured; apical half of scape without a continuous brown stripe; flagellum brown to dark brown.

Hosts : *Ferrisia virgata*; *Icerya formicarum* on *Psidium guajava*; *Nipaecoccus viridis*, same host on wild plant; *Nipaecoccus* sp. on *Casuarina equisetifolia*, *Tamarindus indica*, *Morus alba*; *Planococcus citri* on *Citrus medica*; *Rastrococcus iceryoides* on *Citrus*.

Distribution : India : Maharashtra, Andhra Pradesh, Andaman & Nicobar Islands, Karnataka, Haryana, Himachal Pradesh, Haryana, Orissa, Kerala, Punjab, Tamil Nadu, Uttar Pradesh.

Anagyrus chrysos Noyes & Hayat, 1994

Anagyrus chrysos Noyes & Hayat, 1994 : 80, 176-178, F. M. Holotype F : India, Lucknow (BMNH).

Anagyrus flavidus Shafee *et al.*, 1975 : 20. Material ex. *Pl. robustus* a misidentification.

Anagyrus pseudococci (Girault) : Tandon & Lal, 1978 : ex *Rast. Iceryoides*. misidentification.

Diagnosis : Head orange; antennal scape dark brown with subapical white band; F1 dark brown, F2-6 white; wings hyaline, 2.0X as long as broad; ventral surface of costal cell with several lines of setae; thorax orange; legs yellowish; gaster dark brown.

Hosts : *Rastrococcus iceryoides* on *Mangifera*, *Capparis* sp., *Citrus* sp. and *Acacia* sp: indet mealybugs on coffee; *Rastrococcus mangiferae*; *Planococcoides robustus* on *Ficus* sp.

Distribution : India : Maharashtra, Madhya Pradesh, Tamil Nadu, Uttar Pradesh.

Genus *Apoleptomastix* Kerrich, 1982

Apoleptomastix Kerrich, 1982 : 416. Type species *Apoleptomastix spoliata* Kerrich [= *A. bicoloricornis* (Girault)], by original designation.

Hosts : Parasitoids of pseudococcidae (Homoptera).

Distribution : World 06 species; 05 species from India and 01 species from Maharashtra.

Apoleptomastix poonensis (Mani & Kaul), 1982

Pseudoleptomastix [sic] *poonensis* Mani & Kaul, in Mani *et al.*, 1974 : 68-70, F. Holotype F : India, Poona, Bhorgat Dam (USNM).

Xiphomastix poonensis (Mani & Kaul) : Hayat, 1979b : 323, transfer of species.

Apoleptomastix poonensis (Mani & Kaul) : Kerrich, 1982 : 420-421, 427, tax., key

Diagnosis : Tegulae mostly orange basally; thorax almost entirely orange, at most with mesoscutum, scutellum and pronotum partially marked with brown.

Hosts : Unknown.

Distribution : India : Maharashtra, Delhi, Uttar Pradesh, Orissa.

Genus *Callipteroma* Motschulsky, 1863

Callipteroma Motschulsky, 1863 : 36. Type species *Callipteroma 5-guttata* [= *quinqueguttata*] Motschulsky, by designation of Ashmead, 1900 : 402.

Calocerinella Girault, 1913 : 46. Type species *Calocerinella trifasciatus* Girault, by monotypy and original designation. Synonymy by Noyes, 1978 : 539.

Hosts : Unknown.

Species and distribution : World 05 species; 02 species from India and Maharashtra.

Callipteroma sexguttata Motschulsky, 1863

Callipteroma sexguttata Motschulsky, 1863 : 37, M. Syntype M : Sri Lanka, Mt. Patannas (ZMMU).

Callipteroma quinqueguttata Motschulsky, 1863 : 36-37, F. Syntypes F : Sri Lanka, Mt. Patannas (ZMMU). Synonymy by Boucek, 1977 : 70.

Diagnosis : Propodeum steeply inclined and appearing short in dorsal view, medially the distance separating the anterior and posterior margins equal to not more than 1/5 length of scutellum; fore wing infusate brown with hyaline spots or bands.

Hosts : Unknown.

Distribution : India : Maharashtra, Delhi,

Madhya Pradesh, Karnataka, Kerala, Orissa, Rajasthan, Tamil Nadu, Uttar Pradesh.

***Callipteroma testacea* Motschulsky, 1863**

Callipteroma testacea Motschulsky, 1863 : 37-38, F. [?]
Holotype F : Sri Lanka, Mt. Patannas (ZMMU).

Leptomastidea sayadriae Mani & Kaul, 1974 : 70-72, M.
Holotype M : India, Poona, Bhorgat Dam (USNM).
Synonymy by Hayat, 1981 : 17.

Diagnosis : Propodeum shallowly inclined and appearing long in dorsal view, medially the distance separating the anterior and posterior margins equal to at least 1/3 length of scutellum; fore wing infusate brown with hyaline spots or bands.

Hosts : Indet. sugarcane mealybug.

Distribution : India : Maharashtra, Karnataka, Himachal Pradesh, Delhi, Kerala, Madhya Pradesh, Tamil Nadu, Uttar Pradesh.

Genus *Gyranusoidea* Compere, 1947

Gyranusoidea Compere, 1947 : 17. Type species *Gyranusa citrine* Compere, by monotypy and original designation.

Leptanusia De Santis 1964 : 80. Type species *Leptanusia pseudococci* Brethes, by original designation.
Synonymy by Noyes & Hayat, 1994 : 308.

Neuranagyrus Boucek, 1977 : 140. Type species *Heterarthrellus aphycoides* Mercet, by original designation. Synonymy by Prinsloo, 1983 : 103.

Therencyrthus Trjapitzin, 1977 : 159. Type species *Heterarthrellus aphycoides* Mercet, by monotypy and original designation. Synonymy with *Neuranagyrus* by Kerrich, 1982 : 401.

Hosts : Parasitoids of mealybugs (Homoptera : Pseudococcidae).

Species and distribution : World 37 species; 05 species from India and 03 Species from Maharashtra.

***Gyranusoidea flava* Shafee et al., 1975**

Gyranusoidea flava Shafee et al., 1975 : 21-22, F. Holotype F; India, Haldwani (ZDAMU).

Diagnosis : Fore wing with a single complete line of setae on ventral surface of costal cell, Scape

with infusate areas more extensive, reaching or nearly reaching its dorsal margin, Forewing with marginal vein not longer than stigmal vein; scape yellowish, with a semicircular dark patch on its ventral margin, this sometime joined along the dorsal margin; mid coxa yellow or white.

Hosts : *Nipaecoccus viridis* on *Palnoccoides robustus* on *Mangifera indica*; *Planococcus citri* on pomegranate, *P. lilacinus* on guava.

Distribution : India : Maharashtra, Gujarat, Karnataka, Kerala, Orissa, Uttrakhand, Uttar Pradesh.

Genus *Leptomastix* Foerster, 1856

Leptomastix Foerster, 1856 : 34, 37. Type species *Leptomastix histrio* Mayr, by subsequent reference of Mayr, 1876 : 730.

Sterrhocomia Foerster, 1856 : 33, 36. Type species *Sterrhocomia histrio* Foerster, by monotypy and original designation. Synonymy by Graham, 1969 : 216.

Stenoterys Thomson, 1876 : 115, 128. Type species *Stenoterys orbitalis* Thomson, by monotypy. Synonymy by Mercet, 1921 : 119.

Hosts : Parasitoids of mealybugs (Homoptera : Pseudococcidae).

Species and distribution : World 33 species; 10 species from India and 01 species from Maharashtra.

***Leptomastix nigrocoxalis* Compere, 1928**

Leptomastix nigrocoxalis Compere, 1928 : 219-220, F. Holotype F : South Africa, Natal (USNM).

Leptomastix brevis Hayat, Alam & Agarwal, 1975 : 14-16, F. Holotype F : India, Kalamasseri (BMNH). Synonymy by Noyes & Hayat, 1994 : 278.

Leptomastix aligarhensis Khan & Shafee, 1975 : 194, F.M. Holotype F : India, Aligarh (ZDAMU). Synonymy by Noyes & Hayat, 1994 : 278.

Leptomastix longiscapus Khan & Agarwal, 1976 : 378-380, F. M. Lectotype F [designated by Noyes & Hayat, 1994 : 279] : India, Gharwal (ZDAMU). Synonymy by Noyes & Hayat, 1994 : 278.

Diagnosis : Mid coxa at least on ventral surface brown to black; forewing with linea calva interrupted by four or more lines of setae; base of

mandible dark brown; mesoscutum yellow orange with at most a narrow brown area anteriorly.

Hosts : *Coccidohystrix* sp. on *Achyranthes aspera*, *Pupalia lappacea*, *Wittania somnifera*; *C. insolita* on *A. aspera* and *W. somnifera*; *Icerya aegyptica*; *Nipaecoccus* sp. on *Citrus*, *Acacia*, *Peritropha bicalyculata*, *Morus alba*; *N. viridis* on *Ziziphus* sp., *Acacia* sp., *Tephrosia purpurea*; *Planococcus citri* on *Citrus medica*.

Distribution : India : Maharashtra, Andhra Pradesh, Goa, himachal Pradesh, Karnataka, Kerala, Tamil Nadu, Orissa, Punjab, Pondicherry, Uttrakhand, Uttar Pradesh, West Bengal.

Genus *Leptomastidea* Mercet, 1916

Leptomastidea Mercet, 1916 : 112. Type species *Leptomastidea aurantiaca* Mercet, by monotypy.

Tanaomastix Timberlake 1918 : 362. Type species *Paraleptomastix abnormis* Girault, by original designation. Synonymy by Mercet, 1924 : 252.

Hosts : Parasitoids of mealybugs (Homoptera : Pseudococcidae).

Species and distribution : 25 species; 03 species from India and 01 species from Maharashtra.

Leptomastidea shafeei Hayat & Subba Rao, 1981

Leptomastidea indica Shafee, Alam & Agarwal, 1975 : 24-25, F. Holotype F : India : Bihar, Darbhanga, Samastipur (BMNH). [Peroccupied by *L. indica* Subba Rao, 1967].

Leptomastidea shafeei Hayat & Subba Rao, 1981 : 114. [Replacement name for *L. indica* Shafee *et al.*]

Diagnosis : Forewing hyaline, more than 3.0X as long as broad; postmarginal vein clearly longer than stigma vein.

Hosts : Indt. Coccid on wild plant (Shafee *et al.* 1975); *Acalypha* scale (Noyes & Hayat, 1984).

Distribution : India : Maharashtra, Bihar, Tamil Nadu, Kerala, Karnataka.

ACKNOWLEDGEMENTS

The authors are grateful to Director, Zoological Survey of India, Kolkata, for providing facilities. We are also thankful to Dr. Kailash Chandra, Scientist-F and Divisional In-Charge Z.S.I. Kolkata for his useful suggestions in the preparation of the manuscript.

REFERENCES

- Alam, S.M. 1957. Taxonomy of some encyrtid parasites (Hymenoptera : Chalcidoidea) of British scale insects. *Transaction of the Royal Entomological Society of London*, **109** : 421-426.
- Alam, S.M. 1972. New species of Encyrtidae (Hymenoptera : Chalcidoidea) recorded from India. *Bulletine of Entomology, New Delhi*, **11** : 131-137.
- Agarwal, M.M. 1965. Taxonomy of encyrtid parasites (Hymenoptera : Chalcidoidea) of Indian coccoidea. *Acta Hymenopterologica*, **10** : 37-97.
- Compere, H. and Annecke, D.P. 1961. Description of parasitic Hymenoptera and comments (Hymenopt : Aphelinidae, Encyrtidae, Eulophidae). *Journal of Entomological Society of Southern Africa*, **24** : 17-71.
- Fatima, A. and Shafee, S.A. 1994. Studies on the taxonomy of the Indian Encyrtids (Hymenoptera : Encyrtidae). *Aligarh Muslim University Publication (Zoological Series) on Indian Insect Types*, **15** : 114pp.
- Gahan, A.B. 1919. Report on a small collection of Indian parasitic Hymenoptera. *Proceeding of the United States National Museum*, **189** : 201-210.
- Gordh, G. and Trijapitzin, V.A. 1979. Notes on the genus *Zaomma* Ashmead, with a key to species (Hymenoptera : Encyrtidae). *Pan-Pacific Entomologist*, **55** : 34-40.

- Graham, M.W.R. de V. 1994. The identify of some species of Chalcidoidea (Hym.) described by Geoffroy (in Fourcroy, 1785) with new synonymy. *Entomologist's Monthly Magazine*, **130** : 121-129.
- Hayat, M. 1970. New species of Encyrtidae (Hymenoptera : Chalcidoidea) reared from coccids. *Mushi*, **44** : 55-63.
- Hayat, M. 1979a. Taxonomic notes on Indian Encyrtidae (Hymenoptera : Chalcidoidea) V. *Oriental Insects*, **33** : 349-407.
- Hayat, M. 1979b. Taxonomic notes on Indian Encyrtidae (Hymenoptera : Chalcidoidea) I. *Journal of Natural History*, **13** : 315-326.
- Hayat, M. 1981. Taxonomic notes on Indian Encyrtidae (Hymenoptera : Chalcidoidea) III. *Colemania*, **1**(1) : 13-34.
- Hayat, M. 1985. "Family Encyrtidae" In "The Chalcidoidea (Insecta : Hymenoptera) of India and the adjacent countries. Part I." (B.R. Subba Rao & M. Hayat eds.). *Oriental Insects*, **19** : 192-223.
- Hayat, M. 1986. "Family Encyrtidae" In "The Chalcidoidea (Insecta : Hymenoptera) of India and the adjacent countries. Part II." (B.R. Subba Rao & M. Hayat eds.). *Oriental Insects*, **20** : 430 pp.
- Hayat, M. 1989. Taxonomic notes on Indian Encyrtidae (Hymenoptera : Chalcidoidea) IV. *Oriental Insects*, **23** : 275-285.
- Hayat, M. 2003. Record and descriptions of Indian Encyrtidae (Hymenoptera : Encyrtidae). *Oriental Insects*, **37** : 187-260.
- Hayat, M. 2004. A review of the classification of Encyrtidae (Hymenoptera : Chalcidoidea). In *Perspective on Biosystematics and Biodiversity* TCN Com. Vol. 349-361.
- Hayat, M. 2006. *Indian Encyrtidae (Hymenoptera : Chalcidoidea)*. Viii+496 pp. Published by M. Hayat, Department of Zoology, Aligarh Muslim University, India.
- Hayat, M. and Subba Rao, B.r. 1981. A systematic catalogue of Encyrtidae (Hymenoptera : Chalcidoidea) from Indian subcontinent. *Colemania*, **1** : 103-125.
- Hayat, M. and Singh, S. 2002. Description of a new genus and two new species with record of a Known species of Encyrtidae (Hymenoptera : Chalcidoidea) from Andaman & Nicobar Islands, India. *Entomon*, **27** : 161-168.
- Hayat, M., Alam, S.M. and Agarwal, M.M. 1975. Taxonomic survey of encyrtid parasites (Hymenoptera : Encyrtidae) in India. *Aligarh Muslim University Publication (Zoological Serise) on Indian Insect Types*, **9** : 1-112.
- Kaul, K. and Agarwal, M.M. 1986. Taxonomic studies on encyrtid parasitoids (Hymenoptera : Chalcidoidea) of India. *Aligarh Muslim University Publication (Zoological Serise) on Indian Insect Types*, **13** : viii + 89pp.
- Kazmi, S.I. Insecta : Hymenoptera : Chalcidoidea : Encyrtidae : Tetracneminae. *Zool. Surv. India, Fauna of Andaman & Nicobar Islands : State Fauna Series*, In Press.
- Kazmi, S.I. 2006. A checklist of Encyrtidae (Hymenoptera : Chalcidoidea) from Uttar Pradesh (India). *Record of Zoological Survey of India*, **106**(Part-4) : 73-91.

- Kazmi, S.I. 2008. Record of some Encyrtidae (Hymenoptera : Chalcidoidea) from the Thar Desert of Rajasthan, India. *Columban Journal of Life Science*, **9**(1&2)B : 24-29.
- Kazmi, S.I. and Hayat, M. 1998. Revision of the Indian Copidosomatini (Hymenoptera : Chalcidoidea : Encyrtidae). *Oriental Insects*, **32** : 287-362.
- Mani, M.S. 1939. Descriptions of new and records of some known chalcidoid and other hymenopterous parasites from India. *Indian Journal of Entomology*, **1** : 69-99.
- Mani, M.S. 1941. Studies on Indian parasitic Hymenoptera I. *Indian Journal of Entomology*, **3** : 25-36.
- Mani, M.S. 1989. *The fauna of India and the adjacent countries Chalcidoidea (Hymenoptera) Part I. Zoological Survey of India*, 1-1067.
- Noyes, J.S. 2001. *Interactive catalogue of world chalcidoidea 2001. (CD-Rom). Disk Yu, Bentall centre, Canada.*
- Noyes, J.S. 1979. The West Indian species of Encyrtidae described by L.D. Howard, 1894 abd 1897 (Hymenoptera, Chalcidoidea). *Systematic Entomology*, **4** : 143-169.
- Noyes, J.S. and Hayat, M. 1984. A review of genera of Indo-Pacific Encyrtidae (Hymenoptera : Chalcidoidea). *Bulletin of British Museum (Natural History), Entomology*, **48** : 131-395.
- Noyes, J.S. and Hui, Ren 1987. Two new species of Encyrtidae (Hymenoptera) recorded from diaspidid scale insects (Hymenoptera : Diaspididae) in Chiana. *Entomotaxonomia*, **9** : 167-174.
- Noyes, J.S. and Hayat, M. 1994. *Oriental Mealybug parasitoids of Anagyrini (Hymenoptera : Chalcidoidea). CAB Int. Oxon.*
- Noyes, J.S. and Woolley, J.B. 1994. North American encyrtid taxa (Hymenoptera : Encyrtidae) : taxonomic changes and new taxa. *Journal of Natural History*, **28** : 1327-1401.
- Rosen, D. and Alon, A. 1983. Taxonomic and biological studies of *Diversinervus cervantesi* (Girault) (Hymenoptera : Encyrtidae), a primary parasite of soft scale insects. *Contribution of the American Entomological Institute*, **20** : 479-485.
- Shafee, S.A., Alam, S.M. and Agarwal, M.M. 1975. Taxonomic survey of encyrtid parasites (Hymenoptera : Encyrtidae) in India. *Aligarh Muslim University Zoological Publications, Indian Insect Types*, **10** : 125 pp.
- Singh, S. and Agarwal, M.M. 1993. Taxonomic studies on Indian encyrtid parasites (Hymenoptera : Encyrtidae) from North Eastern region. *Aligarh Muslim University Zoological Publications, Indian Insect Types*, **14** : 180pp.
- Subba Rao, B.R. 1957. Some new species of Indian Hymenopter. *Proceeding of Indian Academic of Science, (B)* **46** : 376-390.
- Tachikawa, T. 1981. Hosts of encyrtid genera in the world (Hymenoptera : Chalcidoidea). *Memoirs of the College of Agriculture, Ehime University*, **25** : 85-110.
- Timberlake, P.H. 1919. Description of new genera and species of Hawaiian Encyrtid (Hymenoptera). *Proceeding of Hawaiian Entomological Society*, **4** : 197-231.

- Trjapitzin, V.A. 1971. Encyrtidae (Hymenoptera, Chalcidoidea) collected by E.S. Sugonjaev in Afganistan. I. *Entomological Essay to Commemorate the Retirement of Professor Yasumatsu*. Pp. 119-127, Tokyo.
- Trjapitzin, V.A. 1973a. The Classification of parasitic Hymenoptera of family Encyrtidae (Hymenoptera : Chalcidoidea). Part I. Survey of the system of classification. The subfamily Tetracneminae Howard 1892 [In Russian]. *Entomologicheskoe Obozrenie*, **52** : 163-175.
- Trjapitzin, V.A. 1973b. The Classification of parasitic Hymenoptera of family Encyrtidae (Hymenoptera : Chalcidoidea). Part II. The subfamily Encyrtinae Walker, 1873 1892 [In Russian]. *Entomologicheskoe Obozrenie*, **52** : 416-429.

INSECTA : HYMENOPTERA : SCOLIIDAE

P. GIRISH KUMAR and S.I. KAZMI

Zoological Survey of India, M-Block, New Alipore, Kolkata-700 053, India

INTRODUCTION

The family Scoliidae is a group of solitary fossorial aculeate wasps. It belongs to the Superfamily Vespoidea. It is commonly known as hairy wasps. Body length may vary from 5 mm to 35 mm (rarely up to 50 mm). Adults are usually black, commonly marked with yellow, white or red. Their wings are usually dark with metallic reflections. Vestiture varies from entirely black or black mixed with white to entirely golden or reddish. Sexual dimorphism is distinct in many species. They are world wide in distribution but predominantly found in tropical region and consist of about 300 species in two subfamilies: Proscoliniinae and Scoliinae. The larvae of scoliid wasps are ectoparasitic on the larvae of beetles, usually Scarabaeoidea but rarely Curculionoidea.

The members of this family are readily distinguished from other wasps by having the following combination of characters : (1). Wing membranes finely and longitudinally wrinkled apically; (2). Metacoxae widely separated (rarely less so) by wide flat metasternum at same level as mesosternum; metacoxa partly concealed basally by a wide lamina (3). Propodeum divided into three by 2 longitudinal grooves passing through both disc and declivity.

This is comparatively a small family with 79 species under 13 genera have been reported from Indian subregion so far (Gupta & Jonathan, 2003). The knowledge of Scoliid fauna of Maharashtra state is very scanty and fragmentary. Only 5 genera

and 7 species are reported so far. So in this paper, in addition to these 5 genera and 7 species, 1 genus and 3 more species are reported as new records from Maharashtra state.

MATERIAL AND METHODS

The systematic account on the scoliid fauna of Maharashtra state is given below based on the collections made by different Survey parties including the authors present at the Hymenoptera Section of the Zoological Survey of India, Kolkata as well as on the data from the published literatures.

Gupta & Jonathan (2003) along with the taxonomic keys for the identification of scoliid wasps of Indian subregion, also provided the detailed synonymical references and descriptions of each species. So in the present study, the keys for the identification of various taxa recorded from Maharashtra state and the detailed synonymical references of the species are not provided.

All the specimens studied in this paper are properly registered and kept at the 'National Zoological Collections' of the Hymenoptera Section, Zoological Survey of India, Kolkata (NZSI).

The following abbreviations used in the text for the Museums: BMNH = The Natural History Museum, London SW7 5BD, England; HDEO = Hope Department of Entomology, University Museum, Oxford, England; MNNH = Museum

National d' Histoire Naturelle, Paris, France; NZSI = National Zoological Collections, Zoological Survey of India, Kolkata, India; ZMHU = Zoologisches Museum Der Humboldt Universität, Berlin, Germany; ZMUC = Zoological Museum of the University of Copenhagen, Denmark.

SYSTEMATIC ACCOUNT

Family SCOLIIDAE

Subfamily SCOLIINAE

Tribe Campsomerini

Genus *Colpacampsomeris* Betrem

1. *Colpacampsomeris indica deccanensis* Gupta and Jonathan

Genus *Micromeriella* Betrem

2. *Micromeriella marginella marginella* (Klug)

Genus *Campsomeriella* Betrem

Subgenus *Campsomeriella* Betrem

3. *Campsomeriella (Campsomeriella) collaris collaris* (Fabricius)

Genus *Phalerimeris* Betrem

4. *Phalerimeris madurensis* (Betrem)

Genus *Megacampsomeris* Betrem

5. *Megacampsomeris reticulata* (Cameron)

Tribe Scoliini

Genus *Scolia* Fabricius

6. *Scolia (Discolia) affinis* Guérin
7. *Scolia (Discolia) bilunata* Saussure
8. *Scolia (Discolia) binotata binotata* Fabricius
9. *Scolia (Discolia) cruenta* Klug
10. *Scolia (Discolia) cyanipennis* Fabricius

1. *Colpacampsomeris indica deccanensis*
Gupta and Jonathan

2003. *Colpacampsomeris indica deccanensis* Gupta and Jonathan, *Fauna of India and the adjacent countries, Hymenoptera : Scoliidae* : 28. Holotype Female, India : Mudigere (NZSI).

Diagnosis : Female : Length 35 mm. Body black ; vestiture black except the apices of second to fifth tergites and sternites with reddish golden

setae; pygidium with black setae; wings dark brown with strong blue reflections.

Male : Length 27 mm. Integument and vestiture entirely black or sometimes head with white vestiture; wings lighter than female, forewing anteriorly dark, with slight bluish reflections.

Distribution : India : Karnataka, Kerala and Maharashtra.

Remarks : The specimens of this species from Maharashtra state were not available for this study and the above diagnosis is based on the Holotype and Allotype.

2. *Micromeriella marginella marginella* (Klug)

1810. *Scolia marginella* Klug, *Beitr. Naturk.*, 2 : 214. Male, India-Orient (ZMHU).

1974. *Micromeriella marginella marginella* (Klug) : Bradley, *Revue. Suisse Zool.*, 81(2) : 443.

Diagnosis : Female : Length 9.5 mm. Integument black except mandibles, anterior rim of clypeus and antennal flagellum reddish brown. Erect vestiture white and sparse, white fringes at the apices of first four tergites, pygidium with reddish setae. Wings clear with yellowish anterior margin. In front of anterior ocellus and around ocellar triangle with close punctures; vertex with a few scattered punctures, except for a row of close punctures along eye margin, its declivous portion with scattered punctures; dorsomedian area of propodeum with close punctures, dorsolateral area with small and sparse punctures and with an impunctate area anteriorly along the inner margin.

Male : Length 6-9 mm. Integument black with the following yellow parts : mandibles at their bases, on lateral sides of clypeus, pronotum except at its anterior margin, scutellum and metanotum posteromedially, a small mark on fore and mid femora at apex, extensive linear marks on first and second tibiae on outer side, first tarsus on outer side, apical bands on first to fifth tergites, the bands on second and third tergites broad and deeply emarginate in the middle, second and third sternites with narrow apical bands, the band on fourth interrupted in the middle. Erect vestiture white. Wings hyaline. Genitalia with parameres

slender, evenly curved and basal part of volsellae with small, sparse hairs.

Material examined : INDIA : Maharashtra, Satara district, Tambi, Alt. 2100 ft., 1♂, 24-26.iv.1912, Coll. F.H. Gravely, NZSI Regd. No. 598/H3; Satara district, Taloshi, Alt. 2000 ft., 2♂, 27-28.iv.1912, Coll. F.H. Gravely, NZSI Regd. Nos. 596/H3 & 597/H3; Satara district, Helwak, 3♂, 4.v.1913, Coll. S.P. Agarkar, NZSI Regd. Nos. 594/H3, 599/H3 & 600/H3; Pune district, Pune, 1♀, 6.ii.1962, Coll. K.V.L. Narayana, NZSI Regd. No. 2571/H3.

Distribution : India : Andhra Pradesh, Bihar, Delhi, Gujarat, Jharkhand, Karnataka, Kerala, Maharashtra, Odisha, Pondicherry, Rajasthan, Tamil Nadu, Uttarakhand, Uttar Pradesh and West Bengal.

Elsewhere : Sri Lanka.

3. *Campsomeriella (Campsomeriella) collaris collaris* (Fabricius)

1775. *Tiphia collaris* Fabricius, *Syst. Ent.*, : 354; Female, India : coast of Malabar (ZMUC).

1967. *Campsomeriella (Campsomeriella) collaris collaris* (Fabricius) : Betrem, *Ent. Ber., Amst.*, 27 : 29.

Diagnosis : Female : Length 14-27 mm. Integument black; vestiture black, except clypeus and front usually with intermixed cinereous setae, occiput and scapula with dense erect and mesoscutum with decumbent white setae. Wings dark brown with deep blue reflections. Upper front and vertex impunctate except for a few scattered punctures; upper plate of metapleuron impunctate except for a few fine, scattered punctures along upper margin; longer spur of hind tibia black and obtuse apically.

Male : Length 11-19 mm. Integument black. The following parts are yellow : clypeus except for a median triangular black mark; mandibles at basal half; pronotum anteriorly in the middle; a narrow stripe adjacent to tegula; two large spots on scutellum anteriorly; a small anteromedian spot on metanotum; a spot on each callosity; stripe on apical half of all femora; outer surface of all tibiae; almost entire surface of first tergite, about apical

two-thirds of second, apical half of third and fourth, second and third sternites with paired minute posterolateral spots. Vestiture white except black on apical three abdominal segments; sixth and seventh sternites with long dense black setae. Wings hyaline, with weak yellowish reflections.

Material examined : INDIA : Maharashtra, Nagpur district, Pinkapur Reserve Forest, Camp. No. 463, 1♀, 28.ix.2007, Coll. P. Girish Kumar, NZSI Regd. No. 10504/H3; Satara district, Gadolia, 2♂, 9.iii.2009, Coll. S.I. Kazmi & Party, NZSI Regd. Nos. 11847/H3 & 11848/H3; Kolhapur district, Giroli, 1♀, 11.iii.2009, Coll. S.I. Kazmi & Party, NZSI Regd. No. 11846/H3.

Distribution : India : Andhra Pradesh, Arunachal Pradesh, Assam, Bihar, Delhi, Goa, Gujarat, Haryana, Himachal Pradesh, Jharkhand, Karnataka, Kerala, Lakshadweep, Madhya Pradesh, Maharashtra, Meghalaya, Odisha, Rajasthan, Sikkim, Tamil Nadu, Tripura, Uttarakhand, Uttar Pradesh and West Bengal.

Elsewhere : Nepal and Sri Lanka.

4. *Phalerimeris madurensis* (Betrem)

1928. *Campsomeris (Dielis) madurensis* Betrem, *Treubia*, 9 (suppl.) : 105. Holotype Female, India : Madurai (BMNH).

2003. *Phalerimeris madurensis* (Betrem) : Gupta and Jonathan, *Fauna of India and the adjacent countries, Hymenoptera : Scoliidae* : 75.

Diagnosis : Female : Length 12 mm. Black, except antennae and legs reddish and first three abdominal tergites with broad apical yellow bands, band on second tergite covering three-fourths to almost the entire surface, band on fourth tergite covering three-fourths of the surface; second and third sternites with postero-lateral yellow spots. Erect vestiture reddish golden on head and thorax, golden on abdomen, tomentum golden. Wings yellowish hyaline, apex of forewing with a well defined dark spot.

Male : Length 13 mm. black, abdomen with faint blue reflection. The following are yellow portions : Base of mandible, clypeus anteriorly at

the sides, antennal scrobe, small spots on gena, pronotum dorsally, small postero-lateral marks on mesoscutum, broad anterior bands on scutellum and metanotum, a broad line on apical half of fore femur beneath, a broad line on the apical three-fourths of the middle and hind femora, apical yellow bands on first four abdominal tergites, narrow widely interrupted apical bands on second to fourth sternites. Erect vestiture yellowish white, except black on the last three abdominal segments. Wings hyaline, slightly infumated, apex of the forewing with a slight dark mark.

Material examined : INDIA : Maharashtra, Satara district, Gadolia, ♀ & 1♂, 9.iii.2009, Coll. S.I. Kazmi & Party, NZSI Regd. Nos. 11851/H3 & 11852/H3.

Distribution : India : Karnataka, Kerala, Maharashtra (new record) and Tamil Nadu.

Remarks : It is the new record of the genus *Phalerimeris* Betrem from Maharashtra state.

5. *Megacampsomeris reticulata* (Cameron)

1892. *Elis (Dielis) reticulata* Cameron, *Mem. Proc. Manch. Lit. Phil. Soc.*, 5(4) : 109. Male, India : Pune (HDEO).

1972. *Megacampsomeris reticulata* (Cameron) : Betrem in Betrem & Bradley, *Mon. Ned. Ent. Ver.*, 6 : 164.

Diagnosis : Female : Length 21 mm. Integument and vestiture black; wings dark brown with dark blue reflections; clypeal disc broadly impunctate in the middle; frontal fissure extending up to anterior ocellus; vertex with coarse, close to scattered punctures, its declivous portion with close punctures; mesoscutum with an impunctate area posteriorly in the middle; upper plate of metapleuron impunctate except for some close punctures above.

Material examined : INDIA : Maharashtra, Pune district, Pune, 1♀, 6.ii.1962, Coll. K.V.L. Narayana, NZSI Regd. No. 13096/H3.

Distribution : India : Andhra Pradesh, Delhi, Haryana, Himachal Pradesh, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Odisha, Rajasthan and Tamil Nadu.

6. *Scolia (Discolia) affinis* Guerin

1838. *Scolia affinis* Guerin, *Voy. Coq.*, : 254. Female, Male, Senegal (MNNH).

1973. *Scolia (Discolia) affinis* Guerin : Bradley, *Bull. Mus. natn. Hist. Nat., Zool.*, 86 : 218. Lectotype female designated.

Diagnosis : Female : Length 15-25 mm. Integument black except antennal flagellum orange red. Vestiture entirely black. Wings dark brown with dark bluish reflections. Upper plate of metapleuron with medium sized, subcontiguous punctures on upper half to three-fourths; dorsum of propodeum and posterior surface with very tiny scattered punctures; first tergite with a well developed anteromedian tubercle.

Male : Length 12-21 mm. Integument black except antennal flagellum orange red entirely or only apically. Wings dark to light brown with purplish reflections.

Distribution : Arunachal Pradesh, Assam, Bihar, Chhattisgarh, Delhi, Himachal Pradesh, Jammu & Kashmir, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Meghalaya, Nagaland, Odisha, Pondicherry, Sikkim, Tamil Nadu, Tripura, Uttarakhand, Uttar Pradesh and West Bengal.

Elsewhere : Bangladesh, Myanmar, Nepal and Pakistan.

Remarks : The specimens of this species from Maharashtra state were not available for this study and the above diagnosis is based on the descriptions provided by Gupta and Jonathan (2003).

7. *Scolia (Discolia) bilunata* de Saussure

1858. *Scolia (Lacosi) bilunata* Saussure, *Ann. Soc. Ent. France*, (3)6 : 212. Male, Nepal (ZMHU).

1864. *Scolia (Discolia) bilunata* Saussure : Saussure & Sichel, *Cat. Spec. Gen. Scolia*, : 115.

Diagnosis : Female : Length 14 mm. Integument black, flagellum orange to red, except basal segment. Vestiture entirely black. Wings dark brown with purplish reflections. Frontal fissure extending upto anterior ocellus; mesoscutum without any impunctate area.

Material examined : INDIA : Maharashtra, Nasik district, Gangapur, 1 ♀, 13.ix.2003, Coll. P.H. Roy & Party, NZSI Regd. No. 11873/H3.

Distribution : India : Delhi, Jharkhand, Karnataka, Maharashtra, Manipur, Odisha, Punjab, Uttarakhand, Uttar Pradesh and Tamil Nadu.

Elsewhere : Nepal and Sri Lanka.

8. *Scolia (Discolia) binotata binotata* Fabricius

1804. *Scolia binotata* Fabricius, *Syst. Peiz.*, : 244. Male, Tranquebar (ZMUC).

1978. *Scolia (Discolia) binotata binotata* Fabricius : Krombein, *Smithsonian Contr. Zool.*, **283** : 41-43.

Diagnosis : Female : Length 14-15 mm. Integument black, third and fourth tergites with paired, large rounded red spots. Vestiture black, except white on the occiput. Wings medium to dark brown, forewing anteriorly darker with bluish reflections. Dorsomedian area of propodeum with moderately large, deep punctures, dorsolateral area impunctate at its inner half; first abdominal tergite with a prominent anteromedian tubercle; second sternite with a weak basal tubercle.

Male : Length 14-15 mm. Integument black, third and fourth tergites with paired, rounded, light red spots. Vestiture black mixed with white. Wings dark brown at base and paler at apices with bluish purple reflections; forewing membrane beyond cells devoid of microtrichiae except for a small patch adjacent to apex of marginal cell; flagellum clavate towards apex.

Material examined : INDIA : Maharashtra, Nasik district, Gangapur, 1 ♀, 13.ix.2003, Coll. P.H. Roy & Party, NZSI Regd. No. 11869/H3; Satara district, Gadolia, 1 ♀ & 4 ♂, 9.iii.2009, Coll. S.I. Kazmi & Party, NZSI Regd. Nos. 11841/H3 to 11845/H3.

Distribution : India : Andhra Pradesh, Arunachal Pradesh, Assam, Delhi, Karnataka, Kerala, Maharashtra (new record), Manipur, Rajasthan, Sikkim, Tamil Nadu, Tripura, Uttarakhand, Uttar Pradesh and West Bengal.

Elsewhere : Sri Lanka.

9. *Scolia (Discolia) cruenta* Klug

1805. *Scolia analis* Klug, *Beitr. Naturk.*, **1** : 36. Female, India : Pune (ZMHU).

1964. *Scolia (Discolia) cruenta* Klug : Betrem & Bradley, *Zool. Meded.*, **40** : 93.

Diagnosis : Female : Length 16-23 mm. Integument black, the following reddish yellow portions : paired large lateral spots on second tergite and third to fifth tergites almost entirely. Vestiture black except for some yellowish pubescence on coloured abdominal areas. Wings dark brown with purplish blue reflections; upper plate of metapleurum with small, mostly subcontiguous punctures at its upper half, lower plate with small, sparse to scattered punctures and broadly impunctate along posterior margin; first abdominal tergite with an anteromedian tubercle.

Male : Length 12-18 mm. Integument black except third to fifth tergites usually with paired large to small reddish yellow spots, the spots sometimes absent from one or more tergites, rarely the tergites entirely black. Vestiture black except yellowish white pubescence on coloured abdominal areas. Wings dark brown with purplish reflections.

Distribution : India : Bihar, Delhi, Haryana, Karnataka, Madhya Pradesh, Maharashtra, Odisha, Punjab, Tamil Nadu, Uttarakhand, Uttar Pradesh and West Bengal.

Remarks : The specimens of this species from Maharashtra state were not available for this study and the above diagnosis is based on the descriptions provided by Gupta and Jonathan (2003).

10. *Scolia (Discolia) cyanipennis* Fabricius

1804. *Scolia cyanipennis* Fabricius, *Syst. Piez.*, : 244. Female, Tranquebar (ZMUC).

1864. *Scolia (Discolia) cyanipennis* Fabricius : Saussure & Sichel, *Cat. Spec. Gen. Scolia*, : 103. Female.

Diagnosis : Female : Length 16-22 mm. Integument and vestiture entirely black. Wings dark brown with bluish reflections. Median area of clypeus strongly raised and smooth; dorsomedian area of propodeum with moderately

coarse, subcontiguous to contiguous punctures, dorsolateral area with small subcontiguous punctures, with a rectangular impunctate area anteriorly along inner margin, posterior half subcontiguously punctate.

Male : Length 11-18 mm. Integument and vestiture black, abdomen with bluish reflections. Wings dark brown.

Material examined : INDIA : Maharashtra, Satara district, Anibera, 1 ♀, 9.iii.2009, Coll. S.I. Kazmi & Party, NZSI Regd. No. 11831/H3; Satara district, Gadolia, 6 ♀ & 3 ♂, 9.iii.2009, Coll. S.I. Kazmi & Party, NZSI Regd. Nos. 11832/H3 to 11840/H3.

Distribution : India : Himachal Pradesh, Jammu & Kashmir, Maharashtra (new record), Sikkim, Tamil Nadu, Uttar Pradesh and West Bengal.

Elsewhere : Sri Lanka.

SUMMARY

This paper deals with the Scoliid fauna of Maharashtra state. Ten species under 6 genera are reported from Maharashtra of which 1 genus namely *Phalerimeris* Betrem and 3 species namely *Phalerimeris madurensis* (Betrem), *Scolia (Discolia) binotata binotata* Fabricius and *Scolia (Discolia) cyanipennis* Fabricius are new records from the state.

ACKNOWLEDGEMENTS

We are grateful to Dr. K. Venkataraman, Director, Zoological Survey of India and Dr. Kailash Chandra, Officer-in-Charge of Entomology Division (A), Zoological Survey of India, Kolkata for providing necessary facilities to carry out this research work.

REFERENCES

- Betrem, J.G. 1928. Monographie der Indo-Australischen Scoliiden mit zoogeographischen Betrachtungen. *Treubia*, **9** (suppl.) : 1-388, 5 plates.
- Betrem, J.G. 1967. The natural groups of *Campsomeriella* Betr., 1941 (Hymenoptera : Scoliidae). *Ent. Ber. Amst.*, **27** : 25-29.
- Betrem, J.G. and Bradley, J.C. 1964. Annotations on the genera *Triscolia*, *Megascolia* and *Scolia* (Hymenoptera : Scoliidae) (Second part). *Zool. Meded.*, **40** : 89-96.
- Betrem, J.G. and Bradley, J.C. 1972. The African Campsomerinae (Hym., Scoliidae). *Mon. Ned. Ent. Ver.*, **6** : 1-326, 55 figures, 6 plates and 47 maps.
- Bradley, J.C. 1973. The scoliid types of Guerin-Meneville (Insecta : Hymenoptera : Scoliidae). *Bull. Mus. Hist. nat. Paris*. (3) 112, *Zool.*, **86** : 217-221.
- Bradley, J.C. 1974. The types of Scoliidae (Hymenoptera) described by Henri de Saussure or by Jules Sichel, or by them jointly. *Revue Suisse Zool.*, **81**(2) : 417-485.
- Cameron, P. 1892. Hymenoptera Orientalis or contribution to a knowledge of the Hymenoptera of the Indian Zoological Region. Part 4 : Scoliidae. *Mem. Proc. Manch. Lit. Phil. Soc.*, **5**(4) : 97-137.
- Fabricius, J.C. 1775. *Systema Entomologiae*, : 832 pages.
- Fabricius, J.C. 1804. *Systema Piezatorium*, : 439 pages.
- Guerin- Meneville, F.E. 1838. Insects : In Duperrey : *Voyage autour du monde, execute par ordre du roi, sur la corvette ote S. M. la Coquille*, pendant les annees 1822-1825, section 1, Zoology, 319 pages, 21 plates.
- Gupta, S.K. and Jonathan, J.K. 2003. *Fauna of India and the adjacent countries*, Hymenoptera : Scoliidae, 1-277 (Published by the director, *Zool. Surv. India*, Kolkata).

- Klug, J.C.F. 1805. Versuch einer Berichtigung der Fabricius schen Gattungen *Scolia* und *Tiphia*. *Beitr. Naturkunde*, **1** : 8-40.
- Klug, J.C.F. 1810. Fortsetzung des im vorigen Bande abgebrochenen Versuchs uber die Gattungen *Scolia* und *Tiphia*. *Beitr. Naturkunde*, **2** : 167-215.
- Krombein, K.V. 1978. Biosystematic studies of Ceylonese wasps, II : A monograph of the Scoliidae (Hymenoptera : Scoliioidea). *Smithsonian Contr. Zoology*, **238** : 1-56.
- Saussure, H. De. 1858. Description de diverses especes nouvelles ou peu connues du genre *Scolia*. *Ann. Soc. Ent. France*, (3)**6** : 193-249.
- Saussure, H. De. and Sichel, J. 1864. *Catalogue des specierum de l'ancien generic Scolia*, : 350 pages, 2 plates.

INSECTA : HYMENOPTERA : ICHNEUMONIDAE

S.M. NIKAM* and A.J. KHARAT

Post-Graduate Department of Zoology, K.T.H.M.College, Nashik, Maharashtra

INTRODUCTION

Family Ichneumonidae is enormously diversified and one of the largest families of order Hymenoptera. Members of this family are parasites of other insects including egg, larva and pupa, thus play a major role in biological control of pests in forestry, agriculture, and horticulture. So far as studies on Indian Ichneumonidae are concerned, the work was initiated by Cameron at the end of 19th century, which was carried forward by Morley (1912, 1913). The later contributions were of Cushman (1934), and Rao (1953). Subsequently, Indo-Australian Ichneumonid fauna was explored by Townes, Townes and Gupta (1961). Thereafter monumental contributions on group were brought out by Kamath and Gupta (1972), Jonathan and Gupta (1973), Gupta and Tikar (1976), Gupta and Gupta (1971, 1983) and Nikam (1980).

The systematic studies on Ichneumonidae from Maharashtra were attempted by Nikam (1970), Bandelu (1976), Heble (1981), Kanhekar (1985), and Nikam (1987). Recently Nikam, (1989, 1990) and Nikam and Desai (2008, 2009) described three new species from Maharashtra.

The present attempt enumerates 181 species of 55 genera under 13 subfamilies.

SYSTEMATIC ACCOUNT

Family ICHNEUMONIDAE

Subfamily PIMPLINAE

Tribe Pimplini

1. *Sericopimpla sagrae albopalteata*, Cameron, 1905

**Sericopimpla sagrae albopalteata*, Gupta and Tikar, 1976

Distribution : Devlali.

Tribe Ephialtini

2. *Coccygomimus laothoe*, Cameron, 1897
**Coccygomimus laothoe*, Gupta and Saxena
3. *Echthromorpha agrestoria notulatoria*, Fabricius, 1804
**Echthromorpha agrestoria notulatoria*, Nikam & Gosavi, 1983
Distribution : Aurangabad.
4. *Xanthopimpla connexa poonaensis*, Rao, 1953
* *Xanthopimpla connexa poonaensis*, Townes & Chiu, 1970
Distribution : Pune, Nanded, Khuladabad.
5. *Xanthopimpla flavolineata*, Cameron, 1907
**Metopius sesamiae*, Rao, 1953
**Xanthopimpla sesamiae*, Rao, 1970
Distribution : Nanded, Khuladabad.
6. *Xanthopimpla honorata honorata*, Cameron, 1899
**Xanthopimpla cera*, Rao, 1970
**Xanthopimpla honorata honorata*, Townes & Chiu, 1970
Distribution : Nanded, Khuladabad.
7. *Xanthopimpla indica*, Rao & Grover, 1960
Distribution : Nanded.
8. *Xanthopimpla nana nana*, Schulz, 1906
**Xanthopimpla nana nana* Townes & Chiu 1970
Distribution : Mumbai.

9. *Xanthopimpla pedator*, (Fabricius), 1767
 **Xanthopimpla pedator*, Morley, 1913
 **Xanthopimpla pedator*, Trehan & Butani, 1950
Distribution : Nagpur, Pune, Mumbai.
10. *Xanthopimpla punctata*, Fabricius 1781
 **Xanthopimpla kandiensis*, Morley, 1913
Distribution : Mumbai.
11. *Xanthopimpla reicherti reicherti*, Krieger 1914
 **Xanthopimpla reicherti reicherti*, Townes and Chiu, 1970
Distribution : Matheran.
12. *Xanthopimpla stemmator*, (Thunberg 1822)
 **Xanthopimpla nursei*, Cameron 1907
 **Xanthopimpla maculifrons* Cameron, 1907
 * *Xanthopimpla nursei*, Dutt, 1923
 **Xanthopimpla nursei*, Trehan & Butani, 1950
 **Xanthopimpla stemmator*, Townes and Chiu, 1970
 * *Xanthopimpla stemmator*, Rao, 1970
 * *Xanthopimpla stemmator*, Nikam & Basarkar, 1981
Distribution : Nagpur, Deesa, Pune, Mumbai, Khuldabad, Nanded, Aurangabad.
13. *Eurga asiensis* Nikam, 2009
Distribution : Nashik.

Subfamily TRYPHONINAE
 Tribe **Phytodietini**
14. *Netelia inaequalis*, (Uchida, 1934)
 **Netelia inaequalis*, Rao & Nikam, 1970
Distribution : Aurangabad.
15. *Netelia macrostigma*, (Enderlein, 1912)
 **Netelia longiterebra*, Rao & Nikam, 1970
 * *Netelia macrostigma*, Rao & Nikam, 1970
 **Netelia macrostigma*, Kaur & Jonathan, 1979
Distribution : Aurangabad.
16. *Netelia recta* (Enderlein, 1912)
 **Netelia mellea*, Rao & Nikam, 1970
 **Netelia recta*, Kaur & Jonathan, 1979
Distribution : Aurangabad.
17. *Netelia elumbis*, (Tosquinet, 1903)
 **Netelia elumbis*, Rao & Nikam, 1970
Distribution : Aurangabad.
18. *Netelia baibarensis*, (Uchida 1928)
 **Netelia baibarensis* Rao & Nikam, 1970
Distribution : Aurangabad.
19. *Netelia latro barnardi*, (Cheesman, 1936),
 **Netelia latro barnardi* Nikam 1973
Distribution : Aurangabad.
20. *Netelia latro latro*, (Holmgren, 1868)
 **Netelia multicolor*, Rao & Nikam, 1972
 **Netelia rugosa*, Nikam & Rao, 1972
 **Netelia carinata*, Nikam & Rao, 1972
 **Netelia cameroni*, Nikam, 1973
 **Netelia ferruginea*, Nikam, 1973
 **Netelia latro latro*, Nikam, 1973
 **Netelia multicolor*, Nikam, 1973
 **Netelia rugosa*, Nikam, 1973
 **Netelia carinata*, Nikam, 1973
 **Netelia latro latro*, Kaur & Jonathan, 1979
Distribution : Aurangabad.
21. *Netelia aberrans*, Townes, Townes & Gupta 1913
 **Netelia aberrans*, Nikam 1973
Distribution : Aurangabad.
22. *Netelia antipodum*, (Vachal, 1907)
 **Netelia antipodum*, Nikam 1973
Distribution : Aurangabad.
23. *Netelia areolata*, Nikam & Rao, 1972
 **Netelia areolata*, Nikam, 1973
 **Netelia areolata*, Kaur & Jonathan, 1979
Distribution : Aurangabad : Himayatbagh.
24. *Netelia celebensis*, (Szépligeti, 1906)
 **Netelia celebensis*, Nikam 1973
Distribution : Aurangabad.
25. *Netelia ceylonica*, (Cameron, 1897)
 **Netelia ceylonica*, Nikam 1973
Distribution : Aurangabad.
26. *Netelia constricta*, (Morley, 1913)
 **Netelia constricta*, Nikam 1973
Distribution : Aurangabad.
27. *Netelia contraria*, (Morley, 1913)
 * *Netelia contraria*, Nikam 1973

Distribution : Aurangabad.

28. *Netelia corrugata*, Kaur & Jonathan 1979

**Paniscus nigriventris*, Morley, 1913

Distribution : Mumbai.

29. *Netelia dimidiata*, (Morley, 1913)

**Netelia dimidiata*, Nikam 1973

Distribution : Aurangabad.

30. *Netelia ehilis*, (Cheesman, 1936)

**Netelia ehilis*, Nikam 1973

Distribution : Aurangabad.

31. *Netelia ephippiata*, (Smith, 1876)

* *Netelia ephippiata*, Nikam 1973

Distribution : Aurangabad.

32. *Netelia fijiensis*, (Brues, 1922)

**Netelia fijiensis*, Nikam 1973

Distribution : Aurangabad.

33. *Netelia formosana*, (Matsumura, 1912)

**Netelia formosana*, Nikam 1973

Distribution : Aurangabad.

34. *Netelia fulvator*, Delrio, 1971

**Netelia fulvator*, Kaur & Jonathan 1979

Distribution : Pratapgarh.

35. *Netelia fuscicornis*, (Holmgren, 1858)

**Paniscus testaceus*, Morley, 1913

**Netelia fuscicornis*, Nikam, 1973

**Netelia longitarsis*, Nikam, 1973

**Netelia yarkandensis*, Nikam, 1975

Distribution : Mumbai, Aurangabad.

36. *Netelia gigantia*, Nikam, 1973

**Netelia gigantia gigantia*, Nikam, 1973

**Netelia gigantia*, Kaur & Jonathan, 1979

Distribution : Aurangabad : Himayatbagh

37. *Netelia gracilis*, (Morley, 1913)

**Netelia gracilis*, Nikam 1973

Distribution : Aurangabad.

38. *Netelia incommunis*, (Szépligeti, 1906)

**Netelia incommunis*, Nikam 1973

Distribution : Aurangabad.

39. *Netelia indica*, (Rao & Grover 1960)

**Stauropodoctonus indica*, Rao 1973

Distribution : Nagpur, Aurangabad.

40. *Netelia indicata*, Gupta 1973

**Netelia indica*, Nikam 1973

**Netelia indica*, Kaur & Jonathan, 1979

Distribution : Aurangabad.

41. *Netelia intermedia* (Cameron, 1905)

**Netelia intermedia*, Nikam 1973

**Netelia intermedia*, Kaur & Jonathan, 1979

Distribution : Aurangabad.

42. *Netelia kashmirensis*, (Cameron, 1906)

**Netelia kashmirensis*, Nikam 1973

Distribution : Aurangabad.

43. *Netelia laevis*, (Cameron, 1906)

**Netelia laevis*, Nikam 1973

**Netelia baibarama*, Nikam 1973

Distribution : Aurangabad.

44. *Netelia lineata* (Brulle, 1846)

**Netelia lineata*, Nikam 1973

Distribution : Aurangabad.

45. *Netelia nigriventris* (Brulle, 1846)

**Netelia nigriventris*, Nikam 1973

Distribution : Aurangabad.

46. *Netelia ocellaris*, (Thomson, 1888)

**Netelia ocellaris*, Nikam 1973

Distribution : Aurangabad.

47. *Netelia opacula*, (Thomson, 1888)

**Paniscus testaceus* var. *opaculus*, Morley 1913

* *Netelia opacula*, Nikam 1973

Distribution : Mumbai, Aurangabad.

48. *Netelia orientalis*, (Cameron, 1905)

**Paniscus orientalis*, Morley 1913

**Netelia orientalis*, Nikam 1973

**Netelia orientalis*, Kaur & Jonathan, 1979

Distribution : Aurangabad.

49. *Netelia pengalengana* (Enderlein, 1912)

**Netelia pengalengana*, Nikam 1973

Distribution : Aurangabad.

50. *Netelia producta* (Brulle, 1846)

**Netelia producta*, Nikam 1973

Distribution : Aurangabad.

51. *Netelia rimosa*, (Enderlein, 1912)

**Netelia rimosa*, Nikam 1973

Distribution : Aurangabad.

52. *Netelia scissulata*, (Enderlein, 1912)
 **Netelia scissulata*, Nikam 1973
Distribution : Aurangabad.
53. *Netelia setosa*, Kaur & Jonathan, 1979
Distribution : Chikalda, Satpura hills.
54. *Netelia shopar*, Cheesman, 1953
 **Netelia shopar*, Nikam 1973
Distribution : Aurangabad.
55. *Netelia siva*, Kaur & Jonathan, 1979
 **Netelia sola*, Nikam 1973
Distribution : Aurangabad.
56. *Netelia striata*, Nikam, 1973
 **Netelia striata*, Kaur & Jonathan, 1979
Distribution : Aurangabad, Matheran.
57. *Netelia tamis*, (Cheesman, 1936)
 **Netelia tamis*, Nikam 1973
Distribution : Aurangabad.
58. *Netelia terebrica*, Nikam, 1973
 **Netelia indica*, Nikam, 1973
Distribution : Parbhani, Aurangabad.
59. *Netelia testacea* (Gravenhorst, 1829)
 **Paniscus testaceus*, Morley, 1913
 **Netelia testacea*, Nikam 1973
Distribution : Mumbai, Aurangabad.
60. *Netelia testaceinervis*, (Cameron, 1912)
 **Netelia testaceinervis*, Nikam 1973
Distribution : Aurangabad.
61. *Netelia truncativenosa*, (Enderlein, 1912)
 **Netelia truncativenosa*, Nikam 1973
Distribution : Aurangabad.
62. *Netelia unicolor* (Smith, 1874)
 **Netelia unicolor*, Nikam 1973
Distribution : Aurangabad.
63. *Netelia vinulae*, (Scopoli, 1763)
 **Netelia cephalotes*, Nikam 1973
Distribution : Aurangabad.
64. *Netelia woris*, (Cheesman, 1936)
 **Netelia woris*, Nikam 1973
Distribution : Aurangabad.

Subfamily BANCHINAE

Tribe Lissonotini

65. *Syzeuctus apicipennis*, (Cameron, 1902),

**Syzeuctus apicipennis*, Chandra & Gupta 1977

Distribution : Panchgani near Mahabaleshwar.

66. *Syzeuctus zanthorius*, (Cameron, 1902)
 **Syzeuctus zanthorius*, Morley, 1913
 **Syzeuctus indicus* Rao 1970
 **Syzeuctus zanthorius*, Chandra & Gupta 1977
Distribution : Deesa, Pune, Khuldabad, Deolali.

Tribe Banchini

67. *Leptobatopsis v-maculata* (Cameron, 1907)
 **Leptobatopsis v-maculata*, Chandra & Gupta 1977
Distribution : Mahabaleshwar.

Subfamily CTENOPELMATINAE

Tribe Perilissini

68. *Perilissus cingulator* (Morley, 1913)
 **Pseudochorus kuriani*, Rao & Grover, 1960
Distribution : Nagpur.

Subfamily PORIZONTINAE

Tribe Porizontini

69. *Campoplex fascialvus*, Gupta & Maheshwary, 1977
Distribution : Mahabaleshwar.
70. *Campoplex montanus*, Gupta & Maheshwary, 1977
Distribution : North Thana, Plaghar range.
71. *Venturia inclyta*, (Morley, 1923)
 **Venturia inclyta*, Maheshwary 1977
Distribution : Satpura hills, Chikalda.
72. *Venturia utara*, Maheshwary, 1977
Distribution : Satpura hills, Chikalda.
73. *Casitaria formosana bharata*, Maheshwary & Gupta, 1977
Distribution : Mahabaleshwar, Panhala fort.
74. *Casitaria indubia*, (Morley, 1913)
 **Casitaria indubia*, Maheshwary & Gupta 1977
Distribution : Matheran, Chikalda.
75. *Casitaria parvicarinata*, (Cameron, 1906)

**Casinaria parvicarinata*, Maheshwary & Gupta 1977

Distribution : Deolali.

76. *Charops obtusus obtusus*, Morley, 1913

**Charops obtusa*, Morley, 1913

Distribution : Pune.

77. *Cymodusa punctata*, Nikam S M, 1990

Distribution : Nashik.

Tribe Cymodusini

78. *Delopia alveolata*, Gupta & Gupta, 1978

Distribution : Satpura hills, Chikalda.

79. *Delopia chikaldaensis*, Gupta & Gupta, 1978

Distribution : Satpura hills, Chikalda.

80. *Delopia nursei*, (Cameron, 1907)

**Dusona nursei*, Gupta & Gupta, 1978

Distribution : Satpura hills, Chikalda.

81. *Delopia perditor*, (Foerster, 1869)

**Campoplex perdiator*, Morley, 1913

Distribution : Pune.

Tribe Macrini

82. *Campoletis chlorideae*, Uchida, 1957

**Campoletis chlorideae*, Gupta, 1974

**Campoletis chlorideae*, Nikam &

Basarkar, 1978

Distribution : Aurangabad.

83. *Diadegma fenestralis*, (Holmgren, 1858)

**Diadegma fenestralis*, Rao, 1970

**Diadegma fenestralis*, Nikam & Basarkar, 1978

84. *Diadegma trichoptilus*, (Cameron, 1909)

**Diocetes debilis*, Morley, 1913

**Diocetes debilis*, Dutt, 1919

**Diadegma trichoptilus*, Nikam & Sathe, 1981

**Diadegma trichoptilus*, Sathe & Nikam, 1981

Distribution : Nagpur.

85. *Eriborus argenteopilosus*, (Cameron, 1907)

**Diocetes argenteopilosa*, Morley, 1913

**Diocetes argenteopilosa*, Dutt, 1919

**Eriborus argenteopilosus*, Nikam & Gosavi, 1982

Distribution : Deesa, Nagpur, Aurangabad.

86. *Eriborus ricini*, (Rao and Kurian, 1951)

**Eriborus ricini*, Rao, 1970

Distribution : Aurangabad.

87. *Eriborus trochanteratus*, (Morley, 1913)

**Eriborus trochanteratus*, Gupta, 1974

Distribution : Deolali.

Subfamily CREMASTINAE

88. *Pristomerus euzopherae*, Viereck, 1912

**Pristomerus euzopherae*, Rao, 1970

Distribution : Khuldabad.

89. *Pristomerus marginicollis*, (Cameron, 1907)

**Pristomerus marginicollis*, Rao, 1970

Distribution : Aurangabad.

90. *Pristomerus secundus*, (Morley, 1913)

**Pristomerus secunda*, Rao & Grover, 1960

**Pristomerus secundus*, Rao, 1970

Distribution : Nagpur-Aurangabad.

91. *Pristomerus testaceus*, Morley, 1913

**Pristomerus testaceus*, Dutt, 1919

Distribution : Nagpur.

92. *Trathala flavo-orbitalis*, (Cameron, 1907)

**Trathala flavo-orbitalis*, Morley, 1913

Distribution : Deesa.

93. *Trathala hapaliae*, (Cushman, 1934)

**Trathala hapaliae*, Rao, 1970

Distribution : Khuldabad.

94. *Temelucha basimacula*, (Cameron, 1907)

**Tarytia basimacula*, Morley, 1913

Distribution : Deesa.

95. *Temelucha cariniscutis*, (Cameron, 1907)

**Temelucha basimacula*, Morley, 1913

Distribution : Deesa.

96. *Temelucha indica*, (Szépligeti, 1906)

Distribution : Mumbai.

97. *Temelucha nigromaculata*, (Cameron, 1907)

**Tarytia nigromaculata*, Morley, 1913

Distribution : Deesa.

Subfamily OPHIONINAE

Tribe Ophionini

98. *Ophion turcomanicus*, Szépligeti, 1905

**Ophion turcomanicus*, Gauld & Mitchell, 1981

Distribution : Deolali.

Tribe **Enicospilini**

99. *Orientospilus individuus*, Morley, 1912
 **Orientospilus individuus*, Morley, 1913
 **Orientospilus individuus*, Gauld & Mitchell, 1981
Distribution : Deesa.
100. *Leptophion maculipennis*, (Cameron, 1905)
 **Stauropodoctonus orientalis*, Morley, 1913
 **Stauropodoctonus orientalis*, Dutt, 1923
Distribution : Mumbai.
101. *Dicamptus bicarinus*, Nikam and Kanhekar, 1984
Distribution : Omerga.
102. *Dicamptus indicus*, Nikam, 1972,
Dicamptus indicus, Gauld & Mitchell, 1981
Distribution : Aurangabad : Himayatbagh.
103. *Enicospilus albeiger* (Kriechbaumer, 1894)
 **Encospilus uniscleromeaus*, Nikam, 1972
 **Enicospilus albeiger* Gauld & Mithcell, 1971
Distribution : Aurangabad, Parbhani.
104. *Enicospilus auragabadensis*, Rao, 1970
 **Enicospilus auragabadensis*, Rao, 1973
Distribution : Aurangabad.
105. *Enicospilus biharensis*, Townes, Townes & Gupta, 1970,
 **Enicospilus pungens*, Rao, 1970
 **Enicospilus bicornis*, Rao & Nikam, 1971
Distribution : Aurangabad, Parbhani.
106. *Enicospilus breviterebrus*, Nikam, 1975
 **Enicospilus breviterebrus*, Gauld & Mithcell, 1971
Distribution : Parbhani, Matheran.
107. *Enicospilus caenospilus*, Cameron, 1911
 **Enicospilus caenospilus*, Nikam, 1972
Distribution : Aurangabad.
108. *Enicospilus capensis*, (Thunberg, 1822)
 **Enicospilus indica*, Rao & Grover, 1960
 **Enicospilus silvaraji*, Rao & Nikam, 1970
 **Enicospilus capensis*, Nikam, 1980
Distribution : Nagpur, Aurangabad, Nanded, Daulatabad.
109. *Enicospilus ceylonicus*, Cameron, 1897
 **Enicospilus ceylonicus*, Rao, 1970
Distribution : Aurangabad.
110. *Enicospilus dasychirae*, Cameron, 1905
 **Henicospilus horsfieldi*, Morley, 1913
 **Enicospilus dasychirae*, Rao, 1970
Distribution : Bandra, Aurangabad.
111. *Enicospilus dolosus*, (Tosquinet, 1896)
 **Henicospilus atricornis*, Dutt, 1990
 **Enicospilus dwibinduae*, Rao & Nikam, 1969
 **Enicospilus spilonotus*, Rao, 1970
Distribution : Balaghat, Nagpur, Aurangabad: Himayatbagh.
112. *Enicospilus enicospilus*, Nikam, 1972
 **Enicospilus enicospilus*, Gauld & Mithcell, 1981
Distribution : Parbhani.
113. *Enicospilus flatus*, Chiu, 1954
 **Enicospilus flatus*, Rao & Nikam, 1971
Distribution : Aurangabad.
114. *Enicospilus flavicaput*, (Morley, 1913)
 **Enicospilus flavicaput*, Rao, 1970
Distribution : Kasaba, Aurangabad.
115. *Enicospilus heliothidis*, Viereck, 1913
 **Enicospilus rufus*, Rao & Grover, 1960
 **Enicospilus neorufus*, Rao & Nikam, 1969
 **Enicospilus biconatus*, Nikam, 1980
Distribution : Nagpur, Aurangabad, Nanded.
116. *Enicospilus javanus*, (Szépligeti, 1910)
 **Enicospilus diurnus*, Nikam, 1975
 **Enicospilus diurnus*, Nikam, 1980/
Enicospilus javanus, Gauld & Mitchell, 1981
Distribution : Aurangabad : Himayatbagh.
117. *Enicospilus lineolatus*, (Roman, 1913)
 **Enicospilus unicornis*, Rao & Nikam, 1970
 **Enicospilus striolatus*, Nikam, 1980
Distribution : Aurangabad : Himayatbagh, Muddalwadi (Paithan), Nanded.
118. *Enicospilus marathwadensis*, Nikam, 1980
 **Enicospilus marathwadensis*, Gauld & Mitchell, 1981

- Distribution* : Panhala Fort.
119. *Enicospilus melanocarpus*, Cameron, 1902
 **Henicospilus melanocarpus*, Morley, 1913
 **Enicospilus uncivena*, Rao, 1970
 **Enicospilus brunnis*, Rao & Nikam, 1971
 **Enicospilus nocturnus*, Nikam, 1980
Distribution : Igatpuri, Aurangabad: Himayatbagh.
120. *Enicospilus nigriventis*, Nikam, 1975
 **Enicospilus nigriventis*, Gauld & Mitchell, 1981
Distribution : Aurangabad.
121. *Enicospilus orientalis*, (Morley, 1913)
 **Enicospilus orientalis*, Rao, 1970
Distribution : Thana near Pune, Aurangabad.
122. *Enicospilus przewalskii*, (Kokujev, 1909)
 **Enicospilus crassus*, Rao, 1970
Distribution : Aurangabad.
123. *Econispilus purifenestratus*, (Enderlein, 1921)
 **Econispilus purifenestratus*, Nikam, 1972
Distribution : Aurangabad.
124. *Enicospilus shinkanus*, (Uchida, 1928)
 **Enicospilus bindus*, Nikam, 1972
 **Enicospilus relictus*, Nikam, 1975
 **Enicospilus shinkanus*, Gauld & Mitchell, 1981
Distribution : Aurangabad.
125. *Enicospilus signativentris*, (Tosquinet, 1903)
 **Enicospilus pectiniclavae*, Nikam, 1980
Distribution : Deolali, Panhala fort (3000 ft), Aurangabad.
126. *Enicospilus transversus*, Chiu, 1954
 **Enicospilus perpendicularis*, Nikam, 1972
 **Enicospilus transversus*, Gauld & Mitchell, 1981
Distribution : Aurangabad: Himayatbagh.
127. *Enicospilus tribindus*, Rao and Nikam, 1970,
 **Enicospilus tribindus*, Gauld & Mitchell, 1981
Distribution : Aurangabad: Himayatbagh, Doulatabad.
28. *Enicospilus tricorniatus*, Rao and Nikam, 1970
 **Enicospilus tricorniatus*, Gauld & Mitchell, 1981
Distribution : Aurangabad, Omerga, Doulatabad.
129. *Enicospilus vestigator*, (Smith, 1858)
 **Enicospilus unilineatus*, Rao, 1970
 **Enicospilus carinatus*, Rao & Nikam, 1971
 **Enicospilus vestigator*, Gauld & Mitchell, 1981
Distribution : Aurangabad: Himayatbagh.
130. *Enicospilus xanthocephalus*, Cameron, 1905
 **Enicospilus merdarius*, Rao 1970
 **Enicospilus paraclinatus*, Nikam, 1975
 **Enicospilus xanthocephalus*, Nikam, 1980
 **Enicospilus xanthocephalus*, Gauld & Mitchell, 1981
Distribution : Aurangabad.
- Subfamily METOPIINAE
131. *Metopius rufus indicus*, Nikam & Heble, 1976
Distribution : Aurangabad: Himayatbagh.
132. *Metopius rufus rufus*, Cameron, 1905
 **Metopius rufus*, Morley, 1912
Distribution : Pune, Nashik.
133. *Triclistus aitkini*, (Cameron, 1897)
 **Triclistus curvicainatus*, Morley, 1913
Distribution : Deesa.
- Subfamily ANOMALONINAE
134. *Anomalon foliator*, (Fabricius, 1798)
 **Nototrachys flavor-orbitalis*, Cameron, 1907
 **Nototrachys foliator*, Morley, 1912
Distribution : Pune, Deesa.
- Subfamily GRAVENHORSTIINAE
135. *Heteropelma nigricorne*, (Szépligeti, 1906)
 **Heteropelma nigricorne*, Gauld, 1976
Distribution : Matheran.
136. *Trichomma decorum*, (Cameron, 1897)
 **Trichomma decorum*, Gauld, 1976

137. *Agrypon indicum* Szépligeti, 1906,
**Labrorychus indicus*, Townes, Townes &
Gupta, 1961

Distribution : Mumbai.

138. *Indagrypon raoi*, Nikam, 1982

Distribution : Aurangabad: Himayatbagh.

Subfamily DIPLAZONTINAE

139. *Diplazon orientalis*, (Cameron, 1905)

**Bassus clotho*, Morley, 1913

**Diplazon orientalis*, Diller, 1971

Distribution : Nagpur, Mumbai, Matheran.

140. *Diplazon tetragonus delhius*, Diller, 1977

**Bassus multicolor*, Morley, 1914

Distribution : Mumbai.

Subfamily MESOSTENINAE

Tribe Gabuniini

141. *Xoridesopus notialis*, Gupta & Gupta, 1983

Distribution : Matheran, Mahabaleshwar.

142. *Xoridesopus schuleri*, (Dalla Torre, 1902)

**Xoridesopus schuleri*, Gupta & Gupta, 1983

Distribution : Matheran.

143. *Arhytis maculiscutis*, (Cameron, 1907)

**Arhytis maculiscutis*, Gupta & Gupta 1983

Distribution : Mumbai.

144. *Buodias guptai*, Nikam S M, 2008

Distribution : Aurangabad.

145. *Buodias reticulate*, Nikam S M, 2008

Distribution : Nashik.

Tribe Ischnini

146. *Dihelus orientalis*, Gupta & Gupta, 1979

Distribution : Panhala Fort.

Tribe Baryceratini

147. *Chlorocryptus coeruleus* Cameron, 1903

**Neodontocryptus hyalina*, Saxena 1978

Distribution : Mumbai.

Tribe Mesostenini

148. *Gotra cyclosiae*, (Cameron, 1905)

**Skeatia cyclosiae*, Dutt, 1923

**Gotra cyclosiae*, Gupta, 1970

Distribution : Nagpur.

149. *Gotra hapaliae*, Rao, 1970

Distribution : Khuldabad, Marathwada.

150. *Gotra marginata*, (Brullé 1846)

**Gotra marginata*, Gupta, 1970

Tribe Goryphini

151. *Allophatnus abdominalis*, Szépligeti, 1916

Distribution : Mumbai.

152. *Allophatnus fulvitergus*, (Tosquinet, 1903)

**Stictocryptus testaceus*, Cameron, 1907

Distribution : Deesa.

153. *Neobuodias indicus*, Rao & Nikam, 1984

Distribution : Aurangabad : Himayatbagh

154. *Menaforia indica*, Gupta & Saxena, 1979

Distribution : Deolali, Ghoti.

155. *Friona octobalteata*, Cameron, 1907

Distribution : Deesa.

156. *Listrognathus laevifrons*, (Cameron, 1903)

**Sulvata laevifrons*, Dutt, 1923

Distribution : Pune.

157. *Listrognathus rufipes*, (Cameron, 1907)

**Listrognathus perfecta*, Gupta &
Kamath, 1967

Distribution : Matheran, Deolali, Deesa.

158. *Listrognathus spinifrons*, (Cameron, 1905)

**Sulvata rugifrons*, Dutt 1923

**Listrognathus spinifrons*, Gupta &
Kamath, 1967

Distribution : Satpura Hills, Chikalda,
Devlali, Matheran, Nagpur.

159. *Listrognathus annulipes*, (Cameron, 1904)

**Listrognathus annulipes*, Gupta & Kamath
1967

Distribution : Mahabaleshwar.

160. *Goryphus brahminus*, (Cameron, 1904)

**Goryphus brahminus*, Jonathan & Gupta,
1973

Distribution : Matheran.

161. *Goryphus cinctipes*, (Cameron, 1905)

**Goryphus cinctipes*, Jonathan & Gupta,
1973

Distribution : Nagpur.

162. *Goryphus difficilis*, Jonathan & Gupta, 1973

Distribution : Panhala Fort.

163. *Goryphus nilgiricus*, Jonathan and Gupta, 1973

Distribution : Mahabaleshwar.

164. *Goryphus nursei*, (Cameron, 1907)

**Melcha nursei*, Dutt 1923

**Melcha nursei*, Rao & Grover, 1960

**Goryphus nursei*, Jonathan & Gupta, 1973

Distribution : Pune, Deesa, Nagpur, Aurangabad, Mumbai.

165. *Goryphus tirkyi*, Jonathan & Gupta, 1973

Distribution : Mowar.

166. *Goryphus villosus*, Jonathan & Gupta, 1973

Distribution : Mumbai, Panhala fort.

167. *Skeatia infernalis*, (Cameron, 1897)

**Neomesostenus indicus*, Szépligeti, 1916

**Skeatia infernalis*, Jonathan & Gupta, 1973

Distribution : Mumbai, Nasik.

168. *Skeatia mysorensis*, Jonathan & Gupta, 1973

Distribution : Panhala Fort, Nagpur.

169. *Skeatia rubricata*, Jonathan & Gupta, 1973

Distribution : Mahabaleshwar.

170. *Skeatia simulator*, Jonathan & Gupta, 1973

Distribution : Mahabaleshwar.

171. *Gambroides javensis*, (Rohwer, 1918)

**Melcha ornatipennis*, Rao & Grover, 1960

Distribution : Nagpur, Aurangabad.

172. *Isotima panhalensis*, Jonathan 1980

Distribution : Panhala fort.

173. *Isotima pusilla*, (Szépligeti, 1916)

**Isotima pusilla*, Jonathan, 1980

Distribution : Mumbai, Matheran.

174. *Isotima quadrata*, Szépligeti, 1908

Distribution : Matheran.

175. *Isotima rufipleuralis*, Jonathan, 1980

Distribution : Panhala fort.

Tribe Ceratocryptini

176. *Cremnocyrtus montanus*, Kamath, 1969

Distribution : Satpura hills, Chikalda.

177. *Acromia punctata*, Kamath, 1972

Distribution : Mahabaleshwar, Matheran, Satpura hills, Chikalda, Deolali.

178. *Fitatsia depressa*, Kamath, 1972

Distribution : Matheran, Pratapgarh, Panhala fort, Deolali.

179. *Silsila fulvipes*, Cameron, 1903

**Silsila fulvipes*, Kamath, 1972

Distribution : Panhala fort.

180. *Silsila similis*, Kamath, 1972

Distribution : Deolali.

Subfamily ICHNEUMONINAE

Tribe Gyrodontini

181. *Barichneumon rufipes*, Cameron, 1907

Distribution : Deesa.

**Denotes synonymy*

SUMMARY

The present account enumerates 181 species of ichneumonids belonging to 55 genera under 13 subfamilies so far reported from the state of Maharashtra.

ACKNOWLEDGEMENTS

The authors are thankful to Dr. K. Venkatraman, Director, Zoological Survey of India, Kolkata and Dr. R.M. Sharma, Scientist-D & Officer-in-Charge, Zoological Survey of India, Pune for providing this opportunity to contribute the present work.

REFERENCES

- Bandelu, R.S. 1976. Studies on Parasitic Hymenoptera of Marathwada with special reference to Family Ichneumonidae. Ph. D. Thesis, Marathwada University, pp 76-115.
- Cameron, P. 1897. Hymenoptera Orientalis : Part-V. Ichneumonidae, Cryptinae, Tryphoninae., *Mem. Proc. Manchr. Lit., Phil. Soc.*, 41(4) : 1-144.

- Cameron, P. 1907. On the Parasitic Hymenoptera collected by Major C.G. Nurse in the Bombay Presidency (Ichneumonidae, Cryptinae, Pimplinae, Tryphoninae, et Ophioninae) *J. Bombay Nat. Hist. Soc.*, **17** : 591-592.
- Cushman, R.A. 1935. New Ichneumonidae from India and China. *Indian Forest Rec.*, **20**(12) : 1-8.
- Gupta, V.K. and Tikar, D.T. 1976. Ichneumonologia Orientalis or a Monographic study of the Ichneumonidae of Oriental Region, Part-I. The tribe Pimplini (Hymenoptera : Ichneumonidae : Pimplinae) *Oriental Ins. Monogr.*, **1** : 312.
- Gupta, M.L. and Gupta V.K. 1977. Ichneumonologia Orientalis, Part-V. The Genus *Dusona* of the Indian subregion (Hymenoptera : Ichneumonidae : Porizontinae). *Oriental Ins. Monogr.*, **5** : 1-226.
- Heble, K.S. 1981. Studies on Parasitic Hymenoptera of Marathwada with special reference to Family Ichneumonidae. Ph. D. Thesis, Marathwada University, pp 1-218.
- Jonathan, J.K. and Gupta, V.K. 1973. Ichneumonologia Orientalis of the Ichneumonidae of the Oriental Region, Part-III. The *Goryphus*-Complex (Hymenoptera : Ichneumonidae). *Oriental Ins. Monogr.*, **3** : 1-203.
- Kamath, M.K. and Gupta, V.K. 1972. Ichneumonologia Orientalis or a Monographic study of Oriental Ichneumonidae Part-II. The tribe Rhyssini (Hymenoptera : Ichneumonidae). *Oriental Ins. Monogr.*, **2** : 1-300.
- Kanhekar, L.J. 1985. Studies on Parasitic Hymenoptera of Maharashtra with special reference to Family Ichneumonidae. Ph. D. Thesis, Marathwada University, pp 1-226.
- Morley, C. 1912. A Revision of the Ichneumonidae based on the collection in the British Museum (Natural History) Part-I : 1-88.
- Morley, C. 1913 A Revision of the Ichneumonidae based on the collection in the British Museum (Natural History) with description of new genera and species, **2** : 1-140, British Museum London.
- Nikam, P.K. 1970. Studies on Parasitic Hymenoptera of Marathwada with special reference to family Ichneumonidae. Ph. D. Thesis, Marathwada University, Aurangabad, India, pp 1-227.
- Nikam, P.K. 1980. Studies on Indian species of *Enicospilus* Stephens (Hymenoptera : Ichneumonidae). *Oriental Ins.*, **14**(2) : 131-219.
- Nikam, S.M., 1989. Discovery of *Diaglyptela* (Hymenopter : Ichneumonidae) in India. *Oriental Insects*, **23** : 329-331.
- Nikam, S.M and Nikam P.K. 1990. On a new species of *Cymodusa* Holmgren (Hymenoptera : Ichneumonidae) from India. *Indian J. Zool. and Aqua. Biol.*, **2**(1) : 42-45.
- Nikam, S.M. and Desai A.E. 2008. Two new species of *Budias* Cameron (Ichneumonidae : Mesosteninae) from India, *Indian Journal Entomology*, **70**(2) : 172-175
- S.M. Nikam and Desai, A.E 2009. Discovery of polysphinctini genus *Eruga* Town Es (Hymenoptera : Ichneumonidae) from the Orient. *Geobios*, **36**(1) : 141-144.
- Rao, S.N. (1953). On a collection of Indian Ichneumonidae (Hymenoptera) in the forest Research Institute Dehradun. *Indian Forest Rev.*, **8**(8) : 159-225.
- Townes, H.M., Townes and V.K. Gupta 1961. A Catalogue and Reclassification of the Indo-Australian Ichneumonidae. *Mem. Amer. Ent. Inst.*, **1** : 1-522.

CHILOPODA : SCOLOPENDROMORPHA : SCOLOPENDRIDAE

B.E. YADAV

Zoological Survey of India, Western Regional Centre, Akurdi, Pune-411044, Maharashtra

INTRODUCTION

Centipedes are nocturnal, poisonous invertebrates, occurring through out the world in warm and tropical regions. There are 687 species at global level out of which 90 occur in India and 42 species are found in Maharashtra State. Centipedes are subterranean, soil inhabiting carnivorous arthropods. There is no antidote developed against their bites and help in improving soil fertility.

From the time of Carl Linnaeus (1757) several workers have studied these interesting small arthropods from North America, U.K., Itali, south Africa, Austria, Europe, Asia and Australia (Attems, 1930, Koch, 1984, Lewis 1981; 1986, Lawrence 1984, Shelley 2006 and Khanna, 2008b).

India is tropical country coming under mega diversity countries and its two hotspots Eastern Himalaya having temperate climate and the Western Ghats representing hot tropical climate are of immense importance from biodiversity point of view. (Jangi and Dass 1984, Khanna 1987, Yadav, 1993b, 1993c, 1993d, 1999, 1993a, 2004, 2005, 2006) Khanna, 1994, 1995a 1995b 1995c 1994; 1997; 2001, 2004, 2005; 2008). Further, few workers studied collection preservation and identification of scolopedrid centipedes (Khanna, 2004a, Yadav 1995); Yadav (1994), Sureshan *et al.* (2004) presented pictorial key for identification of centipedes of Kerala. Sureshan *et al.* (2006a, 2006b), Rathinasabapathy and Yadav (2000); Rao

et al. (2004, 2005); Yadav (2001) Ahmed (1980) studied centipedes of Kerala, Odisha, Coimbatore, Andhra Pradesh Niligiri Biosphere Reserve, Karnataka, Andaman Nicobar islands. Further, Sureshan and Yadav, (2008) explored centipede fauna of Goa.

Maharashtra state is gifted by a part of Western Ghats, Deccan plateau, and Peninsular India. The state contains 35 districts of which 12 come under Western Ghats (Sahyandri hill ranges) few from Vidarbha region, Central, East and south Maharashtra. Its rain fall is irregular and scanty. The centipede fauna of Maharashtra in black and red laterite soil is fairly known comprising about 51% species of the country (Jangi and Dass, 1984, Yadav, 1993a, b, c; Khanna and Yadav 1997, Yadav 1997, Khanna and Yadav 2005, Yadav 2004, 2005, 2006; Yadav and Sureshan 2006).

The present work submits the results of centipede collection collected from the inception of W.R.S., Pune (1960 on wards). A voluminous material is preserved in the Invertebrate Laboratory; it reports 42 species comprising 7 genera, Two Subfamilies and a single large family Scolopendridae. Out of which actually collected species are 40.

It is interesting to note that the giant centipede *S. gigantea* Linn. collected from Aligab, Raigad Dist., Maharashtra, (Yadav 1997, Khanna and Yadav, 2005) is the only specimen from India. Further, *S. jangii* Khanna and Yadav 1997, from Sinhgad fort, Pune is a new species from the state.

SYSTEMATIC LIST

[Asterisks indicate species actually collected]

Phylum ARTHROPODA

Superclass MYRIAPODA

Class CHILOPODA

Subclass EPIMORPHA

Order SCOLOPENDROMORPHA

Family SCOLOPENDRIDAE

Subfamily SCOLOPENDRINAE

Tribe Scolopendrini

- *1. *Scolopendra morsitans* Linnaeus
- *2. *Scolopendra hardwickei* Newport
- *3. *Scolopendra andhrensensis* Jangi and Dass
- *4. *Scolopendra gigantiea* Linnaeus
- *5. *Scolopendra jangii* Khanna and Yadav
- *6. *Scolopendra ellorensis* Jangi and Dass
- *7. *Scolopendra miraibilis* (Porath)
- *8. *Scolopendra indiae* (Chamberlin)
- *9. *Scolopendra punensis* Jangi and Dass
- *10. *Cormocephalus pilosus* Jangi
- *11. *Cormocephalus pygmaeus* Pocock
- *12. *Cormocephalus dentipes* Pocock
- *13. *Cormocephalus denticaudus* Jangi and Dass
- *14. *Cormocephalus nigriticatus* Verhoeff.
- *15. *Cormocephalus westwoodi westwoodi* (Newport)
- *16. *Cormocephalus macrosestrus* Attems
- *17. *Cormocephalus nudipes* Jangi and Dass.

Tribe Asanadini

- *18. *Asanada indica* Jangi and Dass
- *19. *Asanada sokotrana* Pocock
- *20. *Asanada brevicornis* Meinert
- *21. *Asanada sukhensis* Jangi and Dass
- *22. *Asanada agharkari* (Gravely)

Subfamily OTOSTIGMINAE

Tribe Otostigmini

- *23. *Otostigmus orientalis* Porath
- *24. *Otostigmus nudus* Pocock
- *25. *Otostigmus p. politus* Karsch

- *26. *Digitipes barnabasi* Jangi and Dass
- *27. *Digitipes chhotanii* Jangi and Dass
- *28. *Digitipes indicus* Jangi and Dass
- *29. *Digitipes coonoorensis* Jangi and Dass
- *30. *Ehtomostigmus rubripes platycephalus* (Newport)
- 31. *Ehtomostigmus rubripes spinosus* (Newport)
- *32. *Ehtomostigmus coonooranus* Chamberlin
- *33. *Rhysida nuda* (Newport)
- *34. *Rhysida immarginata immarginata* (Porath)
- *35. *Rhysida immarginata subnuda* (Jangi)
- *36. *Rhysida longipes* (Newport)
- *37. *Rhysida longipes longipes* (Newport)
- *38. *Rhysida longipes simplicor* (Chamberlin)
- *39. *Rhysida l. lithobioides* (Newport)
- *40. *Rhysida lithobioides trispinosus* Jangi and Dass
- *41. *Rhysida lithobioides pauciden* (Pocock)
- 42. *Rhysida crassispina* Kraepelin

SYSTEMATIC ACCOUNT

Family SCOLOPENDRIDAE

21 or 23 pairs of legs; simple eyes, present as a group of 4 ocelli on each side of cephalic plate; tarsi two jointed; sternites with a pair of longitudinal sutures; exceptionally with unpaired median suture.

42 species of centipedes occur in the Maharashtra State.

Key to subfamilies

- 1a. Spiracles triangular, with spiracular cavity divided into an inner and outer chambers by tripartite valve SCOLOPENDRINAE
- 1b. Spiracles oval or round, with spiracular cavity undivided and fully exposed OTOSTIGMINAE

Subfamily SCOLOPENDRINAE

Key to tribes

- 1a. Terminal leg segment with coxopleural pores Scolopendrini

- 1b. Terminal leg segment without coxopleural pores **Asanadini**

Tribe Scolopendrini

Key to genera

- 1a. All legs without tarsal spur
..... **Cormocephalus** Newport, 1844
- 1b. Legs mostly with tarsal spure 2
- 2a. 1st tergite anteriorly overlaid by cephalic plate
..... **Scolopendra** Linnaeus, 1758

17 species occure under the tribe Scolopendrini in the Maharashtra State.

The genus *Scolopendra* Linnaeus, 1758

Members of the genus *Scolopendra* occur in tropical and warm lands throughout the world. It is widely distributed in Maharashtra by representing 9 species.

Key to the species of the genus *Scolopendra* Linnaeus 1758

- 1a. Cephalic plate with pit like puncta. Coxosternal plate of maxillipedes without furrow 3
- 1b. Cephalic plate without pit like puncta. Coxosternal plate of maxillipedes with furrows 2
- 2a. 20th pair of walking legs without tarsal spur, anal leg prefemur with (1-6) spines
..... *S. andhrensensis* Jangi and Dass
- 2b. 20th pair of walking legs with or without tarsal spur, anal leg prefemur without spines 4
- 3a. Tergites 17th to 21st laterally emarginate
..... *S. mirabilis* (Porath)
- 3b. Only the tergite 21st laterally emarginate
..... *S. indiae* (Chamberlin)
- 4a. Body strong, lengthy and stout with alternate brilliant black and yellow bards
..... *S. hardwickei* Newport
- 4b. Body strong, stout, very lengthy with deep grey to black colour without bands
..... *S. gigantean* Linn

- 5a. Body robust and leangthy 20th pair of walking legs with or without tarsal spurs. Anal leg prefemur with 9 spines of 3 rows each
..... *S. morsitans* Linn

- 5b. Body leangthy, not robust 20th pair of walking legs without tarsal spur. Anal leg prefemur with irregular spines 6

- 6a. 20th pair of legs with tarsal spur prefemur of anal legs with 26 spines 7

- 6b. 20th pair of walking legs without tarsal spur, anal leg prefemur with (6-13) spines cephalic plate with sutures
..... *S. jangii* Khanna and Yadav

- 7a. Cephalic plate rugose anal leg prefemur with (1-6) spines *S. punensis* Jangi and Dass

- 7b. Cephalic plate smooth or rugose, anal leg prefemur with 26 irregular spine
..... *S. elloreensis* Jangi and Dass

*1. *Scolopendra morsitans* Linnaeus

1758. *Scolopendra morsitans* Linnaeus, Syst. Nat., 10 : 638
(Type locality : India)
1984. *Scolopendra morsitans*, Jangi and Dass, J.Scient. Indls. Res., 43 : 27-54.
2001. *Scolopendra morsitans*, Khanna, Ann. For., 9(2) : 199-219.
2008. *Scolopendra morsitans*, Khanna, Biosystematica, 1(2) : 33-45.

Diagnostic characters : Large, robust specimens, 20th pair of legs with or without tarsal, spur anal leg of prefemur ventrally with 9 spines, generally with 3 longitudinal rows.

Material examined : 1ex., Vasisti river, chiplun, Ratnagiri Dist; M.B. Rao, 14-2-1973; 1ex., Rohad river, Nasik Dist., M.B. Rao, 29-9-1973; 25exs., Masli River, Isad vill; Gangakhed, Parabhani Dist., M.B. Rao, 12-7-1972; 2exs., Godavari river, Dussalgaon, Nasik Dist; M.B. Rao, 10-7-1972; 3exs., Rathir talav, 30km. NE, Deolali, Nasik Dist., M.B. Rao, 24-9-1973; 5exs., Shiv temple, Gevrai, M.B. Rao, 30-6-1972; 3exs., Phulambri river, G.R.B.S., M.B. Rao, 19-7-1972; 3exs., Bokhdhal, Nifad, Nasik Dist., M.B. Rao, 3-10-1973; 1ex., Sindfana W. Bank, Manjlegaon, Beed Dist; M.B.

- Rao, 5-7-1972; 6 exs., Vitalsi nalla, Gangakhed, Parbhani Dist., M.B. Rao, 11-7-1972; 2exs., Barsoi nalla, Ratnagiri Dist., M.B. Rao, 22-2-1973; 7exs., Kharpara river, Beed, M.B. Rao, 3-7-1972; 4exs., Nalla at Aurangabad, M.B. Rao, 20-7-1972; 2exs., Vethalwadi, Jalna, Aurangabad Dist., R.N. Chopra, 20-9-1964; 4exs., Godavari river, Nasik Dist., M.B. Rao, 4-10-1973; 4exs., Dheku river, Vaizapur-Aurangabad rd., M.B. Rao, 10-10-1973; 11exs., Ganesh temple Gevrai, M.B. Rao, 2-7-1972; 2exs., Chaurgon talav, 20km. NE of Nasik, M.B. Rao, 23-9-1973, 4exs., Fardapur, Aurangabad rd., M.B. Rao, R.N. Chopra, 12-9-1964; 1exs., Panjan vill., Nasik, M.B. Rao, 23-1-1968; 2exs., Varavandi, Nasik Dist., M.B. Rao, 25-9-1973; 2exs., Vaghur river Jalgaon rd., M.B. Rao, 15-7-1972 3exs., Nalla at Palan vill., Gangakhed, Parbhani, M.B. Rao, 22-7-1972; 2exs., Yenna lake, Mahabaleshwar, Satara Dist., B.S. Lamba, 15-2-1965; 2exs., Ambenally Ghat, Pratapgad, Satara Dist., B.K. Tikader, 29-5-1976; 11exs., Meshi, 10km. E. of Deolali, Nasik, M.B. Rao, 26-9-1973; 6 exs., Sindfana river, Manjalegaon, Beed, M.B. Rao, 8-7-1972; 1ex., Bombay point, Mahabaleshwar, Satara Dist., M.B. Rao, 10-2-1973; 1ex., Lasalgaon, Nasik, R.N. Chopra, 22-1-1968; 1ex., Yeola, Nasik Dist., M.B. Rao, 12-10-1973; 1ex., Pazar talav, Meshi, Nasik, M.B. Rao, 27-9-1973; 1ex., Shahagadh, G.R.B.S., M.B. Rao, 1-7-1972; 1ex., Rathir talav, Deola, Nasik, M.B. Rao, 5exs., Pazar talav, Meshi, Nasik, M.B. Rao, 27-9-1973; 4exs., Varavandi, 15 km. W. of Deola, Nasik, M.B. Rao, 1ex., Vinitha river, Nasik, M.B. Rao, 28-9-1973; 4exs., Faradpur, Nasik, R.N. Chopra, 12-9-1964; 1ex., Bhwadghat, Deola, Nasik, M.B. Rao, 28-9-1973; 1ex., Godavari river, Dussalgaon, Nasik, M.B. Rao, 10-7-1972; 11exs., Nallat at Faradpur, Nasik, M.B. Rao, 16-7-1972; 4exs., Vaghur river, Jalgaon rd., M.B. Rao, 15-7-1972; 1 ex., Godavari river Puntamba, M.B. Rao, 10-10-1973; 1ex., Panjan, Lasalgaon, Nasik, R.N. Chopra, 23-1-1968; 12 exs., Vitalsi river, Gangakhed, Parbhani, M.B. Rao, 11-7-1972; 1ex., Kholi project, Vaizapur, M.B. Rao, 22-6-1972; 4exs., Jaikwadi, Paithan, Aurangabad, M.B. Rao, 27-6-1972; 3 exs., Sindfana river, Manjalegaon, Beed, M.B. Rao, 12 exs., Bokhadhar, Nifad, Nasik, M.B. Rao, 3-10-1973; 5exs., Rahod river, Nasik, M.B. Rao, 29-9-1973; 18exs., Dharangaon, Nifad, Nasik, M.B. Rao, 2-10-1973; 25exs., Malehan, Mangrul, Nasik, M.B. Rao, 30-9-1973; 13exs., Meshi, Deola, Nasik, M.B. Rao, 26-9-1973; 5exs., Dheku river, Vaizapur, M.B. Rao, 23-6-1972; 1ex., Kalwan, Nasik, R.N. Chopra, 25-1-1968; 7exs., Sindfana river, Manjalegaon Beed, M.B. Rao, 5-7-1972; 6-7-1972; 1ex., Godavari river, Pravra sangam, Nagar, M.B. Rao, 21-6-1972; 6exs., Masli river, Isad vill., Gangakhed, M.B. Rao, 12-7-1972; 3exs., Karpura river, Beed M.B. Rao, 3-7-1972; 1ex., Chngam talav, Deola, Nasik, M.B. Rao, 23-9-1973; 4exs., Nalla at Palan vill Gangakhed, M.B. Rao, 13-7-1973; 2exs., 65km. W of Khalapur on Pen-Alibag rd., Sindhudurg, D.B. Bastawade, 14-12-1987; 1ex., Padmalaya foresh tank, Erandol, R.H. Kamble, 6-12-1983; 3exs., Kondigre vill., Ichalkaranji-Miraj rd., S.G. Patil, 13-8-1989; 6exs., Ankali Vill. Nr. Pandharpur, A.S. Mahabal, 16-11-1978; 2exs., Vill. Kuwa on Panji rd., Rajapur, R.H. Kamble, 22-6-1987; 3exs., Gadegaon Pandharpur, A.S. Mahabal, 14-11-1978; 1ex., 15km. S. of Dhadgaon, on Dhadgaon-talodard., Acrani, R.M. Sharma, 25-1-1986; 1ex., Dhuldeo vill., 6km. E. of Mhaswad, Satara Dist., R.M. Sharma, 17-3-1990; 1ex., Vanyavihar vill 6km. NE. of Akkalkuva, Tal. Taloda, A.S. Mahabal, 3-8-1986; 3exs., Dongargaon on Shahada Aslod rd., dhulia, A.S. Mahabal, 27-7-1986; 3exs., 4km. SW of Akluj, Malshiras rd., Sholapur, A.S. Mahabal, 26-8-1983; 3exs., 6km. E. of Mohol on Pune-Sholpur rd., A.S. Mahabal, 28-8-1983; 14exs., Awalikhind, Malkapur, Kolhapur, M.S. Pradhan, 19-6-1978; 6exs., Dandoba hills, 30km. NE of Miraj, A.S. Mahabal, 28-9-1984; 1ex., 6km. E. of Mohol on Sholapur rd., A.S. Mahabal, 28-8-1983; 1ex., Athamble vill, vani, M.S. Pradhan, 20-11-1987; 3exs., Anusewadi, 10km. on Atpadi-Nimbwad rd., A.S. Mahabal, 14-9-1984; 1ex., 65km. SW Khalapur, Rohard., Raigad, D.B. Bastawade, 11-12-1987; 3exs., Ghat rd., to Pawna dam, after kamshet, D.B. Bastawade, 4-8-1983; 1 Dajipur, Radhanagari Kolhapur, 12-9-1987; 20 10km. S. from Karanjal on Harsul-Karjat rd., D.B. Bastawade, 13-2-1984; 5exs., Lonawala-Khandala, Pune, K. Mathew, 14-9-1979; 3exs.,

Vadila, Shirpur- Shanada rd., Dhulia, A.S. Mahabal, 24-7-1986; 4exs., 30km. Sw of Kagal, Tal. Karvir, Gargoti rd., Kolhapur, D.B. Bastawade, 24-9-1986; 1 Dhara-Siva caves, Oosmanabad, D.B. Bastawade, 1-8-1988; 3exs., Vetat hill, D.B. Bastawade, 22-9-1983; 4exs., 5km. S. of Velhegaon, Pilkhod rd., Nandgaon, Nasik, M.S. Pradhan, 22-11-1987; 7exs., Akurdi, 18km. NW. of Pune, B.E. yadav, 21-6-1993; 1ex., Hirvapada, 42km. W. of Vani, Nasik, D.B. Bastawade, 21-2-1985; 2exs., 50 km. E. of Mangaon rd., Raigad, D.B. Bastawade, 6-12-1987; 2 36 N. of Kagal, Topgaon, Bangalore rd. Kolhapur, 25-9-1986; 4exs., Atigre vill on Kolhapur-Hatkangale rd., S.G. Patil, 14-8-1989; 2 1 30km. NW of Shirol, Kumbhoj vill, Hatkanangle Kolhapur, D.B. Bastawade, 1-10-1986; 1 Dholap fort, 31 km. NW. of Vani, Nasik, D.B. Bastawade, 23-2-1985; 2exs., Kalvan, 38km. NW of Nasik, D.B. Bastawade, 1 Igatpuri 49 km. SW. of Darna dam, Nasik, D.B. Bastawade, 13-2-1985; 1 10 Sinhgad 20km. SW of Pune, K. Mathew, 6-12-1979; 1 Sinhgad fort, D.B. Bastawade, 7-1-1981; 1 Phonda ghat and around, Sindhu; durg, D.B. Bastawade, 10-9-1987; 2 Kothar vill, Taloda-Dhadgaon rd., Akkalkuwa Dhulia, A.S. Mahabal, 31-7-1986; 2exs., 6km. from Atpadi, Kouthuli vill., Sangli, A.S. Mahabal, 15-9-1984; 2exs., 40 km., NW. of Khalapur, on Panvel-Pen rd., Raigad, A.S. Mahabal, 1ex., Navalpur, NE. of Akkalakuwa, Taloda, Dhulia, A.S. Mahabal, 2-8-1986; 7exs., Kharati nalla, Pune-Nagar rd., G.M. Yazdani, 2-7-1977; 1ex., 14 km. SW. of Phonada, Sindhudurg, D.B. Bastawade, 9-9-1987; 1ex., 6km. from Atpadi, Mulankai-Madgule rd., Sangli, A.S. Mahabal, 29-9-1984; 3exs., Koregaon, Bhima, Pune, D.B. Bastawade, 11-2-1982; 1ex., Dighi, Pune, A.S. Mahabal, 10-5-1977; 2exs., Vesya vill. 15km. from Gagan bavda, Kolhapur, S.G. Patil, 10-8-1989; 1ex., Pond nr. Wagholi, B.E. Yadav, 5-12-1990; 1ex., Talai garden, Sinhgad, Pune, M.S. Pradhan, 4-2-1985; 2exs., Athamble vill, Vani Nasik. M.S. Pradhan, 20-11-1987; 8exs., Kondapuri vill., Nagar rd., Pune, D.B. Bastawade, 19-8-1983; 1 Ghat nr., Kamshet, Pune, D.B. Bastawade, 19-8-1980; 4exs., Pathardi lake, Barshi, Sholapur, A.S.

Mahabal, 27-11-1978; 4exs., Arag vill., 18 km. from Miraj, A.S. Mahabal, 30-9-1984; 2exs., Ramdhara, Loni, K. Mathew, 19-7-1979; 13 exs. Jeur, 29 km. N. of Tembhurni, Karmala, Sholapur, A.S. Mahabal, 25-8-1983; 1ex., Dighi vill, Pune, A.S. Mahabal, 10-5-1977; 2exs., Sakri, 23 km. E of Pimpalner, R.H. Kamble, 21-12-1985; 4exs., Malangaon, Tal. Sakri, 30km. NW. of Pimpalner, R.H. Kamble, 23-12-1985; 1 Tulsi lake, S.G.N.P. Borivili, D.B. Bastawade, 17-2-1987; 1ex., Yelavi vill., 21 km. from Jat on Jat-Sangola rd., A.S. Mahabal, 20-9-1984; 1ex., 22km. NW. of Miraj, Miraj-Ashta rd., Sangli, A.S. Mahabal, 25-9-1984; 1ex., from Atpadi, 6km. Mulanki on Atpadi-Mudgule rd., Sangli, A.S. Mahabal, 17-9-1984; 21exs., Nesardi dam, Amalner, R.H. Kamble, 28-11-1983; 1ex., Piparkhed, Maruti, Parola, R.H. Kamble, 2-12-1983; 2exs., Karoli vill., 22km., of Miraj, A.S. Mahabal, 26-9-1984; 1ex., Gome wadi, 30km., SW on Atpadi-Khanapur rd., A.S. Mahabal, 16-9-1984; 1ex., 7km. from Dehu road, Pune Ramakrishna, 3-8-1979; 1ex., Varul vill., on Shahada-Dondiacha rd., Dhulia Dist., A.S. Mahabal, 19-7-1986; 1ex., Pune and around, D.B. Bastawade, 16-6-1985; 2exs., Tamdalge vill., Kadamkai Khind, Kolhapur, S.G. Patil, 15-8-1989; 3exs., Tembhe vill., Ratnagiri, R.H. Kamble, 26-6-1987; 9exs., Nagamm tank, Visapur, Sholapur, A.S. Mahabal, 24-11-1978. From throughout Maharashtra, Yeotmal, Nagpur, Sangli Dist.

Source : Yadav (1993a, 1993b, 1993c, 2004, 2005), Khanna and Yadav (1997), Yadav and Sureshan (2006).

Distribution : Cosmopolitan.

Remarks : Out of two sympatric species *S. amazonica* Bucherl and *S. morsitans* Linn, the latter is only valid species. These are large robust specimens. Fresh collection are of dark blue or greenish tinge.

*2. *Scolopendra hardwickei* Newport

1844. *Scolopendra hardwickei* Newport, *Ann. Nat. Hist.*, 13 : 96 (Type locality : Not known).

1984. *Scolopendra hardwickei*, Jangi and Dass, *J. Scient. Indl. Res.*, 43 : 27-54.

2001. *Scolopendra hardwickei*, Khanna, *Ann. For.*, 9(2) : 199-219.

Diagnostic characters : Body banded with alternate yellow black dark green bands, anal legs ventrally without spines.

Material examined : 1ex., Tupari-takari, Sangli, A.S. Mahabal, 20-9-1979; 1ex., Bhimashankar, M.S. Pradhan, 3-6-1989; 1ex., 30km. SW of Shirol nr. Vill. Lat., Kolhapur, D.B. Bastawade, 3-10-1986; 1ex., Khalati vill. 8km. from Jat, on Kavathe-Mah. Rd., Sangli, A.S. Mahabal, 23-9-1984; 1ex., Giriling onld Panhala, 26km. from Miraj, 29-9-1984; 1ex., Vetat hill, 8km. from Pune, D.B. Bastawade, 22-9-1983; 1ex., Arlewadi, 60km. from Jat on Jat-Khanapur rd., Kavathe Mahankal, A.S. Mahabal, 1ex., Wasumb tank, Vita, Sangli, A.S. Mahabal; 2exs., Bhilawadi, Tasgaon, Sangli, A.S. Mahabal, 11-9-1979.

Source : Yadav (1993b), Yadav (2004,2005), Rane and Yadav (In press), Yadav (In press).

Distribution : India : Andaman and Nicobar Islands, Andhra Pradesh, Karnataka, Maharashtra, Tamil Nadu, West Bengal.

Elsewhere : SriLanka, Sumatra (Indo-Malayan).

Remarks : This is rarely occurring species, having brilliant Yellow and dark alternate bands.

*3. *Scolopendra andhrensensis* Jangi and Dass

1984. *Scolopendra andhrensensis*, Jangi and Dass, *J. Scient. Indl. Res.*, 43 : 27-54 (Type locality : Dolphins nose, Vishakha pattanam)

1993. *Scolopendra andhrensensis*, Yadav, *Rec.Zool. Surv. India*, 93(3-4) : 321-328.

2001. *Scolopendra andhrensensis*, Khanna, *Ann. For.*, 9(2) : 19-219.

Diagnostic characters : Anal legs prefemur bearing few spines (1-6). 20th walking legs without tarsal spur. Cephalic plate bearing coarse pit like puncta.

Material examined : 1ex., Tamdalge vill., Kadamkai Khind, Kolhapur, S.G. Patil, 15-8-1989; 1 Vetat hill, Pune D.B. Bastawade, 22-9-1983; 1ex., tank on Don vill. Chalisgaon, 11-12-1983.

Source : Yadav (1993d)

Distribution : India : Andhra Pradesh and Maharashtra.

Remark : This is uncommon species.

*4. *Scolopendra gigantea* Linnaeus

1758. *Scolopendra gigantea* Linnaeus *Syst. Nat.* 10th ED., 638 (Type locality : Meotype : U.S. Virgin Island; st Thomas.)

1997. *Scolopendra gigantea* Yadav. *Zoos' Print J.*, 12(5) : 8.

2005. *Scolopendra gigantea* Khanna and Yadav, *Zoos' Print J.*, 20(9) : 1988.

Material examined : 1ex., Alibag, Raigad, G.M. Yazdani, Dec. 1973.

Source : Yadav (1997), Khanna and Yadav (2005).

Distribution : India : Maharashtra, Alibag, Raigad Dist.

Elsewhere : N. Columbia, Trinidad, Coastal inslands of Venezuela, Isls. Margarita, Curacao Aruba.

Remarks : This is the only specimen present in W.R.C. Museum, India. The specimen is of deep black coloured, stout having the length 20cm. Anal leg prefemur is without spines.

*5. *Scolopendra Jangii* Khanna and Yadav

1997. *Scolopendra Jangii* Khanna and Yadav, *Rec. zool. Surv. India*, 96(1-4) : 211-220. (Type locality : Maharashtra, Pune, Sinhgad fort)

2001. *Scolopendra Jangii* Khanna, *Ann. For.*, 9(2) : 119-219.

Diagnostic characters : 20th pair of walking legs without tarsi spur, cephalic plate with posterior median sutures. Anal leg prefemur ventrally with irregular spines.

Material examined : 1ex. sinhgad, 20km. SW of Pune, K.Mathew, 16-11-1979.

Source : Khanna and Yadav (1997).

Distribution : India : Maharashtra, Sinhgad fort, Pune.

Remarks : Anal leg prefemur, femur, tibia are dorsally flat in the male specimen. This should be considered as a threatened species.

***6. *Scolopendra elloreensis* Jangi and Dass**

1984. *Scolopendra elloreensis* Jangi and Dass, *J. Scient. Indl. Res.*, **43** : 27-64 (Type locality : Maharashtra, Aurangabad, ellora.)
2001. *Scolopendra elloreensis*, Khanna, *Ann. For.*, **9**(2) : 199-219.

Diagnostic characters : The 21st tergite with median sulcus. Process of coxopleura with 5-7 spines, anal leg prefemur with as many as 26 spines present ventrally.

Material examined : 1ex, 65km sw of Khalapur, Roha rd., Raigad, D.B. Bastawade, 11-12-1987; 2ex, Hirvapada, 42 km W. of Vani, Nasik, D.B. Bastawade, 21-2-1985

Source : Jangi and Dass (1984).

Distribution : India: Maharashtra: Aurangabad, Ellora caves.

Remarks : It is uncommon species.

***7. *Scolopendra mirabilis* (Porath)**

1876. *Cormocephalus mirabilis* Porath, *Bih., Sevenska, AK.*, (Type locality : Not known)
1980. *Trachycormocephalus mirabilis*, Attems, *Das. Tierr. Scolopendromorpha*, **54**(2) : 53-54.
1986. *Scolopendra mirabilis*, Lewis, *J. Nat. Hist.*, **20** : 1083-1089.
2001. *Scolopendra mirabilis*, Khanna, *Ann. For.*, **9**(2) : 199-219.

Diagnostic characters : 21st tergite with a median sulcus, cephalic plate without medial sulcus, 21st pair of legs without spur to the terminal claws.

Material examined : 1 ex, Machuandi, 22 km E. of Jat on Umadi rd., A.S. Mahabal, 19-9-1984.

Source : Yadav (1993d).

Distribution : India : Maharashtra, Rajasthan.

Elsewhere : German, East Africa, Tanzania, Through Somali Land to United Arab Republic, Palestine, Syria, Iraq, Perim Islands And Zanzibar, Iran, (Ethopian, Palaearctic).

Remarks : Lewis (1986) Synonomised the genus *Tyacymormocephus* under *Scolopendra*.

***8. *Scolopendra indiae* (Chamberlin)**

1914. *Trachycormocephalus inidiae* chamberlain, *Ent. News*, Philadelphia, **25** : 390 (Type locality : India, Orissa, Jaypore)
1986. *Scolopendra indiae*, Lewis, *J. Nat. Hiss.*, **20** : 1083-1089.
2001. *Scolopendra indiae*, Khanna, *Ann. For.*, **9**(2) : 199-219.

Diagnostic characters : 21st tergite with a median sulcus and laterally emarginate.

Material examined : 1ex, 50 km E. of Mangaon, D.B. Bastawade, 6-12-1987, 1ex, Chincholi Vill; A. Nagar, R.H. Kamble, 8-9-1988.

Source : Yadav (1993d).

Distribution : India, Maharashtra, Orissa and Rajasthan.

Ramarks : This is uncommon species.

***9. *Scolopendra punensis* Jangi and Dass**

1984. *Scolopendra puniensis* Jangi and Dass, *J. Scient. Indl. Res.*, **43** : 27-54. (India, Maharashtra, Pune)
2001. *Scolopendra punensis*, Khanna, *Ann. For.*, **9**(2) : 199-219.

Diagnostic characters : Anal leg prefemur bearing few spines (1-6), 20th walking leg with tarsal spur, cephalic plate rugose.

Material examined : 2exs., Navade vill., Raigad, M.S. Pradhan, 5-10-1981.

Source : Yadav (1993b), Jangi and Dass (1984).

Distribution: India : Maharashtra, Moshi, Pune Dist.

Remarks : This may be considered as threatened species.

Genus *Cormocephalus* Newport 1844

It is widely distributed genus and out of 8. 7 species occur in Maharashtra state. These are small slender specimens (about 4 cm. long) wanting tarsal spurs to the legs.

Key to species of the genus *Cormocephalus* Newport 1844

- 1a. 21st tergite with a longitudinal median sulcus2
- 1b. 21st tergite without a longitudinal median sulcus7
- 2a. Longitudinal median sulcus on 21st tergite complete. Claws of legs may or may not be spurred species restricted to India only3
- 2b. Species restricted to India and outside 6 and half to 13 basal antennal segment glabrous *C. westwoodi westwoodi* (Newport)
- 3a. Lesser number of antennal segment glabrous coxopleural process absent *C. macrosestrus* Attems
- 3b. Coxopleural process present4
- 4a. Anal leg claw spurred5
- 4b. Anal leg claw unspurred *C. pygmaeus* Pocock
- 5a. Anal legs pilose or tuberculate6
- 5b. Anal legs smooth *C. nudipes* Jangi and Dass
- 6a. Anal legs pilose *C. pilosus* Jangi
- 6b. Anal legs tuberculate *C. denticaudus* Jangi and Dass
- 7a. Lateral margination absent on tergites anterior to 21st. maxillipedes without prefemoral process *C. nigrificatus* Verhoeff
- 7b. Lateral margination present anteriorly to 21st. Maxillipedes without prefemoral process. Anal legs in adult males tuberculate *C. dentipes* Pocock

*10. *Cormocephalus pilosus* Jangi

- 1955. *Cormocephalus pilosus* Jangi, *Ann. Mag. Nat. Hist.*, 8 : 74 (Type locality : Nagpur, Maharashtra.)
- 2001. *Cormocephalus pilosus*, Khanna, *Ann. For.*, 9(2) : 199-219.

Diagnostic characters : Longitudinal median sulcus on 21st tergite complete, number of glabrous

basal antennal segment is less than 6.5 Coxopleural process present. Claw of pilose anal leg is spurred.

Material examined : 4ex., Barisoi Nalla, Ratnagiri, M.B. Rao, 22-2-1973; 1ex., Kagrura, Aurangabad, B.S. Lamba, 18-12-1968; 2ex., Deola, Nasik, M.B. Rao, 25-9-1973; 1ex., Pahur Vill, Vaghur river, G.R.B.S. M.B. Rao, 17-7-1972; 1ex., Lonawala, Pune, G.M. Yazdani, 28-6-1989; 1ex., Brahman Wada, Panjra Gond; Wardha, R.H. Kamble, 12-3-2006.

Source : Yadav (1993b), Yadav (2004, 2005).

Distribution : India : Andhra Pradesh, Goa, Karnataka, Madhya Pradesh, Maharashtra, Pondicherry, Tamil Nadu.

Remarks : It is a common species.

*11. *Cormocephalus Pygmaeus* Pocock

- 1892. *Cormocephalus pygmaeus* Pocock, *J. Bombay Nat. Hist. Soc.*, 7(2) : 140 (Type locality : Madras, Tamil Nadu)
- 1930. *Cormocephalus pygmaeus*, Attems, *Das. Tier. Scolopendromorpha*, 54(2) : 97.
- 1984. *Cormocephalus Pygmaeus*, Jangi and Dass. *J. Scient. Indl. Res.*, 43(2) : 27-54.
- 2001. *Cormocephalus pygmaeus*, Khanna, *Ann. For.*, 9(2) : 199-219.

Diagnostic characters : 21st tergite with longitudinal median sulcus. Basal antennal segments glabrous, which are less than 6.5, coxopleural process present. Anal leg claw unspurred.

Material examined : 1ex., Trimbak, Nasik, M.B. Rao, 15-10-1973; 1ex., Awalikhind, Malkapur, Kolhapur, M.S. Pradhan, 19-6-1978; 1ex., Hill nr. Kavate, Karad, Satara, P.P. Kulkarni, 25-6-1988; 1ex., Baneshwar, 40 km. S. of Pune, D.B. Bastwade, 8-1-1994; 1ex., Matheran, Raigad, M.S. Pradhan, 2-10-1981; 1 ex., Kuwa vill. On Panji rd., Rajpur, Ratnagiri, R.H. Kamble, 22-6-1987; 1ex., Ramdhra, Loni, K. Mathew, 19-7-1979; 2exs., Kube vill., on Indwadi rd., 25 km., W. of Rajapur, tal Lanje, Ratnagiri, R.M. Sharma, 20-8-1988, Throughout Maharashtra.

Distribution : India : Assam, Andaman and Nicobar Islands, Bihar, Maharashtra, Tamil Nadu, Uttar Pradesh, Uttaranchal and West Bengal.

Elsewhere : Myanmar, Nepal.

Remarks : It is an uncommon species.

***12. *Cormocephalus dentipes* Pocock**

1891. *Cormocephalus dentipes* pocock, *Ann. Nat. Hist. Ser.*, 6,7 : 66. (Type locality : Bengal)

1984. *Cormocephalus pseudonudipes*, Jangi and Dass *J. Scient. Indl. Res.*, 43(2) : 27-54.

1994. *Cormocephalus dentipes*, Khanna, *Fauna Conserv. Area Series*, : Rajaji Natl. Park, Zool. Surv. India, 237-249.

Diagnostic characters : 21st tergite without a longitudinal median sulcus. Lateral tergital margination present anterior to 21st tergite. Maxillipeds with preformal process. Anal legs smooth or tuberculate.

Material examined : 3exs., Bhimashankar, Pune, B.S. Lamba, 6-5-1965, 2-5-1965; 1ex, Matheran, Raigad, M.S. Pradhan, 2-10-1981; 10, 40 km NW of Khalapur nr. Matheran, Raigad, D.B. Bastawade, 3-12-1987; 1ex., Pandav leni, 40 km. N. of Darna dam, Nasik, D.B. Bastawade, 16-2-1985; 3 exs, Beyond Banas pati point, Bhimashankar, P.P. Kulkarni, 10-11-1993; 3exs, Bhatsanagar, Thane, S.G. Patil, 11-11-1994; 1ex., Karla caves, Khandala, B.E. Yadav, 18-10-1994; 1ex., Kuwa vill. On Panji rd., Rajapur, Ratnagiri, R.H. Kamble, 22-6-1987; 1ex., savargaon on Neral-Karjat, Raigad, A.S. Mahabal, 22-7-1987; 2exs, 40 km. NW. of Khalapur, Matheran, Raigad, D.B. Bastawade, 13-12-1987; 2exs, 6km SE of Mohol on Sholapur rd. A.S. Mahabal, 28-3-1983; 1 Bilakhed, Chalisgaon, R.H. Kamble, 12-12-1983, from Sindhudurg, Sangli, Yeotmal Dist.

Source : Yadav (1993b), Yadav (2004), Yadav and Sureshan (2006), Yadav (2006), Yadav (1909).

Distribution : India : Andaman and Nicobar Islands, Bihar, Delhi, Himachal Pradesh, Maharashtra, Meghalaya, Himachal Pradesh, Mizoram, Madhya Pradesh, Orissa, West Bengal, Uttar Pradesh and Uttaranchal.

Remarks : It is a species endemic to India.

***13. *Cormocephalus denticaudus* Jangi and Dass**

1984. *Cormocephalus denticaudus* Jangi And Dass, *J. Scient. Indl. Res.*, 43(2) : 27-54. (Type locality : Maharashtra, Panchgani, Satara Dist.)

2001 : *Cormocephalus denticaudus*, Khanna, *Ann. For.*, 9(2) : 199-219.

Diagnostic characters : 21st tergite with a longitudinal median sulcus, lesser antennal segments glabrous (0-6). Coxopleural process present. Anal leg claw spurred, anal leg tuberculate.

Material examined : 2exs, Akurdi, 18km NW. of Pune, B.E. Yadav, 11-7-1993; 4exs, Akurdi 18km NW. of Pune, B.E. Yadav, 24-6-1993; 1ex., Bhate, Ranagiri, R.H. Kamble, 26-6-1987; 1ex., Nanaj Sanct., Barshi, Sholapur, R.H. Kamble, 24-12-1996.

Distribution : India : Maharashtra.

Remarks : This is a common species.

***14. *Cormocephalus nigrificatus* Verhoeff**

1937. *Cormocephalus nigrificatus* Verboeff, *Zool. Anz. Lepizig*, 120 : 81 (Type locality : Trivendrum, Kerala)

2001. *Cormocephalus nigrificatus*, Khanna, *Ann. For.*, 9(2) : 199-219

Diagnostic characters : 21st tergite without a longitudinal median sulcus,. Lateral tergital margination absent on tergites absent on tergites anterior to 21st, maxillipedes without prefemoral process.

Material examined : 1ex., Koregaon, Bhima, Pune, D.B. Bastawade, 11-2-1982; 1ex., nr. Upvan, Yeour, S.G. Patil, 1-1-1996;

Source : Yadav (2005), (2006).

Distribution : India : Kerala, Maharashtra.

Remarks : It is a new record from Maharashtra.

***15. *Cormocephalus westwoodi westwoodi* (Newport)**

1844. *Cormocephalus westwoodi westwoodi* Newport, *Ann. Mag. Nat. Hist.*, 13 : 94-101 (Type locality : Not given)

2004. *Cormocephalus westwoodi westwoodi*, Schileyco and

stapel, *Annalen, Des Naturhistorischen, Mus. In Wien., Ser. B* 105, B : 67-137.

2008. *Cormocephalus westwoodi westwoodi*, Khanna, *Biosystematica*, 1(2) : 33-45.

Diagnostic characters : Longitudinal median sulcus on 21st tergite complete, 6.5 to 13 basal antennal segments glabrous.

Material examined : 1ex., Pond nr. Wagholi, Pune, B.E. Yadav, 5-12-1990; 2exs., 6km., SE of Mohal on Sholapur rd., A.S. Mahabal, 28-3-1983; 1ex., 5km., from Vehelgaon, Pilkho rd; Nandgaon, Nasik, M.S. Pradhan, 22-11-1987.

Source : Yadav (2004, 2005, 2006).

Distribution : India : Gujarat, Maharashtra.

Elsewhere: South Africa, Transvaal, Natal, Zimbabwe, Madagascar and Sri Lanka (Ethiopian).

Remarks : This is a common species.

*16. *Cormocephalus macrosestrus* Attems

1928. *Cormocephalus macrosestrus* Attems, *Zool. Anz. Leipzig*, 78 : 95.

1984. *Cormocephalus macrosestrus*, Jangi and Dass, *J. Scient. Indl. Res.*, 43(2) : 27-54.

2001. *Cormocephalus macrosestrus*, Khanna, *Ann. For.*, 9(2) : 199-219.

Diagnostic characters : Longitudinal median sulcus on 21st tergite complete, lesser (0-6) number of antennal segments glabrous. Coxopleural process absent.

Source : Jangi and Dass (1984), Khanna (2001).

Distribution : India : Maharashtra, Western Ghats, West Bengal.

*17. *Cormocephalus nudipes* Jangi and Dass

1984. *Cormocephalus nudipes*, Jangi and Dass, 43(2) : 27-54. (Type locality : Andhra Pradesh : Nalagonda, Tiger Valley)

2001. *Cormocephalus nudipes*, Khanna, *Ann. For.*, 9(2) : 199-219.

Diagnostic characters : Longitudinal median sulcus on 21st tergite complete. Lesser (0-6) number of antennal segments glabrous, coxopleural process present, anal leg claw spurred, anal leg smooth.

Material examined : 2 exs., Akurdi, 18 km. NW of Pune, B.E. Yadav, 21-6-1993; 1ex, 6km. from Atpadi on Mudgule rd., Sangli, A.S. Mahabal, 17-9-1984.

Source : Yadav (2005), Yadav (1993b).

Remarks : This is a common species.

Tribe Asanadini

This is an old world tribe. The members of this tribe possess short attenuate of antenna composed of 17 articles, including 6 basal glabrous. Tarsal spur absent on all legs. Two claw spurs present on legs 1-20, absent on 21, anal leg claw serrate; anal leg segments without spines and dorsally grooved coxopleura without pores. Processes and spines out of 8 species recorded from the country.

Genus *Asanada* Meinert, 1886

Characters of the genus *Asanada* are same as the tribe five species are found in Maharashtra.

Key to species of the genus *Asanada* Meinert, 1886

- 1a. Anal legs long and slender, paired l.m.s. may or may not be complete on 20th tergite, 21st tergite and sternite about 1 and half times as broad as long2
- 1b. Anal legs short and thick. Paired l.m.s. always complete on 20th tergite, 21st tergite more than twice as broad as long3
2. L.m.s. groove present posteriorly on anal leg prefemur, femur and tibia
..... *A. brevicornis* Meinert
- 3a. Anal leg claw dorsally with a dent
..... *A. agharkari* (Gravely)
- 3b. Anal leg claw dorsally without a dent4
- 4a. L.m.s. groove present on anal leg femur only5
- 4b. L.m.s. groove present on posterior half of anal leg prefemur and femur
..... *A. indica* Jangi and Dass

5a. L.m.s. groove present throughout on anal leg femur *A. sokotrana* Pocock

5b. L.m.s. groove confined to posterior half on anal leg femur
.....*A. sukhensis* Jangi and Dass

***18. *Asanada indica* Jangi and Dass**

1984. *Asanada indica* Jangi and Dass, *J. Scient. Indl. Res.*, 43(2) :27-54 (Type locality: Uruli kanchan, Pune, Maharashtra)

2001. *Asanada indica*, Khanna, *Ann. For.*, 9(2) : 199-219.

Diagnostic characters : anal legs short and thick. Paired longitudinal median sutures complete on 21st tergite, 21st tergite more than twice as broad as long and 21st sternite at least nearly twice as broad as long. Anal leg claw dorsally without a dent. Longitudinal median groove present on posterior half of anal leg prefemur and femur.

Material examined : 2exs., Mangani nalls, Jalan, Deed; M.B. Rao, 1-7-1972; 1ex., Dheku river, Vazapur, M.B. Rao, 23-6-1972; 1ex., Anusewadi, 10km. on Atapdi-Nimbwadi rd; A.S. Mahabal, 14-9-1984; 1ex, Ramdhara, Loni, K. Mathew, 19-7-1979; 1ex., 6km. from Atpadi on Atpadi-Madgule rd., Sangli Dist; A.S. Mahabal, 17-9-1984.

Source : Yadav (1993d), (2004), (2005), (2006).

Distribution : India : Delhi, Haryana, Himachal Pradesh, Kerala, Maharashtra, Rajasthan, Uttar Pradesh and Uttaranchal.

Remarks : It is a common species.

***19. *Asanada sokotrana* Pocock**

1899. *Asanada sokotrana* Pocock, *Bull. Liverpool. Mus.*, 2 : 9 (Type locality : Sokotra)

1930. *Asanada sokotrana*, Attems, *Das Tierr. Scolopen Dromorpha*, 54(2) : 1-308.

2001. *Asanada sokotrana*, Khanna, *Ann. For.*, 9(2) : 199-219.

Diagnostic characters : Anal legs short and thick. Paired longitudinal sutures complete on 20th tergite. 21st tergite more than twice as broad as long and 21st sternite at least nearly twice as broad

as long. Anal leg claw dorsally without a dent. Longitudinal median groove present throughout on anal leg femur only.

Material examined : 1ex., Ambenally, Mahabaleshwar, Satara Dist., B.K. Tikader, 29-5-1976; 2exs., Moshi river Isad Vill., Gangakhed, M.B. Rao, 12-2-1972; 1ex., Vaghur river, Faradpur, Jalgaon rd; M.B. Rao, 12-10-1973; 1ex., Mante Vill., 11km. from Dapoli, Ratnagiri, S.V. Mulay 6-4-1991.

Source : Yadav, (1993d), (2004), (2005), (2006).

Distribution : India : Kerala, Maharashtra, Tamil Nadu.

Elsewhere : Sokotra, Sudan South Africa, Zimbabwe, Transvaal, French Guinea.

Remarks : It is a common species.

***20. *Asanada brevicornis* Meinert**

1886. *Asanada brevicornis* Meinert, *P. Amer. Phil. Soc.*, 23 : 189 (Type locality : Himachal Pradesh : kullu).

2001. *Asanada brevicornis*, Khanna, *Ann. For.*, 9(2) : 199-219.

Diagnostic character : Anal legs long and slender, 21st tergite and sternite about 1.5 times as broad as long. Longitudinal media groove present posteriorly on anal leg femur prefemur, and tibia

Material examined : 1ex., Puntamaba, Nagar Dist; M.B. Rao, 10-10-1973; 2exs., North Bank of shahagadh, M.B. Rao, 30-6-1972; 3exs., Sindfana River, Man jalegaon, Beed, M.B. Rao; 1ex., Vethalwadi, Jalna, Aurangabad, R.N.Chopra, 20-9-1964; 1ex., Vaghur river, Pahur vill. M.B. Rao, 17-7-1972; 1ex., Gevrai Ganesh Temple, M.b. Rao, 2-7-1972; 1ex, Chas, Naskik, M.b. Rao, 4-10-1973; 3exs., Faradpur nalla, M.B. Rao, 16-7-1972; 1ex., Aurangabad Nalla, M.B. Rao, 20-7-1972; 1ex, Ramdhara, Loni, Pune, K. Mathew, 19-7-1979; 1ex., 6km., SE of Mohol on Sholapur rd., A.S. Mahabal, 28-3-1983, From Ratnagiri, Dhulia, Sindhudurg, Sangli, Yeotmal.

Source : Yadav, (1993b), (2005).

Distribution : India: Andaman and Nicobar islands, Delhi, Haryana, Himachal Pradesh, Gujarat, Rajasthan, Maharashtra.

Elsewhere : Myanmar, Reef Island, New Guinea (Morocco) (Oriental, Ethiopian and Indo-Malayan extending to Australia).

Remarks : This is a common species.

***21. *Asanada sukhensis* Jangi and Dass**

1984. *Asanada sukhensis* Jangi and Dass, *J. Scient. Indl. Res.*, 43(2) : 27-54 (Type locality : Sukha, Patan rd., Jabalpur, M.P.)

2001. *Asanada sukhensis*, Khanna, *Ann. For.*, 9(2) : 199-219.

Diagnostic characters : Anal legs short and thick. Paired longitudinal median sulcus complete on 20th tergite, 21st tergite more than twice as broad as long and 21st sternite at least nearly twice as broad as long. Anal leg claw dorsally without a dent, longitudinal median groove confined to posterior half of anal leg femur.

Material examined : 1ex., S.W. Of forest R.H. Kamble, (crater basin forest, P.M. Sureshan, 19-11-2003

Source : Sureshan and Yadav (2008), Yadav and Sureshan (2006).

Distribution : India : Kerala, Madhya Pradesh, Orissa.

Remarks : It is uncommon species.

***22. *Asanada agharkari* (Gravely)**

1912. *Pseudocryptops agharkari* Gravely, *Rec. Indian Mus.*, 7 : 416 (Type locality : Taloshi, Bombay)

1978. *Asanada agharkari*, Jangi and Dass, *J. Nat. Hist.*, 12 : 423-426.

2001. *Asanada agharkari*, Khanna, *Ann. For.*, 9(2) : 199-219.

Diagnostic characters : Anal legs short and thick with its claw having dorsally with dent, paired longitudinal median sutures complete on 20th tergite, 21st tergite more than twice as broad as long.

Material examined : 1ex., 20 km N. of Navapur, Betaki tal. R.H. Kamble., 28-12-1985.

Distribution : India : Andaman Nicaobar Islands, Bihar, Maharashtra, Madhya Pradesh, Orissa.

Remarks : This species is endemic to India.

Subfamily OTOSTIGMINAE

It is represented in India by a single tribe otostigmini. Its sternites with a pair of longitudinal sutures, but never with an unpaired median suture; and the coxosternal plate of maxillipedes with well developed, several-toothed dental plates. Members of the subfamily Otostigminae have 9 to 10 pairs of oval, round spiracles. The genera involved are *Digitipes*, *Otostigmus*, *Ethmostigmus* and *Rhysida*.

Tribe Otostigmini

The characters are same as that of subfamily.

Key to genera

- 1a. 9 pairs of spiracles, one each on leg bearing segments 3,5,8,10,12,14,16,18 & 20 2
- 1b. 10 pairs of spiracles, one each on leg bearing segments 3,5,7,8,10,12,14,16,18 & 20 3
- 2a. Femur of anal leg in male with a posteromedial process. Claw of 2nd maxilla without spur ..
..... *Digitipes*, Attems, 1930
- 2b. Prefemur of anal leg in male without such a process claw of 2nd maxilla without a spur .
..... *Otostigmus*, Porath, 1876
- 3a. Prefemur of maxillipede without a medial dental process
..... *Ethmostigmus*, Pocock, 1898
- 3b. Prefemur of maxillipede with a medial dental process *Rhysida*, Wood, 1862

Genus *Otostigmus*, Porath, 1876

The genus has worldwide distribution, occurring in tropics and subtropics. In India there are 22 species. Of which 9 occur in Deccan plateau and hardly 3 species being collected from Maharashtra. Nominate subgenus *Otostigmus* is distinguished by having spiny prefemur of anal legs and its coxopleural process tipped with spines.

**Key to species of the genus *Otostigmus*
Porath, 1876**

- 1a. All leg without tarsal spur, coxopleural process without lateral or dorsal spinulation. Tergites in posterior half of body, laterally wrinkled *O. nudus* Pocock
- 1b. First 5-6 legs with two tarsal spurs and following legs up to 19 with a single tarsal spur. Coxopleural process with or without lateral or dorsal spinulation. Tergites smooth *O. politus* Karsch
2. Coxopleural process with lateral spines, anal legs without posteromedial process. Tergites without thorny tracts *O. orientalis* Porath

***23. *Otostigmus orientalis* Porath**

1876. *Otostigmus orientalis* Porath, *Bih. Svenska Ak.*, 4(7) : 19 (Type locality : Maharashtra, Bombay)
2001. *Otostigmus orientalis*, Khanna, *Ann. For.*, 9(2) : 199-219.
1996. *Otostigmus orientalis*, Lewis, *J. Nat. Hist.*, 30 : 823-834.
2008. *Otostigmus orientalis*, Khanna, *Biosystematica*, 1(2) : 33-45.

Diagnostic characters : Coxopleural process without dorsal spines, sternites without complete paramedian longitudinal sutures, coxopleural process with lateral spines, anal legs without posteromedial process. Tergites without thorny tracts

Material examined : 1ex., steam nr. Andhra Valley, Gibbs lake, M.S. Pradhan, 12-12-1984; 1ex., Bhakadevi, Bhmashankar, D.B. Bastawade, 5-8-2005.

Source : Yadav (1993b), Yadav (2006).

Distribution : India : Maharashtra.

Elsewhere : Seychelles.

Remarks : The genus *Otostigmus* is rarely occurring in Maharashtra.

***24. *Otostigmus nudus* Pocock**

1890. *Otostigmus nudus* Pocock, *Ann. Nat. Hist. Ser.*, 6,5: 247 (Type locality : Madras, Tamil Nadu).

2001. *Otostigmus nudus*, Khanna, *Ann. For.*, 9(2) : 199-219

Diagnostic characters : Coxopleural process mostly without dorsal spines. Sternites with two complete paramedian sutures. All legs without tarsal spur, coxopleural process without lateral or dorsal spinulation. Tergites in posterior half of body laterally wrinkled.

Material examined : 1ex., Vesraf vill, 15km., from Gagan Bavda, Kolhapur, S.G. Patil, 10-8-1989; 1ex., Vetal hill, Pune, D.b. Bastawade, 22-9-1983.

Distribution : Himachal Pradesh, Meghalaya, Tamil Nadu, Uttaranchal and Uttar Pradesh.

Remarks : This is uncommon species.

***25. *Otostigmus p. politus* kirsch**

1881. *Otostigmus politus* kirsch, *Barlin ent. Z.*, 25 : 219 (Type locality : Tienstein, Tsingtau, China)
1930. *Otostigmus politus*, Attems, *Dass. Tierr., Scolopendromorpha*, 54(2) : 149.
2001. *Otostigmus politus*, Khanna, *Ann. For.*, 9 (2) : 199-219.

Diagnostic characters : Coxopleural process mostly without dorsal spines. Sternites with two complete paramedian sutures. First 5-6 legs with 2 tarsal spurs and following legs up to 19 with a single tarsal spur tergites smooth.

Material examined: 1ex., s. of Lonar R.H. Kamble, (Forest in crater basin) D.B. Bastawade, 16-2-2003.

Source : Sureshan and Yadav (2008).

Distribution : India : Assam, Delhi, Himachal Pradesh, Kerala, Maharashtra, Meghalaya, Orissa, Sikkim, Uttaranchal and West Bengal.

Elsewhere : China, Sumatra, Myanmar, New Guinea, Australia (Indo-Chinese, Indo-Australian).

Remarks : This is uncommon species.

Genus *Digitipes*, Attems, 1930

This little known genus occurs in Congo, South Africa. There are 6 species known from Deccan, out of which, only 4 species could be collected in Maharashtra State.

Key to species of the genus *Digitipes* Attems, 1930

- 1a. 20th pair of walking legs without tarsal spur. 21st tergite little broader than long. Its lateral margin convex. Coxopleural processes long, conical tipped with 2 spines and bearing a single lateral spine.
..... *D. coonorensis* Jangi and Dass
- 1b. 20th pair of walking legs with tarsal spur porous area of coxopleuron almost touching dorsal margin
..... *D. barnabasi* Jangi and Dass
- 2a. Posteromedial process of male, short, stumpy 1st tarsus of anal leg twice as long as 2nd and 2nd tarsus 3 and half as long as claw. Prefemur has ventral spines at 3 different positions ..
..... *D. chhotanii* Jangi and Dass
- 2b. Posteromedial femoral process of male long and finger like. 1st tarsus of anal leg 1 and half times as long as 2nd and 2nd tarsus more than twice as long as claw. Prefemoral spines on anal leg wanting dorsomedial
..... *D. indicus* Jangi and Dass

*26. *Digitipes barnabasi* Jangi And Dass

1984. *Digitipes barnabasi* Jangi And Dass, *J. Scient. Indl. Res.*, 43(2) : 27-54 (Type locality : Ahmed Nagar, Maharashtra).
2001. *Digitipes barnabasi*, Khanna, *Ann. For.* 9(2) : 27-54.

Diagnostic characters : 20th pair of legs with tarsal spur, porous area of coxopleuron almost touching dorsal margin.

Material examined : 1, khara Patton, Ratnagiri Dist., M.B. Rao, 24-2-1973; 3 Bariswadi, Trimbak, Nasik, M.B. Rao; 19-10-1973; 10 Talav nr. Trimbak, Nasik Dist, M.B. Rao, 16-10-1973; 4, Koyana rivulate, Mahabaleshwar Satara Dist., B.S. Lamba, 21-2-1965; 1, 4, Bour knind, Pune, D.B. Bastawade, 9-8-1985; 20 exs., veterinary hospital Khadkale, Kamshet, M.S. Pradhan, 10-7-1980; 1 ex., Karade hills, Varnavati Kolhapur Ramatrishan, 31-10-1981; 4 exs, 5 km. S. fo Djipur, Radhanagiri, Kolhapur D.B. Bastawade, 12-9-1987; 11 exs, Rajapur vill. On Dimbhe-Bhimashankar rd.,

P.P. Kulkarni, 8-11-1993; 3 exs, Kamshet, Pune, Ramskrishan 3-8-1979; 1 ex., Ghat nr. Kamshet, Pune, D.B. Bastawade, 19-8-1980;

Source : Yadav (1993c).

Distribution: India : Maharashtra, Tamil Nadu.

Remarks : It is a common species.

*27. *Digitipes chhotanii* Jangi and Dass

1984. *Digitipes chhotanii* Jangi and Dass, *J. Scient. Indl. Res.*, 43(2) : 27-54 (Type locality : Suranganar Reserve forest, Tamil Nadu)
2001. *Digitipes chhotanii*, Khanna, *Ann. For.*, 9(2) : 199-219.

Diagnostic characters : 20th pair of legs with tarsal spur porous area of coxopleuron far from dorsal margin, lateral tergital margination beginning on 7th segment, posteromedial femoral process of male short and stumpy posterior margin of 21st sternite straight. 1st tarsus of anal leg nearly twice as long as 2nd and 2nd tarsus 3 and 1/2 times al long al claw. Prefemoral spines of anal leg comprising 3 ventrolateral and 2 ventro medial spines, besides a dorsomedial one.

Material examined : 2 , 1 Khandala Ghat, 68 km. NW of Pune, G.M. Yazdani, 1-10-1988; 3 exs., Ghat rd., to Pawana dam., after Kamshet, D.B. Bastawade, 4-8-1983.

Source : Yadav (1993c).

Distribution : India : Kerala, Maharashtra, and Tamil Nadu.

Remarks : It is uncommon species.

*28. *Digitipes indicus* Jangi and Dass

1984. *Digitipes indicus* Jangi and Dass, 43(2) : 27-54 (Type locality : Palghat, Kerala).
2001. *Digitipes indicus*, Khanna, *Ann. For.* 9(2) : 199-219.

Diagnostic characters : 20th leg with tarsal spur, porous area of coxopleuron far from dorsal margin. Lateral tergital margination beginning on 11th leg bearing. Posteromedial femoral process of male long and finger like and posterior margin of 21st sternite concave. 1st tarsus of anal leg 1 and 1/2 times long as 2nd and 2nd tarsus slightly

more than twice as claw. Prefemoral spines on anal leg comprising a ventrolateral and ventromedial spine.

Material examined : 1ex., Khandala ghat, 68 km NW of Pune, G.M. Yazdani, 1-10-1988; 1 Phonda Ghat, Sindhudurg, D.B. Bastawade, 10-9-1987.

Source : Yadav (1993c).

Distribution : India : Kerala, Maharashtra.

Remarks : This is a common species.

***29. *Digitipes coonoorensis* Jangi and Dass**

1984. *Digitipes coonoorensis* Jangi and Dass, *J. Scient. Indl. Res.*, 43(2) : 27-54 (Type locality : 6km. of rly. Stn. Coonoor, Nilgiri, Tamil Nadu).

2001. *Digitipes coonoorensis*, Khanna, *Ann. For.*, 9(2) : 199-219.

Diagnostic characters : 21st tergite little broader than long and having its lateral margins only slightly convex, coxopleural process long, conical tipped with 2 or 4 spines and bearing at least a single lateral spine, 20th leg without tarsal spur, coxopleural process tipped with 2 spines and bearing a single lateral spine.

Material examined : 1ex., 30 km. W. of Amboli Ghat (2700) D.B. Bastawade, 19-9-1987; 1ex., Kamshet, Pune, Ramakrishna, 3-8-1979, From Kolhapur, Chandoli Dist.

Source : Yadav (1993c) Sureshan and Yadav (2008).

Distribution : India : Tamil Nadu, Maharashtra.

Remarks : Kolhapur specimens are dark blue in colour.

Genus *Ethmostigmus*, Pocock, 1898

Although *Ethmostigmus* has been recorded from California, it is an old world genus. There are 6 species so far known to occur in India. In Maharashtra State, 3 species were collected.

Key to species of the genus *Ethmostigmus* Pocock, 1898

- 1a. 3 basal antennal segments glabrous
..... *E. coonoranus* chamberlain

- 1b. 4 basal antennal segments glabrous
..... *E. platycephalus* (Newport)

Key to subspecies

- 1a. Posteromedial spiny process of anal leg prefemur mostly with 3 ventrolateral spines 2
1b. Posteromedial spiny process of anal leg prefemur of gigantic size. Anal leg prefemur mostly with 2 ventrolateral spines
..... *E. rubripes spinosus* (Newport)
2. Coxopleural process tipped with 2-4 spines, and bearing dorsally 0-1 spine
..... *E. rubripes platycephalus* (Newport)

***30. *Ethmostigmus rubripes platycephalus* (Newport)**

1845. *Heterostoma platycephalus platycephalus* Newport *Trans. Linn. Soc.*, 19 : 415

1930. *Ethmostigmus palatycephalus platycephalus*, Attems, *Das. Tier. Scolopendromorpha*, 54(2) : 181

2004. *Ethmostigmus rubripes platycephalus*, Schileyko and Stägel, *Annalen des Naturhi Storischer Mus. In Wien.*, Serie B 105-B : 67-137.

2008. *Ethmostigmus rubripes platycephalus*, Khanna, *Biosystematica*, 1(2) : 33-45.

Diagnostic characters : Dental plates of maxillipedes having 3 teeth, 4 basal antennal segments glabrous coxopleural process tipped with 2-4 spines and bearing dorsally 0-1 spine.

Material examined : 1ex., 60 km., N of Pundra, Ajra rd., Kolhapur, D.B. Bastawade, 24-9-1986; 1ex., Beyond Vanaspati point, Bhimashankar, P.P. Kulkarni, 10-11-1993; 1 Panchgani, Satara, D.B. Bastawade, 4-9-2003

Source : Yadav (1993c).

Remarks : These occur in hill ranges.

31. *Ethmostigmus rubripes spinosus* (Newport)

1930. *Heterostoma spinosa* Newport, *Trans. Linn. Soc. London*, 19 : 414

2008. *Ethmostigmus rubripes spinosus*, Khanna, *Biosystematica*, 1(2) : 33-45.

Diagnostic characters : Dental plates of maxillipedes having 3 teeth, 4 basal antennal segments glabrous, posteriomedial spiny process anal leg prefermure of gigantic size, anal leg prefemur mostly with 2 ventrolateral spines.

Source : Yadav (Unpublished record).

Distribution : India : Karnataka, Maharashtra and Tamil Nadu.

Elsewhere : Shri Lanka, Myanmar.

Remarks : Its anal leg prefemur has spines.

***32. *Ethmostigmus coonooranus* Chamberlin**

1920. *Ethmostigmus coonooranus* Chamberlin. *Univ. Calif. Pub.*, 19 : 392 (Type locality : Coonoor, Tamil Nadu)

2001. *Ethmostigmus coonooranus*, Khanna, *Ann. For.*, 9(2) : 199-219.

Diagnostic characters : Dental plates of maxillipedes having 3 teeth, 4 basal antennal segments glabrous.

Material examined : 1ex., Hanuman tank, Bhimashankar, D.B. Bastawade, 3-8-2005.

Distribution : India : Tamil Nadu, Maharashtra.

Remark : It is a new record from Maharashtra State.

Genus *Rhysida*, Wood, 1862

Out of 22 Indian species, 10 species occur in Maharashtra State.

Key to species of the genus *Rhysida* Wood 1862

1. Tergites except anterior ones with complete paramedia sutures2
- 2a. Tergites preceding 21st leg bearing segment ordinarily not marginate laterally and if at all, hardly couple incompletely
..... *R. nuda* (Newport)
- 2b. Tergites preceding 21st leg bearing segment clearly marginate laterally and several of them involved3
- 3a. Coxopleural process without lateral spine ...
.....4

- 3b. Coxopleural process with lateral spine.....
..... *R. longipes* (Newport)
- 4a. Sternites with anteriorly confined to short suture. First 8 or more pairs of legs with two tarsal spurs *R. lithobioides* (Newport)
- 4b. Majority of sternites with complete paramedian longitudinal suture. Fewer pairs of legs with 2 tarsal spurs5
- 5a. Sternites with 5-19 with complete paramedian suture only first pair of legs with 2 tarsal spurs and remaining up to 17th or 8th with a single tarsal spur. Ventrolateral spines of anal leg prefemur smaller than ventromedial.....
..... *R. crassispina* Kraepelin

Key to subspecies *Rhysida immarginata*

- 1a. Coxopleural process tipped with 3 spines and femoral spur present on 1st walking leg. 20th pair of legs with tarsal spur
..... *R. immarginata subnuda* (Jangi)
- 1b. Coxopleural process not tipped with 3 spines femoral spur absent on 1st pair of walking leg. Tibial spur present. 20th pair of legs without tarsal spur
..... *R. immarginata immarginata* (Porath)

Key to subspecies *Rhysida lithobioides* (Newport)

- 1a. Coxopleural process tipped with 2 spines, seldom with one, 21st sternite hardly tapering posteriorly *R. l. paucidens* (Pocock)
- 1b. Coxopleural process tipped with 3 spines, 21st sternite clearly tapering posteriorly
..... *R. l. trispinosus* Jangi and Dass

***Rhysida longipes* (Newport)**

- 1a. Prefemur of anal leg without posteromedial spiny process
..... *R. l. simplicor* (Chamberlin)
- 1b. Prefemur of anal leg with posteromedial spiny process *R. l. longipes* (Newport)

***33. *Rhysida nuda* (Newport)**

1845. *Branchiostoma nudum* Newport, *Trans. Linn. Soc.*, **19** : 412 (Type locality : Paramata, New south Wales Australia).

1985. *Rhysida nuda*, Koch, *J. Nat. Hist.*, **19** : 207.

Diagnostic characters : Tergites except anterior ones with complete paramedian sutures, tergites preceeding 21st leg bearing segment ordinarily not marginate laterally.

Material examined : 1ex., Deolali, Nasik, B.S. Lamba, 25-9-1973; 2exs., Ozar village, Nasik, B.S. Lamba, 22-12-1964; 1ex., Vaghur river, Jalgaon rd., M.B. Rao, 15-7-1972; Palan Village; gangakhed, Parabhani Dist., M.B. Rao, 13-7-1972; Badgila nalla, Ratnagiri Dist., M.B. Rao, 15-2-1973; 1ex., Malgwahn Vill, Surgana, Nasik Dist., 13-12-1964; 1ex., Mahabaleshwar, Satara Dist., B.S. Lamba, 15-2-1965; 1ex., Vasisti River, Kakwadi, Rantagiri Dist., 14-2-1973; 1ex., Hamalwada, Auran gabad Dist., R.N. Chopra, 4-9-1964; 3exs., Nekka nalla, Ratnagiri Dist., M.B. Rao, 21-2-1973; 1ex., Barasoi nalla, Ratnagiri Dist., M.B. Rao, 22-2-1973; 1ex., Khopoli, Raigad Dist., B.S. Lamba, 10-2-1966; 2exs., 30km. SW of Kagal, Karvir Kolhapur Gargoti rd., D.B. Bastawade, 24-9-1986; 11exs., Tupari-Takari, Sangli, A.S. Mahabal, 20-9-1979; 2exs., Vill.Kuwa on Panji rd., Rajapur, R.H. Kamble, 22-6-1987; 1ex., Chicholi Vill. Nagar, R.H. Kamble, 8-9-1988; 1ex., 50km. E. of Mangaon, Raigad, D.B. Bastawade, 6-12-1987; 1ex., Kothar vill., Taloda-Dhadgaon rd., Akkalkuwa, Dhulia; 1ex., 6km. from Atpadi nr. Kourhuli vill., Sangli, A.S. Mahabal, 15-9-1984; 1ex., Pond nr. Wagholi, Pune B.E. Yadav, 5-12-1990; 1ex., Athamble vill., Vani, Nasik., 20-11-1987; ex., Ghat nr. Kamshet, D.B. Bastawade, 19-8-1980; 1ex., Arag vill., 18km. from Miraj, A.S. Mahabal, 30-9-1984; 1ex., Gomewadi, 30km. SW of Atpadi-Khanapur rd., Sangli, A.S. Mahabal, Sept 1985; 1ex., 7km. from Dehu rd., Pune, Ramakrishna, 3-8-1979; From Raigad, Sindhudurg, Satara, Mumbai, etc.

Source : Yadav (1993b), Yadav and Sureshan (2006).

Distribution : India : Andhra Pradesh, Karnataka, Maharashtra, Tamil Nadu.

Elsewhere : Sri Lanka.

Remarks : It's anal leg are mostly damaged.

***34. *Rhysida immarginata immarginata* (Porath)**

1876. *Branchiostoma immarginatum* Porath, *Bih. Svenska Ak.*, **4**(7) : 24 (Type locality : Monila, Philippines)

2008. *Rhysida immarginata immarginata*, Khanna, *Biosystematica*, **1**(2) : 33-45.

Diagnostic characters : Coxopleural process not tipped with 3 spines. Femoral spur absent on 1st pair of legs, tibial spur present.

Material examined : 1ex., Nirgudamal, Musapada, Vani, Nasik, M.S. Pradhan, 18-11-1987; 1ex., Jogeshwari Khind on Panvel-Uran rd., Raigad, A.S. Mahabal, 23-7-1987; 1ex., Igatpuri, 49km. SW of Darna dam, Nasik, D.B. Bastawade, 13-2-1985; 1ex., Karnala fort, Raigad, D.B. Bastawade, 15-12-1987; 1ex., Municipal Tank Talegaon, M.S. Pradhan, 10-7-1980; 2exs., Mulshi dam, Pune D.B. Bastawade, 11-3-1999; 2exs., 40km. NW of Khalapur, Matheran, Raigad, D.B. Bastawade, 13-12-1987; 2exs., Mal nr. Talegaon, Pune, Ramakrishna, 3-8-1979; 1ex., Kurd-Budruk on Mangaon Nizampur rd., Tal. Mangaon, raigad, A.S. Mahabal, 30-7-1987; Yeotmal Dist.

Source : Yadav and Sureshan (2006) Yadav and Sureshan (2008).

Distribution : India : Andaman and Nicobar Is; amda. Delhi, Gujarat, Madhy Pradesh, Maharashtra Rajasthan, Uttaranchal, U.P. and West Bengal.

Elsewhere : West Africa, Myanmar, Philippines, Venezuela, Gautemala (Oriental and palaerctic).

Remarks : This is a common species.

***35. *Rhysida immarginata subnuda* (Jangi)**

1955. *Rhysida nuda subnuda* Jangi, *Annal. Mags. Nat. Hist.*, **Sr. 12, 8** : 69-80 (Type locality : Nagpur, Maharashtra).

2008. *Rhysida immarginata subnuda*, Khanna, *Biosystematica*, **1** (2) : 33-45.

Diagnostic characters : Coxopleural process tipped with 3 spines, femoral spur present on 1st pair of walking legs and 20th pair of walking legs are with tarsal spur.

Material examined : 4exs., Sonke, Pandharpur, Sholapur, A.S. Mahaba, 15-11-1978; 3exs., Veterinary hospital, Keadkale Vill., Kamshet, 10-7-1980; 1ex., Akurdi 18 km. NW of Pune, B.E. Yadav, 22-11-1992; 1ex., Municipal tank nr. Talegaon Pune, M.S. Pradhan, 10-7-1980; 1ex., 30km., SW of Kagal, Tal. Karvir, Gargoti, Kolhapur, D.B. Bastawade, 24-9-1986; 1ex., 75km. S. of Mangaon, Ambenalli Ghat, Satara, D.B. Bastawade, 7-12-1987; 1ex., Nesardi dam, Amalner, Jalagaon, R.H. Kamble, 28-11-1983; 1ex., Akurdi, 18km. NW of Pune B.E. Yadav, 21-6-1993; 1ex., Hirvapada, 42km. W. of Vani, Nasik, D.B. Bastawade, 21-2-1985; 1ex., Akurdi, 18 km. NW. of Pune, B.E. Yadav, 27-1-1994; 1ex., Vesraf vill, 15km., from Gagan Bavda, Kolhapur S.G. Patil, 10-8-1989; 5exs., Office Campurs, Akurdi, R.Vinod Kumar, 7-12-2000; 1ex., Parashuram vill., Sangameshwar-Mumbai rd., Ratnagiri, P.P. Kulkarni, 27-11-1990; 1ex., Vasant Sagar, Chandoli, S.G. Patil, 6-12-2007; Throughout Maharashtra.

Source : Yadav (2004, 2005, 2006).

Distribution : India : Maharashtra, Kerala.

Remarks : This is a common species.

***36. *Rhysida longipes* (Newport)**

1845. *Branchiostoma longipes* Newport, *Trans. Linn. Soc., London*, 19 : 411.

2001. *Rhysida longipes*, Khanna, *Ann. For.*, 9(2) : 199-219.

Diagnostic characters : tegites preceding 21st leg bearing segment clearly marginate laterally, coxopleural process with lateral spine.

Material examined : 1ex., 30km. SW of Kagal, Tal. Karvir, Gargoti rd., Kolhapur, D.B. Bastawade, 24-9-1986; 2exs., Arag vill, 18km. from Miraj A.S. Mahabal, 30-9-1984.

Distribution : All tropical lands including India.

Elsewhere : SriLanka, Australia, Africa,

Madagascar, Seychelles, Mexico, Central America, Zaire, Neotropical region.

Remarks : This is uncommon species.

***37. *Rhysida longipes longipes* (Newport)**

1845. *Branchiostoma longipes* Newport, *Trans. Linn. Soc., London*, 19 : 411 (Type locality : Not known).

2001. *Rhysida longipes longipes*, Khanna, *Ann. For.*, 9(2) : 199-219.

Diagnostic characters : Prefemur of anal leg with posteromedial spiny process.

Material examined : 1ex., Talegaon Dbhade, Pune, S.Thakar, Octo. 2001; 2exs., Nigdi, Pune, R.H. Kamble, 21-10-2005

Source : Yadav (2005, 2006).

Distribution : India : Arunachal Pradesh, Andaman and Nicobar Islands, Delhi, Goa, Karnataka, Maharashtra, Madhya Pradesh, Uttar Pradesh, Uttaranchal and West Bengal.

Elsewhere : Australia, Africa, Madagascar, Seychelles, Mexico, South-Central America.

Remarks : This is uncommon species.

***38. *Rhysida longipes simplicior* (Chamberlin)**

1920. *Rhysida simplicior* chamberlin, *Univ. Calif. Pub.*, 19 : 39 (Type locality : Coonoor, Tamil Nadu)

1930. *Rhysida longipes simplicior*, Attems, *Das. Tier., Scolopendromorpha*, 54(2) : 194.

2001. *Rhysida longipes simplicior*, Khanna, *Ann. For.*, 9(2) : 199-219.

Diagnostic characters : Prefemur of anal legs without posteromedial spiny process.

Material examined : 1ex., 30km. W. of Amboli Ghat (2700') Sindhudurg, D.B. Bastawade, 19-9-1987.

Distribution : India : Delhi, Tamil Nadu and Uttaranchal.

Remarks : This species is endemic to India.

***39. *Rhysida lithobioides* (Newport)**

1845. *Branchiostoma lithobioides* Newport, *Trans. Linn. Soc. London*, 19 : 411 (Type locality : China).

2001. *Rhysida lithobioides lithobioides*, Khanna, *Ann. For.*, 9(2) : 199-219.

Diagnostic characters : Tergites with complete para-median sutures, tergites preceding 21st with lateral tergital margination coxopleural process without lateral spine. Sternites with anteriorly confined short suture, first 8 or more pairs with 2 tarsal spurs.

Material examined : 1ex., Merel hill, Ratnagiri, R.M. Sharma, 17-8-1987; 4exs., Tamdolge vill., Kadamkai khind, Kolhapur, S.G. Patil, 15-8-1989;

Source : Yadav (1993b).

Distribution : India : Bihar, Haryana, Tamil Nadu, Maharashtra, Uttar Pradesh.

Elsewhere : China, Myanmar.

Remarks : This is a common species.

***40. *Rhysida lithobioides trispinosus* Jangi and Dass**

1984. *Rhysida lithobioides trispinosus* Jangi and Dass, *J. Scient. Indl. Res.*, 43(2) : 27-54 (Type locality : Hill behind Film Instt., Pune Maharashtra).

2001. *Rhysida lithobioides trispinasus*, Khanna, *Ann. For.*, 9(2) : 27-54.

Diagnostic characters : Coxopleural process tipped with 3 spines, 21st sternite clearly tapering posteriorly.

Material examined : 1ex., 20 km. NE of Deolali, Nasik Dist., M.B. Rao, 23-9-1973; 2exs., Varvandi, 15 km. W. of Deola, Nasik, M.B. Rao, 25-9-1973; 1ex., 35km. N. of Phonda ghat on Kankavali-Bombay rd., Singhudurg, D.B. Bastawade, 11-9-1987; 3 exs., Varsaf vill, 15km. Gaganbawada, Kolhapur, S.G. Patil, 10-8-1989; 1ex., Malinagar, 32 km. on Jat kavathe- Mahankal rd., Sangli, A.S. Mahabal, 23-9-1984; 2 exs., Bangalore re., Kolhapur, D.B. Bastawade, 25-9-1986; 1exs., Sadvali vill., Devrukh, Ratnagiri, S.V. Mulay, 13-4-1991; 1ex., 15km. from Dhadgaon, Taloda rd., Acrani, Dhulia, R.M. Sharma, 21-1-1986; 1ex., Verkute phata, 18km., on Atpadi-Mayani rd. Sangli, A.S. Mahabal, 14-9-1984; 3exs., Dighi vill Pune, A.S. Mahabal, 10-5-1977;

1ex., Peth-par and around (300'h), Raigad, M.S. Pradhan, 7-4-1980; 2exs., Nesardi Dam, Amalner R.H. Kamble, 28-11-1983; Throughout Maharashtra.

Source : Yadav (1993b).

Distribution : India : Maharashtra, Tamil Nadu.

Remarks : This is a common specie in Western Ghats.

***41. *Rhysida lithobioides pauciden* (Pocock)**

1897. *Rhysida paucidens* Pocock, D.Smith, *Unknown African Countries. App. C.*, 403 p. (Type locality: Pondicherry, Tamil Nadu)

2001. *Rhysida lithobioides pauciden*, Khanna, *Ann. For.*, 9(2) : 199-219.

Diagnostic characters : Coxopleural process tipped with two spines, seldom one, 21st sternite hardly tapering posteriorly.

Material examined : 1ex., Navapada, Enbirow, S.G.N.P. Borivali, R.M. Sharma, 8-10-1996;

Distribution : India : Tamil Nadu, Maharashtra.

Elsewhere : Somalia.

Remarks : This is uncommon species.

42. *Rhysida crassispina* Kraepelin

1903. *Rhysida crassispina* kraepelin, *Mitt. Mus. Humburg*, 20 : 151. (Type locality : Matheran, Alibag, Maharashtra)

2001. *Rhysida crassispina*, Khanna, *Ann. For.*, 9(2) : 199-219.

Diagnostic characters : Tergites with paramedian longitudinal sutures, tergites preceding 21st with lateral margination. Coxopleural process without lateral spine majority of sternites (5-19) with complete paramedian sutures. Only first pair of legs with tarsal spur, after that 17th or 18th with a singal tarsal spur, ventromedial spines of anal leg prefemur.

Source : Khanna (2001).

Distribution : India : Maharashtra, Meghalaya, Uttaranchal and Uttar Pradesh.

RESULTS AND DISCUSSION

India represents rich species diversity of centipedes. Out of 687 species (Khanna, 2008b) of centipedes in the World, 422 species (61%) occur under the family Scolopendridae, a single large assemblage of centipedes. Khanna (2001) mentioned 96 species of centipedes. Further (Khanna, 2008a) revised as 82 species of Scolopendridae due to synonymies.

Jangi and Dass (1984) worked out 48 species of Scolopendrids from the Deccan plateau, out of which 18 species occur in Maharashtra State. The present work submits 42 species of Centipedes, belonging to 7 genera, under 3 tribes and 2 subfamilies of the family Scolopendridae. In this study 22 speceis are common and 20 species are uncommon. The actually collected species are 40.

The present work represents fair number of species in the genera *Scolopendra*, *Cormocephalus*, *Asanada*, *Digitipes*, *Ethmostigmus* and *Rhysida*. The only genus *Otostigmus* is less represented from Maharashtra. However, Khanna (2001) presented 23 species of the genus *Otostigmus* mostly from Northern India, Himachal Pradesh and North East India. The genus *Digitipes* is a native of Congo, S. Africa shows good number of species. Similar is the case of smaller sized, lesser known group *Asanada* in Maharashtra. A strong and stout centipedes having curved spines on legs of the genus *Ethmostigmus* mostly occur in deep forest of Western Ghats. The genus *Rhysida* has a fair representation of 10 species in Maharashtra. A data on centipede collection indicated that there is a rich speciation in the forest of Western Ghats than Vidarbha and

Central Maharashtra while specimenwise account is maximum in the cosmopolitan species *S. morsitans* Linn.

Among the genus *Scolopendra*, despite our efforts to collect the more specimens of *Scolopendra jangii* Khann and Yadav, *S. elloreensis* Jangi and Dass, *S. punensis* Jangi and Dass and *S. andhrensensis* Jangi and Dass could not be collected in plenty, hence these species may be considered uncommon. Further, *S. gigantea* Linn. a native of S. America, Venezuela is the only specimen found from Raigad Dist., M.S. may, be considered as a rare species.

SUMMARY

A centipede fauna of Maharashtra State (Scolopendridae) is represented by 42 species, belonging to 7 genera under 3 tribes and two subfamilies; Scolopendrinae and Otostigminae. Out of these 22 species are common and 20 species are uncommon. The genus *Otostigmus* is less represented. The present work represents one new species *S. jangii* Khanna and Yadav from Pune one rare species *S. gigantea* Linn. from Raigad Dist., Maharashtra State.

ACKNOWLEDGEMENTS

I am grateful to the Director, Zoological Survey of India, Kolkata for the facilities. Further, I am thankful to Dr. Anil S. Mahabal, Officer-in-Charge, W.R.C., Z.S.I., Pune, to Dr. Vinod Khanna, Asstt. Zool. N.R.C., Z.S.I., DeharaDun for valuable suggestions and to various survey parties for collection of precious centipede material.

REFERENCES

- Ahmed, S. 1980. On a collection of centipedes (Scolopendromorpha : Scolopendridae and Cryptopidae) from Andaman and Nicobar Islands. *Rec. zool. Surv. India*, **77**(1-4) : 25-30.
- Attems C.G., 1930. Myriapod a-2 *Scolopendromorpha*. *Das Tierreich*, **54** : 1-308.
- Jangi, B.S. and Dass, C.M.S. 1984. Scolopendridae of the Deccan. *J. Scient. Indl. Res.*, **43**(2) : 27-54.
- Khanna, V. 1987. Taxonomic and ecological studies on the centipedes (Chilopoda : Scolopendromorpha : Scolopendridae) from Western Himalayas, U.P., India. D.Phil. Garhwal Univ., Srinagar, U.P. 1-243.

- Khanna, V. 1994. Centipede fauna of NE. States, India, Chilopoda : Scolopendromorpha) *Rec. Zool. Surv. India*, **94**(2-4) : 459-472 (Published by Director, Zoological Survey of India, Kolkata).
- Khanna, V. 1995a Fauna of Rajaji natl. Park, U.P. India., Some observation on the centipede *Cormocephalus dentipes* Pocock, with comments on the sexual diamorphism in the species and proposition of a new synonym (Chilopoda : Scolopendromorpha : Scolopendridae) *Zool. Surv. India*, 237-243.
- Khanna, V. 1995b. Chilopoda : Scolopendridae. In: *Fauna of Rajaji Natl. Park, Conservation Area Series*, **5** : 309-316. (Published by Director, Zoological Survey of India, Kolkata)
- Khanna, V. 1995c. Chilopoda : Scolopendromorpha : Scolopendridae *Fauna of Western Himalaya*, U.P., : 111-113 (Published by Director Zoological Survey of India, Kolkata).
- Khanna, V. 1997. Chilopoda: In fauna of *Nandadevi Biosphere Reserve, Conservation Area Series*, **9** : 105-106 (Published by Director Zoological Survey of India, Kolkata).
- Khanna, V. 2001. A Checklist of the Indian species of centipedes (Chilopoda : Scolopendromorpha) *Ann. For.*, **9**(2) : 199-219.
- Khanna, V. 2004a. Myriapoda (Millipedes and Centipedes) In : Alfred, JR.B. and Ramakrishna (Eds) collection preservation and indentification. 181-188. (Published by Director Zoological Survey of India, Kolkata)
- Khanna, V. 2004b. Myriapod diversity in Arunachal Pradesh with checklist of Scolopendrid centipedes. *Ann For.*, **12**(2) : 259-267.
- Khanna, V. 2005. Chilopoda : Scolopendridae In : *Fauna of Western Himalaya (pt. 2) : Himachal Pradesh* : 221-229 (Published by Director Zoological Survey of India, Kolkata).
- Khanna, V 2008a. Nationa Register of the valid species of the Scolopendrid Centipedes (Chilopoda : Scolopenromorpha) in India, *Biosystematica*, **1**(2) : 31-35.
- Khanna, V 2008b *Guide to Myriapodology of Indian Subcontinent*. Pp. 1-88 (Nature Books India, New Delhi).
- Khanna, V and Yadav, B.E. 1997. Indian species of the genus *Scolopendra* Linnaeus (Chilopoda : scolopendridae) with description of a new species. *Rec. zool. Surv. India*, **96**(1-4) : 211-220.
- Khanna, V and Yadav, B.E. 2005. A taxonomic reassessment of the centipede *Scolopendra gigantia* Linnaeus (Chilopoda : Scolopendridae) and confirmation of its occurrence in India. *Zoo's Print J.*, **20**(9) : 1988.
- Koch, L.E. 1984 Australian species of the centipede genus *Arthrorhabdus* pocock (Chilopoda : Scolopendridae : Scolopendrinae). *J. Nat. Hist.*, **18** : 363-368.
- Lawrence, R.F. 1984. *Centipedes and Millipedes of South Africa*. 1-148, A.A. Balkema Publ. England
- Lewis, J.G.E. 1981. *The Biology of centipedes*, Oxford, IBH Publ.
- Lewis, J.G.E. 1986. The genus *Trachycormocephalus* a Junior Synonym of *Scolopendra* with *Remarks* on the validity of other genera of the tribe Scolopendrini (Chilopoda : Scolopendromorpha) *J. Nat. Hist.*, **20** : 1083-1088.
- Rathinasabapathy, B. and Yadav. B.E. 2000. Centipedes (Scolopendridae) of Coimbatore Zoological Park area, Annaikatty Western Ghats. *Zoo's Print*, **12**(8) : 1.

- Rao, K. Thulsi, Yadav, B.E., R.M. Prudhvi; J.S.M. Maqsood, Krishna, I, Siva Rama, 2004. On a collection of centipedes from Nagarjunasagar–Srisailem Tiger Reserve, A.P. *Zoo's Print J.*, **19**(11) : 1691-1692.
- Rao, K. Thulsi, Yadav, B.E., Sudhakar, Method; Maqsood Javed; and Siva Rama Krishan, 2005. A note on the Tiger centipede *Scolopendra hardwickei* Newport, from Nagarjunasagar, Srisailem Tiger Reserve, A.P. Fauna of Protected Area, *Bugs R All*, **8**(1) : 6.
- Shelley, R.M. 2006. A chronological catalog of the new world species of *Scolopendra* L, 1758. (Chilopoda : Scolopendromorpha : Scolopendridae) *Zootaxa*, **1253** : 1-50.
- Sureshan, P.M.; Dash, S., and Samantha, T. 2006. On a collection of Scolopendrid centipedes (Chilopoda : Scolopendromorpha) from Orissa with notes on some distributional records *Rec. zool. Surv. India*, **106**(3) : 27-34.
- Sureshan, P.M. and Yadav, B.E. and Radhakrishnan, C. 2004. An illustrated key to the identification of centipedes (Chilopoda : Scolopendromorpha) of Kerala. *Zoo's Print J.* **19**(3) : 1401-1407.
- Sureshan P.M. and B.E. Yadav 2008. Chilopoda : Scolopendromorpha, In : *Fauna of Goa, State Fauna Series*, **16** : 73-77 (Published by the Director, Zoological Survey of India, Kolkata).
- Sureshan P.M. and B.E. Yadav (2008) Chilopoda : Scolopendromorpha, In : *Fauna of Lonar Crater Wildlife Sanctuary*, Conserv. Area Series. 37; 155-158 Maharashtra, *Zool. Surv. India, Kolkata*.
- Sureshan, P.M; Khanna, V. and Radhakrishnan, C. 2006. Additional distributional records of Scolopendrid centipedes (Chilopoda : Scolopendromorpha) from Kerala. *Zoo's Print J.*, **21**(6) : 2285-2291.
- Yadav, B.E. (1933a) Colour variation in the centipede *Scolopendra morsitans* Linnaeus (Myriapoda : Chilopoda) from Maharashtra, India. *Rec. Zool. Surv. India*, **93**(1-2) : 159-160.
- Yadav, B.E. 1993b. On a collection centipedes (Myriapoda : Chilopoda) from Pune, Maharashtra *Rec. zool. Surv. India*, **93**(1-2) : 165-174.
- Yadav, B.E. 1993c. A report of some species of the genera *Digitipes* and *Ethmostigmus* (Chilopoda : Scolopendromorpha : Scolopendridae : Otostigminae) from Maharashtra. *Rec. zool. Surv. India*, **93**(3-4) : 313-315.
- Yadav, B.E. 1993d. Scolopendridae (Chilopoda) of Western Ghats with some records from Maharashtra State with some first records. *Rec. Zool. Surv. India*, **93**(3-4) : 321-328.
- Yadav, B.E. 1995. Invertebrate conservation : Centipedes. *Zoos' Print*, **10**(10) : 12.
- Yadav, B.E. 1994. The Scolopendrid centipedes. *Sci. and Cult.*, **60**(7-12) : 77-79.
- Yadav, B.E. 1997. First record of the giant Centipede *Scolopendra gigantea* Linnaeus (Chilopoda : Scolopendridae) from India. *Zoos' Print*, **12**(5) : 8.
- Yadav, B.E. 1999. Colour pattern in scolopendrid centipedes *Zoos' Print. J.*, **14**(8) : 96.
- Yadav, B.E. 2001. Centipedes (Chilopoda : Scolopendridae) In : *Fauna of Nilgiri Biosphere Reserve, Conservation Area Series*, **11** : 39-44 (Published by the Director, Zoological Survey of India, Kolkata).
- Yadav, B.E. 2004. Centipede (Chilopoda : Scolopendridae) In : *Fauna of Pench Natl. Park (Maharashtra) Conservation Area Series*, **20** : 275-283 (Published by the Director, Zoological Survey of India, Kolkata).

- Yadav, B.E. 2005. Chilopoda : Scolopendridae In : *Fauna of Melghat Tiger Reserv, Conservation Area Series*, **24** : 401-410 (Published by the Director, Zoological Survey of India, Kolkata).
- Yadav, B.E. 2006. Scolopendridae (Chilopoda) In : *Fauna of Andhari Tiger Reserve (Maharashtra) Conservation Area Series*, **25** : 279-282 (Published by the Director, Zoological Survey of India, Kolkata).
- Yadav, B.E. and P.M. Sureshan. 2006. Chilopoda : Scolopendromorpha., In : *Fauna of Sanjay Gandhi Natl. Park. (Invertebrate) Conservation Area Series*, **26** : 125-129. (Published by the Director, Zoological Survey of India, Kolkata).
- Yadav, B.E. 2009. Chilopoda : Scolopendromorpha : Scolopendridae, In : *Fauna of Bhimashankar Wildlife Sanctury, Conserv. Area Series*, **42** : 223-230 Pune Maharashtra. (Ed. D.ZSI., Kolkata)

ACARINA : ARACHNIDA

A.N. SIRSIKAR and D.D. WANULE

Post Graduate Dept. of Zoology and Entomology, N.E.S. Science College, Nanded-431602

INTRODUCTION

Acarina includes arthropods which are commonly called as Ticks and Mites. The acarine fauna of Maharashtra state is rich but has remained largely unexplored despite its great economic value mainly due to lack of expertise. Many mite species are phytophagous and some are even serious pests on important crop plants like Cotton, Cereals, Vegetable crops and Fruit plants. The group of predatory mites plays an important role in suppressing potential pests from reaching economic injury levels. Soil mites are an important component of soil fauna contributing to maintenance of soil productivity. House dust mites are serious allergens and cause severe allergy problems in humans dealt separately. Ticks, an important group of exclusively ectoparasitic arthropods, are known to be important veterinary pests especially in milching cattle, adversely affecting their milk producing capacity.

The acarine fauna so far documented from Maharashtra has been enlisted below (19 species under 12 genera of Prostigmata; 5 species belonging to a single genus under Mesostigmata and 10 species of Metastigmata belonging to 3 genera) with a brief account of their hosts and distribution.

SYSTEMATIC ACCOUNT

Order PROSTIGMATA

Family TETRANYCHIDAE

1. *Bryobia eharai* Pritchard and Keifer

Hosts : *Chrysanthemum* sp.; *Colocasia antiquorum*.

Distribution : Delhi, Jammu & Kashmir, Karnataka, Maharashtra, Punjab and Uttar Pradesh.

Elsewhere : Japan, Pakistan and Taiwan.

2. *Eutetranychus orientalis* (Klein)

Hosts : Citrus, peach, fig, plum, walnut, castor, cotton. *Cassia fistula*, maize, beans, *Croton*, *Tabernaemontana coronaria*, *Melia azedarach*, *Azadirachta indica*, oleander, *Euphorbia*, papaya, *Glyricedia*, *Zizyphus jujuba*, rose, *Aegle marmelos*, grass, *Anacardium viridis*, *Cassava*, banana, *Luffa* sp.

Distribution : Assam, Delhi Gujarat, Haryana, Jammu & Kashmir, Karnataka, Maharashtra, Punjab, Uttar Pradesh and West Bengal.

Elsewhere : Israel, Turkey, Jordan, Iran, Egypt, Cyprus, Sudan, South Africa, Afghanistan, Pakistan, Taiwan, Thailand, East Transvaal.

3. *Tetranychus neocaledonicus* Andre

Hosts : *Pennisetum typhoideum*, beans, *Bidens pilosa*, brinjal, cabbage, *Solanum melongena*, *S. tuberosum*, *Coriandrum*, cotton, cowpea, *Crossandra undulaefolia*, *Croton* sp., *Cucumis sativus*, *C. pepo*, *Cyperus* sp., *Tagetes erecta*, *Dodonaea viscosa*, *Dolichos lanulatus*, *Cragrostis* sp., *Euphorbia geniculata*, *E. hirta*, fig, french bean, *Geranium*, *Gladiolus* sp., grape vines, Hollyhock, *Ipomoea*, jasmine, Jowar, cucumber, 'Kulthi, lemon, lima bean, lucern, mango, tapioca, papaya, pea, pumpkin, potato, *Quamoclit vulgaris*, *Quisqualis indica*, radish, *Brassica juncea*, *Luffa aegyptica*, rose, sandal wood, *Brassica campestris*,

Melilotus parviflora, soybean, mulberry, sugerbeet, sunnherap, *Eruca saliva*, tomato, *Occimum sanctum*, castor, *Parthenium hysterophorus*, *Solanum nigrum*, lady's finger, cardamom.

Distribution : Assam, Bihar, Delhi, Gujarat, Haryana Karnataka, Kerala, Maharashtra, Meghalaya, Orissa, Punjab, Rajasthan and Uttar Pradesh.

4. *Oligonychus mangiferus* Rahman & Sapra

Hosts : *Mangifera indica*, *Eugenia jambolana*, *Syzgium cumini*, *Prunus persica*, *Psidium guvajava* *Musa paradiasica*, *Ficus carica*, *Rosa indica* and *Vitis vinifera*.

Distribution : Delhi, Haryana, Himachal Pradesh, Karnataka, Kerala, Maharashtra and Punjab.

Elsewhere : Egypt, Hawaii, Mauritius and Peru.

5. *Oligonychus tylus* (Baker & Pritchard)

Hosts : *Panicum maximum*, *Sorghum cernuum*, *Sorghum dochna* (Forsk.) Snowden, *Sorghum cernuum*, *Sorghum durra* (Forsk.) Stapf, *Sorghum milii-forme* (Hack) Snowden, *Pennisetum americanum* (L.) Leeck, *Zea mays* L., *Pennisetum purpureum*, *X. typhoideus*, *Arundo donax* L., *Echinochloa colonum* (L.) Link, *Eleusine indica* Gaertn., *Sporobolus fertilis* (Steud.) Clayton, *Digitaria ciliaris* (Retz) Koel, *Chionachne koenigii* (Spr.) Thw., *Setaria pallide-fusca* (Sehum.) Stapf et Hubb., *Apluda mutica* L. *Coix aquatica* Roxb, *Dinebra retroflexa* (Wall) Panz., *Dendrocalamus strictus* Nees.

Distribution : So far this species has been reported only from Maharashtra state in India.

Elsewhere : Israel.

6. *Oligonychus indicus* (Hirst)

Hosts : *Andropogon sorghum*, *Areca catechu* (Areca nut), sp., *Chrysopogon* sp., Coconut, *Cynodon dactylon*, *Dicanthium annulatum*, *Elusine 'egypticum* grasses. *Musa* sp., *Panychum distachyum*, *P.javanicum*, *Panicum* sp.,

Pennisetum typhoides, *Saccharum* sp., *S. arundinaceum*, *S. munia*, *S. officinarum*, *Sorghum bicolour*, *S. halepense*, *S. vutgare*, *Zea mays*.

Distribution : Andaman & Nicobar Islands, Andhra Pradesh, Bihar, Delhi, Haryana, Karnataka, Maharashtra, Orissa, Punjab, Tamilnadu and Uttar Pradesh.

Family TENUIPALPIDAE

7. *Brevipalpus phoenicis* (Geij.)

Hosts : *Abutilon* sp., *Artocarpus heterophyllus*, *Cucurbita* sp., *Acalypha hispida*, *Alpinia* sp., *Althea rosea*, *Annona squamosa*, *Aralia* sp., *Artocarpus altilis*, *Barleria cristata*, *B. cuspidata*, *B. biternata*, *Cassia spectabilis*, *Cestrum diurnum*, *Cerebera odollam*, *Citrus aurantium*, *Pheseolus vulgaris*, *Citrus decumna*, *C. medica*, *Clerodendron* sp., *Cocos nucifera*, *Coffea arabica*, *Cosmos* sp., *Crescentia cujeta*, *Dahlia* sp., *Eranthemum* sp., *Geranium* sp. *Gerbera* sp., *Helianthus annuus*, *Hibiscus rosa-sinensis*, *Nerium odorum*, *Nyctanthes arbortristis*, *Plumeria alba*, *Plumeria* sp., *Psidium guvajava*, *Rosa* sp., *Sida* sp., *Solanum melongena*, *Theobroma cacao*, *Thunbergia alata*, *Vitex negundo*, *Thea sinensis*, *Punica granatum*, *Bignonia venusta*, grape vines, *Oroxylum indicum*, *Punica granatum*, *Zinia* sp., *Sesamum indicum* *Eryobotrya japonica*, *Musa paradisica*, *Ficus carica*, *Prunus persica*, *Morus* sp.

Distribution : Assam, Bihar, Himachal Pradesh, Karnataka, Maharashtra, Meghalaya, Punjab, Delhi, Orissa, and Tamil Nadu.

Elsewhere : Argentina, Australia, Brazil, California, Columbia, Ethiopia, Florida, Hawaii Holland, Italy, Kenya, Malay Mauritius, Okinawa Isl., Philippines, Portugal Sicily, Spain, Syria, Taiwan, Tanganyika Texas, Trinidad and Venezuela.

8. *Tenuipalpus amygdalusae*

Maninder & Ghai

Host : *Amygdalus communis*.

Distribution : Maharashtra.

Family ERIOPHYIDAE

9. *Aceria cajani* Channa Basavanna*Host : Cajanus cajan.**Distribution : Delhi, Karnataka and Maharashtra.*10. *Aceria cernuus* (Masee)*Host : Zizyphus jujuba.**Distribution : Throughout India.*11. *Aceria cheriani* (Masee)*Host : Pongamia pinnata.**Distribution : Throughout India.*12. *Aceria jasmini* Channa Basavanna*Host : Jasmine.**Distribution : Karnataka, Maharashtra, Tamil Nadu.*13. *Aceria gastrotrichus* (Nalepa)*Host : Ipomoea staphylinia**Distribution : Karnataka, Maharashtra and Tamil Nadu.**Elsewhere : East Indies.*14. *Aceria guerreronis* Keifer*Host : Coconut.**Distribution : Throughout India.*15. *Epitrimerus chandramohani*
Mohansundaram*Host : Undetermined host plant.**Distribution : Maharashtra.*16. *Metaculus londaensis* Mohansundaram*Host : Undetermined host tree.**Distribution : Maharashtra.*

Family TARSONEMIDAE

17. *Polyphagotarsonemus latus* (Banks)*Hosts : Jute, cotton, Zinnia, marigold, dahlia,**Datura, Amaranthus, chilli, potato, tomato, brinjal, cucurbits, tea, cowpea, cluster-bean, sword-bean, lablab, dew-gram, horse-gram, green-gram, hollyhock, kidney-bean, Sesamum, thorn-apple.**Distribution : Bihar, Karnataka, Maharashtra, Punjab, Uttar Pradesh., West Bengal.*

Family ERYTHRAEIDAE

18 *Leptus poonaensis* Khot*Host : Fig.**Distribution : Maharashtra.*

Family PONTARACHIDAE

19. *Litarchana denhami* (Lohmann)*Distribution : Maharashtra (Malvan), Arabian Sea among subtidal macroalgae, West coast of India.**Elsewhere : Korea, Red sea, South Africa, Western Australia.*

Order MESOSTIGMATA

Family PHYTOSEIIDAE

20. *Amblyseius (Amblyseius) adhatodae* Muma*Hosts : Ipomoea sp., Adhatoda vasica.**Distribution : Maharashtra.*21. *Amblyseius (Amblyseius) ipomoeae* Ghai
& Menon*Host : Ipomoea sp.**Distribution : Maharashtra.*22. *Amblyseius (Euseius) ovalis* (Evans)*Hosts : Arecanut, banana, Ficus, Bougainvillea spectabilis, Terminalia arjuna mango, grass, beans, lucern, castor, Nerium indicum, coconut, Bauhinia purpurea, pomegranate, rose, coffee, paddy, Vitex pubescens, Tabernaemontana coronaria, cashew nut, chrysanthemum, sugarcane.**Distribution : Andaman Nicobar Isls, Andhra Pradesh, Bihar, Gujarat, Karnataka, Kerala, Maharashtra, Manipur, Meghalaya, Pondicherry, Tamil Nadu, Tripura and West Bengal.*

Elsewhere : Hawaii, Hong Kong, Indonesia, Japan, Malaya, Mauritius, Mexico, New Zealand.

23. *Amblyseius (Paraphytoseius) multidentatus*
(Swirski & Shechter)

Hosts : *Eupatorium odoratum*, *Datura metel*, rose paddy, pigeon-pea, *Rubus* sp., banana, pear, brinjal, fern, *Shorea robusta*, sunflower, cashew nut, *Dalbergia* sp., *Ipomoea*-, cotton.

Distribution : Andaman Isl., Andhra Pradesh, Arunachal Pradesh Assam, Bihar, Jammu & Kashmir, Karnataka, Maharashtra, Meghalaya, Orissa, Punjab, Tamil Nadu, Tripura, Uttar Pradesh and West Bengal.

Elsewhere : Hong Kong, Madagascar, Malagasy, Nigeria, Thailand.

24. *Amblyseius (Typhlodromalus) havu*
Pritchard & Baker

Host : *Clerodendron serratus*.

Distribution : Maharashtra.

Elsewhere : Africa.

Order METASTIGMATA

Family IXODIDAE

25. *Hyalomma anatolicum anatolicum* (Koch)

Hosts : Buffalo, goat, camel, cattle, horse, mule, pig, sheep and monkey.

Distribution : Andhra Pradesh, Delhi, Gujarat, Himachal Pradesh, Maharashtra and Madhya Pradesh.

26. *Hyalomma detritum* Schulze

Hosts : Buffalo, dog, goat, cattle, horse, pony and sheep

Distribution : Bihar, Haryana, Himachal Pradesh, Jammu and Kashmir, Karnataka, Maharashtra, Madhya Pradesh, Orissa, Punjab, Tamil Nadu and Uttar Pradesh.

27. *Hyalomma excavatum* (Koch)

Hosts : Goat, donkey, dog, camel, cattle, horse, sheep and bear.

Distribution : Bihar, Delhi, Haryana, Maharashtra, Orissa, Rajasthan, Tamil Nadu and Uttar Pradesh.

28. *Hyalomma hussaini* Sharif

Hosts : Buffalo, camel, dog, goat, cattle, horse, pony, bear and nilgai.

Distribution : Bihar, Delhi, Gujarat, Himachal Pradesh, Jammu and Kashmir, Madhya Pradesh, Maharashtra, Orissa, Punjab and Tamil Nadu.

29. *Hyalomma brevipunctata* Sharif

Hosts : Buffalo, camel, dog, goat, cattle, horse, human and various other mammals such as *Suncus murinus* (Linn), *Vandeleuria oleracea* (Bennett), *Mus platythrix* (Bennett), *M. booduga* (Gray), *Rattus (Millardia) meltada* (Gray), *Rattus rattus rufescens* (Gray), *Rattus rattus wroughtoni* (Hinton), *Rattus blankardi* (Thomas) and *Funambulus tristatus*.

Distribution : Andhra Pradesh, Bihar, Delhi, Gujarat, Karnataka, Madhya Pradesh, Maharashtra, Orissa, Punjab, Tamil Nadu and West Bengal.

30. *Hyalomma kumari* Sharif

Hosts : Buffalo, camel, dog, goat, sheep, horse, cow, wild goat, barking deer, Indian muntjak and tiger.

Distribution : Assam, Bihar, Delhi, Gujarat, Maharashtra, Orissa, Punjab and Uttar Pradesh.

31. *Hyalomma marginatum* Isaaci Sharif

Hosts : Camel, dog, goat, cattle, horse, sheep and bear.

Distribution : Bihar, Delhi, Maharashtra, Orissa, Tamil Nadu and Uttar Pradesh.

32. *Haemaphysalis intermedia* Warbuton and Nuttall

Distribution : Maharashtra (Pune).

33. *Rhipicephalus sanguineus* (Latreille)

Host : Dog.

. *Distribution* : Maharashtra Pune (Satavwadi & Hadapsar suburbs).

species of 3 genera (Metastigma) so far reported from the state are enumerated.

34. *Rhipicephalus turanicus* Pomerantzev

Host : Dog.

Distribution : Maharashtra Pune (Magarpatta suburbs).

ACKNOWLEDGEMENTS

We are thankful to the authorities of Science College, Nanded for providing facilities. We also acknowledge the opportunity provided to contribute this work by Dr. K. Venkatraman, Director, Zoological Survey of India, Kolkata and Dr. R.M. Sharma, Scientist-D & Officer-in-Charge, Zoological Survey of India, Pune.

SUMMARY

19 species under 12 genera (Prostigma), 5 species under one genus (Mesostigmata) and 10

REFERENCES

- Gupta, S.K. 1985. Handbook plant mites of India, Published by Director, Zoological Survey of India, Calcutta, 700012, pp. 520.
- Mahadev, P.V.M. 1981 Restricted occurrence of *Rhipicephalus sanguineus* and *R. turanicus* (Ixodidae : Metastigmata), in Pune district Maharashtra state, pp-33-35 Contribution to acarology in India edited by ChannaBasvanna-Acarological society of India, Univ. of Agricultural Sciences, Hebbal, Bengaluru-255pp.
- P.M. Patil. 1977. Studies on the biology of an arachnid, *Hylomma anatolicum anatolicum* (Koch) Ph. D. Thesis Submitted to Marathwada University (Now Dr. BAM University), Aurangabad.
- Sadana, G.L. 1985. Plant feeding mites of India (Teternychoidea) Kalyani Publishers, New Delhi, pp.
- Sharma, R.M. 2003. Checklist of plant galls (Zooecidia) from Maharashtra state *Ann.. For.*, 11(2) : 101-112.
- Sirsikar, A.N. and R. Nagabhushanam. 1982. On the occurrence and host spectrum of *Oligonychus tylos* a potential mite pest of sorghum and other cereals. *Indian Bot. Repr.*, 1(2) : 166-167.
- Sirsikar, A.N. 1982. Studies on some aspects of biology of plant mites of Marathwada, Ph.D. Thesis, Submitted to Marathwada University (Now BAM University), Aurangabad
- Vladimir, P., T. Chatterjee, Bennk Chan and B. Ingole 2003. Marine water mites (Acari : Hydrachinda : Pontarachidae) from Taiwan, Korea and India with first description of the *Pontarachna australis* [http ://drs.nio.org/drs/biseream/2264/1061/3/syst_appl_acarology_13_70p.pdf](http://drs.nio.org/drs/biseream/2264/1061/3/syst_appl_acarology_13_70p.pdf) (accessed on 21.8.2011).

ARACHNIDA : ACARINA : ASTIGMATA (HOUSE DUST MITES)

S.B. JOGDAND

Department of Botany, Yashwantrao Mohite College, Yerendwane, Pune-411 038

INTRODUCTION

Now a days the study of house dust mites (HDM) as metropolitan bio-resource has acquired great attention of scientists because of their biodiversity, nutritional and environmental adaptability and vast inhabitation on varied substrates in indoor and outdoor, leading to their significant importance.

The term "House Dust Mites" usually refers to those species of mite family Pyroglyphidae under Astigmata of Arachnida that are known to commonly occur in the dust of human dwellings. These species belong to five genera, *Dermatophagoides*, *Euroglyphus*, *Hirstia*, *Malayanoglyphus* and *Pyroglyphus* (Spieksma, 1990). Subsequently many species have been added as listed in this paper. HDM are usually microscopic and show variation in their size, shape, colour, structure. Usually they are 300-500 μ in size, oval to round or elongate in shape, colourless, ash coloured, red or variously coloured and lack neck. Sclerotized body cover has various designs.

Kern (1921) was the first to discover *Dermatophagoides pteronyssinus* as potent allergen from USA. At present 36 species are known from the world of which 29 species are recorded from India (Modak et al 1991). Out of these, 20 species are reported from Maharashtra state (Jogdand, 2007). Probably many more species may be expected from the state if concerted efforts are taken to collect them from various ecozones.

Prominent role of different acarid mites in soil conservation, recycling of materials in ecosystems, bio control of weeds and other harmful organisms by predator mites, vectors of some diseases, parasitic nature, their use in human and veterinary medicines as antigens for immunotherapy, as decomposers as potent allergens etc have gained significance in sustainable development of the environment.

SYSTEMATIC LIST

Family PYROGLYPHIDAE

Subfamily DERMATOPHAGOIDINAE

1. *Dermatophagoides pteronyssinus* Trouessart
European bed mite
2. *Dermatophagoides farinae* Hughes
American Floor mite
3. *Hirstia domicola* Fain, Oshima, Bronswijk

Family GLYCYPHAGIDAE

4. *Blomia tropicalis* Bronswijk, Cock, Oshima
Dust mite
5. *Glycyphagus* sp
6. *Ghoieria fusca* Oudemans:
Blood sucking mite

Family CHEYLETIDAE

7. *Cheyletus erudatus* Scharank Poultry mite
8. *Dermanyssius gallinae* Poultry mite

Family ACARIDAE

9. *Acarus siro* Linn. 1758 Flour mite
10. *Tyrophagus putrescentiae* Scharank

- | | |
|--|-----------------------|
| 11. <i>Caloglyphus oudemansi</i> | Fowl mite |
| 12. <i>Campylochirus</i> sp. | Pig mite |
| 13. <i>Euroglyphus</i> sp. | |
| 14. <i>Sarcoptes scabiei</i> De Geer, 1778 | Scabies mite |
| 15. <i>Ornithonyssus bacoti</i> (Hirst, 1913) | Poultry mite/Rat mite |
| 16. <i>Diplaegidia columbae</i> | Pigeon mite |
| 17. <i>Pterophagus strictus</i> , Mengin, 1877 | Pigeon mite |
| 18. <i>Scheloribates</i> sp. | Oribatid mite |
| 19. <i>Oribatida</i> sp. | Oribatid mite |
| 20. <i>Oppia</i> sp. | |

SUMMARY

Altogether, 20 species in 19 genera of house dust mites are reported from Maharashtra state.

ACKNOWLEDGEMENTS

The author is thankful to the authorities of Yeshwantrao Mohite College, Pune for facilities and encouragements. He also expresses his gratitude to Dr. K. Venkatraman, Director, Zoological Survey of India, Kolkata and Dr. R.M.Sharma, Scientist-D & Officer-in-Charge, Zoological Survey of India, Pune for providing opportunity to contribute the study.

REFERENCES

- Kern, R. 1921. Dust sensitization in bronchial asthma, M. Chin, N. America, **5** : 751-758.
- Modak, A., Saha, G.K., Tandon, N., and S.K.Gupta.1991. Dust mite fauna in houses of bronchial asthma patients- a comparative study of three zones of West Bengal. *Entomon*, **16**(12) : 115-120
- Jogdand, S.B. 2007. Mites as a Bioresource of India in Conservation and Sustainable Development of Environment. *Endemic Bioresources of India- Conservation & Sustainable Development with special Reference to North-East India*.Pp. 293-329.Published by Bishen Singh Mahendra Pal Singh, Dehradun, India.

CHIGGER MITES (ARACHNIDA : ACARINA : TROMBICULIDAE)

R. BANO and R.M. SHARMA

Zoological Survey of India, Western Regional Centre, Pune-411044

INTRODUCTION

Chigger mites are usually bright red in color and commonly known by several names as red bugs, itch mites, scrub mites etc. Only larvae are parasitic in nature and have wide range of vertebrate hosts including mammals, birds, reptiles, and amphibians. Dermatitis and severe allergic reactions are caused in human beings. The larval mites most frequently attach themselves at hair follicles of the ears, the thigh and inter-nasal regions of their hosts. They are vectors of the rickettsiosis, a disease called scrub typhus caused by *Rickettsia tsutsugamushi* endemic to the Oriental, Australian and Palearctic regions but not in the New World, Europe or Africa (Traub and Wisseman, 1974 & Brown *et al.*, 1978; Nadchatram, 1984). The nymphs and adults are free-living predators and live in the soil of grasslands and forests, in mammal nests and burrows, crevices of decaying wood, bat caves, lawns, and marsh areas. Worldwide, the family is represented by over 3000 species out of which 204 species are recorded from India (Stan Fernandes and Kulkarni, 2003). A perusal of literature revealed the occurrence of 50 species belonging to 17 genera under two subfamilies from Maharashtra State.

SYSTAMETIC ACCOUNT

Class ARACHNIDA
Subclass ACARINA
Order ACARIFORMES
Family TROMBICULIDAE

Subfamily LEEUWENHOEKIINAE

1. *Odontacarus (Leogonius) indica* Nadchatram and Joshee
2. *Whartonia (Fascutonia) brennani* Hiregaudar and Bal
3. *Whartonia (Fascutonia) indica* Hiregaudar and Bal
4. *Whartonia (Fascutonia) kumaonensis* Bhat

Subfamily TROMBICULINAE

Tribe Trombiculini

5. *Trombicula hypodermata* Nadchatram and Traub
6. *Trombicula schmitzi* (Oudemans)
7. *Chiroptella (Chiroptella) bandupi* (Hiregaudar and Bal)
8. *Fonsecia (Fonsecia) ptyasi* Rao and Hiregaudar
9. *Leptotrombidium (Leptotrombidium) delience* (Walch)
10. *Leptotrombidium (Leptotrombidium) kulkarnii* Vercammen-Grandjean and Langston
11. *Leptotrombidium (Leptotrombidium) multisetosum* (Joshee)
12. *Leptotrombidium (Leptotrombidium) sinharhense* Kulkarni
13. *Leptotrombidium (Ericotrombidium) bhattipadense* (Joshee)
14. *Leptotrombidium (Ericotrombidium) rajaniae* Kulkarni
15. *Leptotrombidium (Ericotrombidium) vietzi* (Womersley)

16. *Microtrombicula (Microtrombicula) kajutekrii* (Joshee) Kulkarni
17. *Microtrombicula (Microtrombicula) munda* (Gater) 35. *Gahrliopia khandalaensis* Kulkarni
18. *Miyatrombicula najai* (Hiregaudar) 36. *Gahrliopia murini* Stan Fernandes and Kulkarni
19. *Neotrombicula autumnalis* (Shaw) 37. *Gahrliopia punensis* Stan Fernandes and Kulkarni
- Tribe Schoengastiini** 38. *Schoengastiella bengalensis* Hirst
20. *Schoengastia propria* Audy and Womersley 39. *Schoengastiella argalea* Traub and Morrow
21. *Ascoschoengastia guptai* Kulkarni 40. *Schoengastiella ceylonica* (Womersley)
22. *Ascoschoengastia indica* (Hirst) 41. *Schoengastiella galarea* Stan Fernandes and Kulkarni
23. *Ascoschoengastia roluis* (Traub and Audy) 42. *Schoengastiella herulata* Stan Fernandes and Kulkarni
24. *Helenicula globularis* (Walch) 43. *Schoengastiella homunguis* (Abdussalam)
25. *Helenicula kohlsi* (Philip and Woodward) 44. *Schoengastiella ligula* Radford
26. *Herpetacarus (Herpetacarus) longisetosa* (Hiregaudar) 45. *Schoengastiella punctata* Radford
27. *Herpetacarus (Herpetacarus) schlugeri* (Radford) 46. *Schoengastiella ralagea* Stan Fernandes and Kulkarni
28. *Riedlinia coeca* Oudemans 47. *Schoengastiella ramachandrai* (Kulkarni)
29. *Schoutedenichia (Schoutedenichia) goffi* Stan Fernandes and Kulkarni 48. *Schoengastiella shrivastavi* (Srivastava and Wattal)
30. *Schoutedenichia (Schoutedenichia) nagpurensis* Srivastava and Wattal 49. *Schoengastiella sicata* Stan Fernandes and Kulkarni
- Tribe Gahrliopiini** 50. *Schoengastiella singularis* Stan Fernandes and Kulkarni
31. *Gahrliopia armata* Stan Fernandes and Kulkarni
32. *Gahrliopia armigera* Stan Fernandes and Kulkarni
33. *Gahrliopia crassiscuti* Stan Fernandes and Kulkarni
34. *Gahrliopia dhandai* Stan Fernandes and

SUMMARY

An enumeration of 50 species under 17 genera of the family Trombiculidae (Acarina) from Maharashtra State is provided.

REFERENCES

- Brown, G.W.; J.P. Saunders; Sandhu Singh; D.L. Huxoll and A. Shirai. 1978. Single dose doxycycline therapy for scrub typhus. *Trans. R. Soc. Trop. Med. Hyg.*, **72** : 412-16.
- Nadchatram, M. 1984. The natural history of the genus *Leptotrombidium* (Acari: Trombiculidae) with reference to scrub typhus. Pp. 1107-13, *In* D.A. Griffiths and C.E. Bowman, eds., *Acarology*, VI, Vol.2. Ellis Horwood, Chichester, England.
- Stan Fernandes, S.J. and Kulkarni, S.M. 2003. Studies on the trombiculid mite fauna of India. *Zoological Survey of India, (Occ. Paper)* **212** : 539 pp.
- Traub, R. and C.L. Wisseman, Jr. 1974. The ecology of chigger-borne rickettsiosis (scrub typhus). *J. Med. Entomol.*, **11** : 237-303.

ARACHNIDA : SCORPIONIDA

D.B. BASTAWADE

Retd. Scientist, Zoological Survey of India, Western Regional Centre, Pune-411044

INTRODUCTION

The order Scorpionida is a member of the class Arachnida, occurring in Silurian period. They are the most abundant in arid and semi-arid zones and widely distributed in tropical and subtropical areas. All species of scorpions are poisonous though all are not fatal to human beings. The scorpions are nocturnal and shy animals; try to hide under stones, barks and thin crevices, burrows and occasionally in dark corners of houses. According to the habitats, the scorpions are divided into three categories as burrowing (Psammophilous or Pelophilous), Rock dwelling (Lithophilous) and Arboreal. All scorpions are carnivorous in nature and cannibalism is rarely seen. Scorpions can survive without food for a long time. The mating is very remarkable process in scorpions. After mating, males run away or sometimes are killed and eaten by females. The young ones remain on mothers back for 10 to 20 days during which they complete two molts. At the time of birth, the young ones of all species are white in colour and after first molt they start changing their body colour.

Order Scorpionida is composed of 9 living families of which 5 are represented in the Indian subcontinent. The knowledge on Indian Scorpionida is mainly based on Pocock (1900) and Tikader and Bastawade (1983). Other significant contributions are by Bastawade (1986a, b, 1998, 2004, 2005, 2006a, b), Mirza *et al.* (2010) and Zambre *et al.* (2011).

The present communication deals with 34 species under 10 genera belonging to 4 families

from Maharashtra. All the reported species are actually studied by the author at Zoological Survey of India, Western Regional Centre, Pune.

SYSTEMATIC LIST

Class: Arachnida

Order: Scorpionida

Family: Buthidae

Subfamily: Buthinae

1. *Lychas rugosus* Pocock, 1897
 2. *Lychas kamshetensis* Tikader and Bastawade, 1983
 3. *Lychas kharpadi* Bastawade, 1986
 4. *Lychas aareyensis* Mirza & Sanap, 2010
 5. *Orthochirus flavescens* Pocock, 1897
 6. *Orthochirus bicolor* Pocock, 1897
 7. *Orthochirus bastawadei* Zambre *et al.* 2011
 8. *Buthoscorpio politus* (Pocock, 1899)
 9. *Charmus sinhagadensis* Tikader and Bastawade, 1983
 10. *Hottentotta tamulus concanensis* Pocock, (1900)
 11. *Hottentotta tamulus tumulus* Fabricius, 1798
 12. *Hottentotta rugiscutis* Pocock, 1897
 13. *Hottentotta pachyurus* Pocock, 1897
 14. *Stenochirus sarasinorum* Pocock, 1899
- Subfamily CENTRURINAE
15. *Isometrus (Reddyanus) vittatus* Pocock, 1900
 16. *Isometrus (Reddyanus) thrustoni* Pocock, 1893

17. *Isometrus (Reddyanus) rigidulus* Pocock, 1897
18. *Isometrus (Reddyanus) isadensis* Tikader and Bastawade, 1983
19. *Isometrus (Reddyanus) acanthurus* Pocock, 1899
20. *Isometrus (Isometrus) europaeus* Linnaeus, 1758
28. *Heterometrus (Chersonesometrus) fastigiosus* Couzijn, 1981
29. *Heterometrus (Chersonesometrus) wroughtoni* Pocock, 1899
30. *Heterometrus (Chersonesometrus) fulvipes* Koch, 1838
31. *Heterometrus (Chersonesometrus) xanthopus* Pocock, 1897

Family EUSCORPIIDAE

Subfamily SCORPIOPSINAE

21. *Neoscorpiops deccanensis* (Tikader and Bastawade, 1978)
22. *Neoscorpiops satarensis* (Pocock, 1900)
23. *Neoscorpiops tenuicauda* (Pocock, 1894)

Family HEMISCORPIIDAE

24. *Iomachus surgani* Bastawade 1986

Family SCORPIONIDAE

Subfamily SCORPIONINAE

25. *Heterometrus (Heterometrus) bengalensis* Koch, 1842
26. *Heterometrus (Gigantometrus) swammerdami* Simon, 1872
27. *Heterometrus (Chersonesometrus) granulomanus* Couzijn, 1981

32. *Heterometrus (Chersonesometrus) kanaraensis* Pocock, 1900
33. *Heterometrus (Chersonesometrus) pelekomanus* Couzijn, 1981
34. *Heterometrus (Chersonesometrus) phipsoni* Pocock, 1893

SUMMARY

34 species under 10 genera belonging to 4 families of scorpions occurring in Maharashtra state are enumerated.

ACKNOWLEDGEMENTS

The author is thankful to Dr. K. Venkatraman, Director, Zoological Survey of India, Kolkata and Dr. R.M.Sharma, Scientist-D & Officer-in-Charge, Zoological Survey of India, Pune for providing opportunity to contribute the study.

REFERENCES

- Bastawade, D.B. 1986a. New species of scorpion of the genus *Lychas* (Buthidae : Scorpionida) from Nasik District, Maharashtra, India. *J. Bombay nat. Hist. Soc.*, **83**(3) : 643-637.
- Bastawade, D. B. 1986b. The first record of the family Ishnuridae (Scorpionida : Arachnida) from Nasik district, Maharashtra with description of a new species of a Genus *Iomachus* Pocock. *Entomon*, **12**(2) : 101-114.
- Bastawade, D.B. 1998. Distribution of *Neoscorpiops* Scorpions in the Western Ghats of Maharashtra, Gujarat and possible trichobothridial variations among isolated populations. *J. Bombay nat. Hist. Soc.*, **94**(1) : 104-114.
- Bastawade, D.B. 2004. *Fauna of Pench National Park*, Arachnida : Scorpionida, Araneae and Solifugae, *Conservation Area Series*, **20** : 285-312.
- Bastawade, D.B. 2005. *Fauna of Melghat Tiger Reserve*, Arachnida : Scorpionida and Solifugae, *Conservation Area Series*, **24** : 411-419.
- Bastawade, D.B. 2006a. *Fauna of Sanjay Gandhi National Park*, Arachnida : Scorpionida and Amblypygi, *Conservation Area Series*, **26** : 131-138.

- Bastawade, D.B. 2006b. *Fauna of Tadoba Andhari Tiger Reserve*, Arachnida : Scorpionida and Solifugi, *Conservation Area Series*, **25** : 283-309.
- Mirza. Z.A., Sanap. R.V. 2010. Description of a new species of scorpion of the genus *Lychas* C.L. Koch, 1845 (Scorpiones: Buthidae) from Maharashtra, India. *Journal of Threatened Taxa*, **2**(4) : 789-796.
- Pocock, R.I. 1900. Fauna of British India, Arachnida, London : 1-279.
- Tikader. B.K. and Bastawade. D.B. 1983. *The Fauna of India, Scorpions*, Scorpionida : Arachnida Vol. **3** : 1-673.
- Zambre. A.M., Mirza. Z.A., Sanap R.V., Raman Upadhye. R. and Maqsood Javed. S.M. 2011 : A new species of *Orthochirus* Karsch, 1892 (Scorpiones : Buthidae) from Maharashtra, India, *Occasional Publications in Scorpiology* 2011, No. 107.