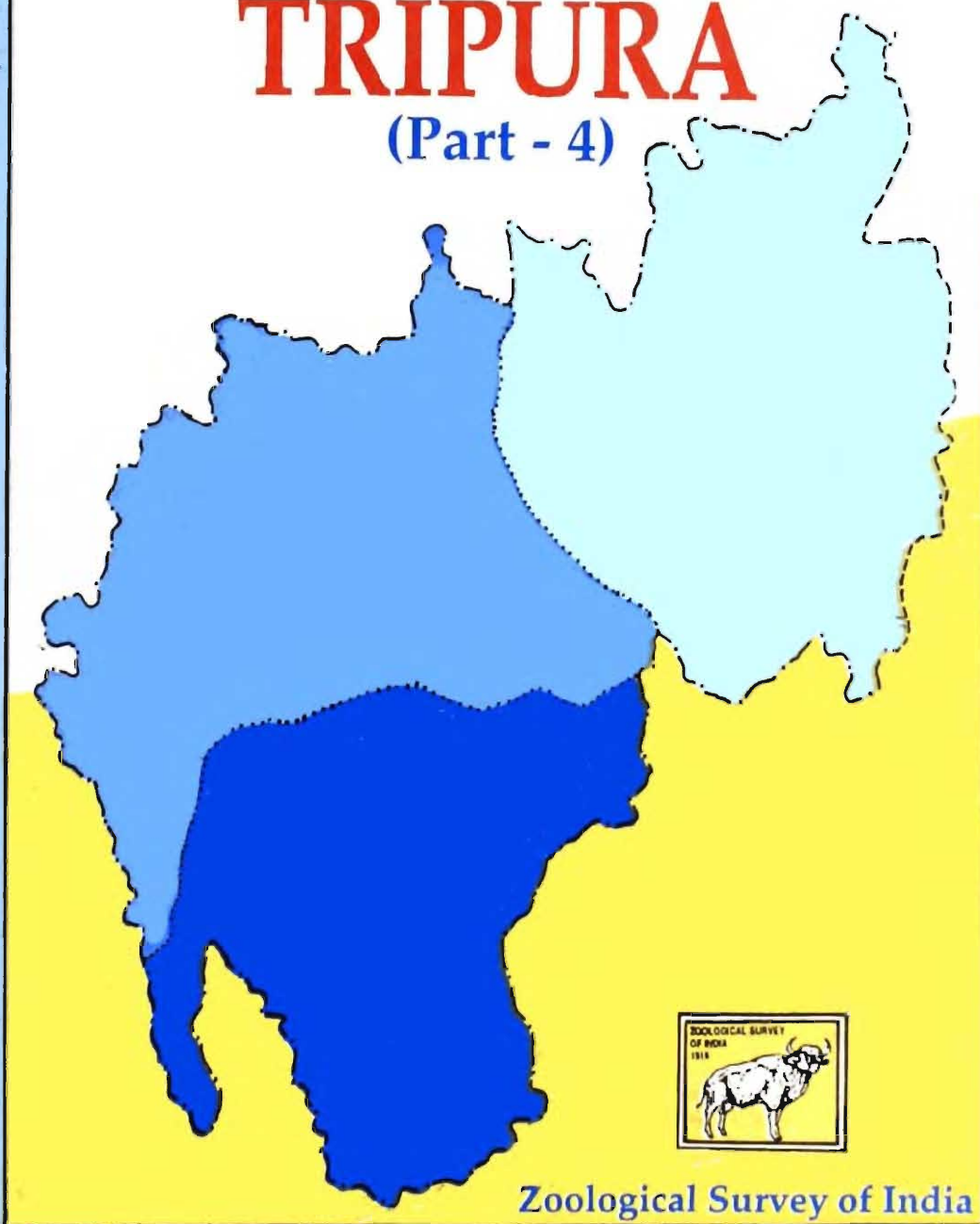


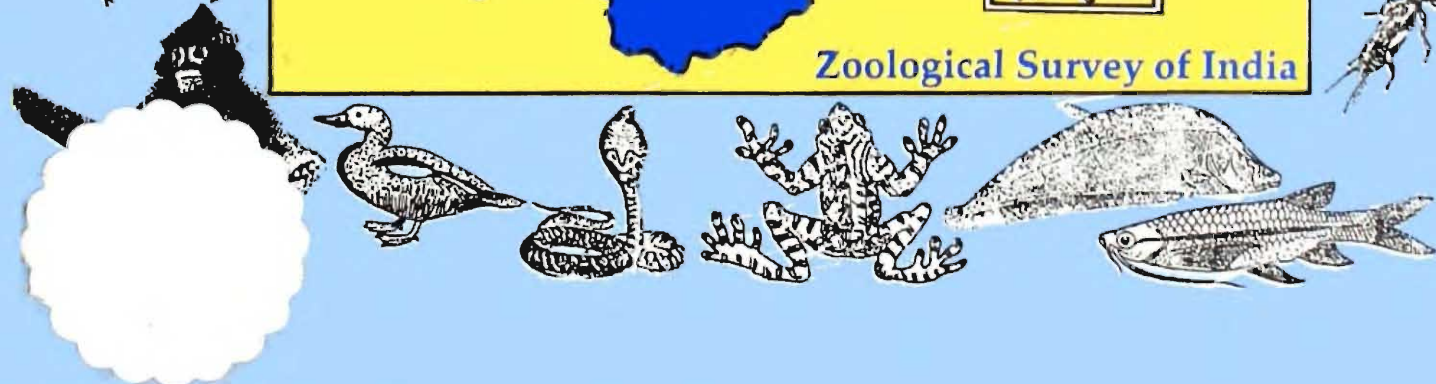
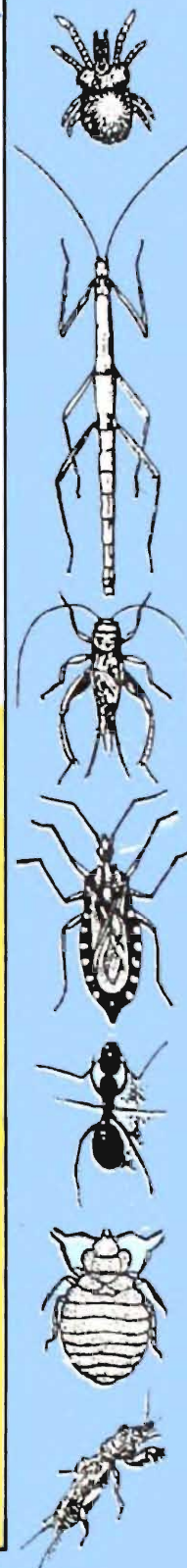
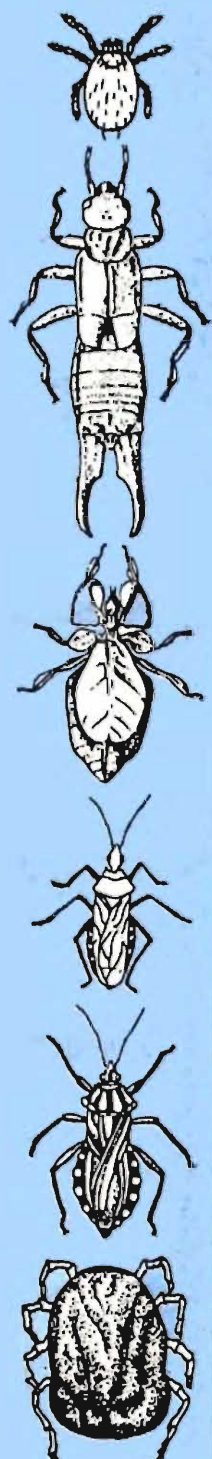
State Fauna Series - 7

FAUNA OF TRIPURA

(Part - 4)



Zoological Survey of India



State Fauna Series 7

FAUNA OF TRIPURA

PART-4

Edited by

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Zoological Survey of India, Calcutta**



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STATE FAUNA SERIES
FAUNA OF TRIPURA

PART-4

2000

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PROTOZOA

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INTRODUCTION

Taxonomic work on Protozoa from Tripura is almost untouched. Perusal of available literature reveals that there is no published report on the occurrence of any protozoan species from the state excepting a single parasitic flagellate, *Trypanosoma rotatorium* which was reported by Ray and Choudhury (1983) from anuran blood. However, they (*op. cit.*) did not mention the name of anuran species from which this flagellate was recovered from Tripura. In this context, an attempt has been made to present a consolidated systematic account of 102 species of protozoa solely based on material collected by the scientists of the Zoological Survey of India during 1991-92 from all the three districts of the state.

The present material include 45 species of freeliving, 37 species of parasitic and 20 species of symbiotic protozoa. Amongst these, one species of freeliving ciliate is new to sciences, 7 species are reported for the first time from India and 93 species constitute new records for the state. The present systematic account is dealt with under three broad categories, *viz.*, freeliving, parasitic and symbiotic for the convenience of taxonomic treatment and for maintaining the earlier convention of the State Fauna Series published by the Zoological Survey of India on this group.

MATERIAL AND METHODS

Freeliving protozoa were collected from freshwater ponds and streams as well as from

mosses grown on soil, rocks and trees of different habitats, covering all the three districts of Tripura. Parasitic and symbiotic protozoa were recovered from different host species as mentioned in the following systematic list and taxonomic account.

Freshwater samples were collected along with little algal mass, water weeds, bottom ooze and flocculent matter arising out of washing of aquatic vegetation of the sampling localities. Samples were kept in wide mouthed glass jars. These jars were brought to the laboratory and kept for few days, with their lids open for considerable increase in protozoa population. 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 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 perepheral organellae. Schaudinn's fluid and Carnoy's fluid were used as fixatives of freeliving ciliates for making their permanent slides. 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. These slides were mounted in DPX.

For preparing permanent slides of testacid rhizopods empty tests were isolated from bottom

ooze. Testacids were also collected by squeezing different parts of aquatic vegetation including their roots and submerged portion of leaves. The testacids are placed on micro-slides, air dried after two to 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 a day or two aqueous drops drawn from the moss by micropipette were kept on microslides and examined thoroughly under the light microscope. Any testacid or ciliated protozoa observed in those drops was fixed, stained and mounted in the same manner as stated earlier for freshwater protozoa.

In order to collect parasitic protozoa host samples collected from the field were brought to the camp laboratory. The hosts were then dissected and their different organs and tissues, namely, lumen of the digestive tract, body cavity, gill, gall bladder, lung, liver, spleen, blood, etc., were thoroughly examined for different groups of parasitic protozoa. Gut contents were examined after diluting them with physiological saline. Organ smears and blood smears were drawn on clean and grease-free slides, air dried, fixed and/or stained mostly with Giemsa and Leishman's stains. The lumen dwelling forms as and when observed in physiological saline were fixed in Schaudinn's fixative and stained with Heidenhain's iron haematoxylin. Faecal samples were kept in 2.5 per cent potassium dichromate solution for subsequent sporulation of coccidial oocysts, if any.

For the collection of flagellate symbiotes of termites, the entire gut of the worker caste was removed and gut contents were emptied on clear slides containing a drop of 0.5 per cent saline. Sometimes 67 per cent Lock's solution was used, in which these protozoans remain

less deformed in living condition and considerably active for a longer period. For preparing permanent slides, these flagellates were fixed in Schaudinn's fixative, stained with Heidenhain's iron haematoxylin and mounted in DPX. For more details Das *et al*, (1993, 1995) may be consulted.

SYSTEMATIC LIST

A. FREELIVING PROTOZOA

Phylum SARCOMAS-
TIGOPHORA

Subphylum SARCODINA

Class LOBOSEA

Order ARCELLINIDA

Family ARCELLIDAE

Genus *Arcella* Ehrenberg

1. *Arcella discoides* Ehrenberg

Genus *Lesquereusia*
Schlumberger

2. *Lesquereusia spiralis* (Ehrenberg)

Family DIFFLUGIIDAE

Genus *Centropyxis* Stein

3. *Centropyxis aculeata* (Ehrenberg)
4. *Centropyxis aerophila* Deflandre
5. *Centropyxis arcelloides* Penard
6. *Centropyxis constricta* (Ehrenberg)
7. *Centropyxis minuta* Deflandre
8. *Centropyxis platystoma* (Penard)

Genus *Diffflugia* Leclerc

9. *Diffflugia acuminata* Ehrenberg
10. *Diffflugia corona* Wallich
11. *Diffflugia lithophila* (Penard)
12. *Diffflugia lobostoma* Leidy

- Class FILOSEA
Order GROMIIDA
Family EUGLYPHIDAE
Genus *Assulina* Ehrenberg
13. *Assulina muscorum* Greef
Genus *Corythion* Taranek
14. *Corythion dubium* Taranek
Genus *Euglypha* Dujardin
15. *Euglypha ciliata* (Ehrenberg)
16. *Euglypha cristata* Leidy
17. *Euglypha denticulata* Brown
18. *Euglypha filifera* Penard
19. *Euglypha laevis* (Ehrenberg)
20. *Euglypha rotunda* Wailes
21. *Euglypha scutigera* Penard
22. *Euglypha tuberculata* Dujardin
Genus *Tracheleuglypha* Deflandre
23. *Tracheleuglypha dentata* (Vejdowsky)
Genus *Nebela* Leidy
24. *Nebela collaris* (Ehrenberg)
Genus *Trinema* Dujardin
25. *Trinema enchelys* (Ehrenberg)
26. *Trinema lineare* Penard
- Phylum CILIOPHORA
Class KINETOFRAGMINOPHOREA
Subclass GYMNOSTOMATIA
Order PROSTOMATIDA
Family PROSTOMATIDAE
Genus *Prorodon* Ehrenberg
27. *Prorodon teres* Ehrenberg

- Family COLEPIDAE
Genus *Coleps* Nitzsch
28. *Coleps hirtus* (Muller)
Family SPATHIDIIDAE
Genus *Spathidium* Dujardin
29. *Spathidium muscicola* Kahl
Subclass VESTIBULIFERIA
Order COLPODIDA
Family COLPODIDAE
Genus *Colpoda* O. F. Muller
30. *Colpoda cucullus* Muller
Subclass HYPOSTOMATIA
Order NASSULIDA
Family MICROTHORACIDAE
Genus *Drepanomonas* Fresenius
31. *Drepanomonas dentata* Fresenius
Genus *Microthorax* Engelmann
32. *Microthorax pusillus* Engelmann
Order CYRTOPHORIDA
Family CHILODONELLIDAE
Genus *Chilodonella* Strand
33. *Chilodonella cucullulus* (Muller)
Class OLIGOHYMENOPHOREA
Subclass HYMENOSTOMATIA
Order HYMENOSTOMATIDA
Family PARAMECIIDAE
Genus *Paramecium* Hill
34. *Paramecium caudatum* Ehrenberg
Family FRONTONIIDAE
Genus *Frontonia* Ehrenberg
35. *Frontonia leucas* (Ehrenberg)
Subclass PERITRICHIA
Order PERITRICHIDA

- Family VORTICELLIDAE
Genus *Vorticella* Linnaeus
36. *Vorticella aequilata* Kahl
37. *Vorticella kahli* Stiller
- Class POLYHYMENOPHOREA
Subclass SPIROTRICHIA
Order HETEROTRICHIDA
Family METOPIDAE
Genus *Metopus* Claparede and Lachmann
38. *Metopus es* Muller
39. *Metopus muscicola* sp. nov.
- Order OLIGOTRICHIDA
Family HALTERIIDAE
Genus *Halteria* Dujardin
40. *Halteria grandinella* (Muller)
Family STROBILIDIIDAE
Genus *Strobilidium* Schewiakoff
41. *Strobilidium gyrans* (Stokes)
Order HYPOTRICHIDA
Family SPIROFILIDAE
Genus *Stichotricha* Perty
42. *Stichotricha socialis* Gruber
Family OXYTRICHIDAE
Genus *Oxytricha* Bory
43. *Oxytricha fallax* Stein
Family ASPIDISCIDAE
Genus *Aspidisca* Ehrenberg
44. *Aspidisca costata* (Dujardin)
Family EUPLOTIDAE
Genus *Euplotes* Ehrenberg
45. *Euplotes muscicola* Kahl

B. PARASITIC PROTOZOA

Phylum SARCOMASTI-
GOPHORA

- Subphylum MASTIGOPHORA
Class ZOOMASTIGOPHOREA
Order KINETOPLASTIDA
Family TRYPANOSOMATIDAE
Genus *Trypanosoma* Gruby
- Parasites of fishes** **Name of Hosts**
46. *T. anabasi* Mandal *Anabas testudineus*
47. *T. batrachi* Quadri *Clarius batrachus*
48. *T. pancali* Mandal *Mastacembelus pancalus*
49. *T. striati* Quadri *Channa striatus*
- Parasites of amphibia**
50. *T. rotatorium* (Mayer) *Bufo melanostictus*
 Rana tlgerina
- Parasites of birds**
51. *T. avium* Danilewsky *Dicrurus adsimilis*
- Parasites of mammals**
52. *T. lewsi* (Kent) *Rattus rattus*
- Order RETORTAMONADIDA
Family CHILOMASTIGIDAE
Genus *Chilomastix* Alexeieff
53. *C. caprae* Fonseca *Capra hircus*
- Order TRICHOMONADIDA
Family TRICHOMONADIDAE
Genus *Trichomonas* Donne
54. *T. ruminantium* Braune *Capra hircus*
- Subphylum OPALINATA
Class OPALINATEA
Order OPALINIDA
Family OPALINIDAE
Genus *Cepedia* Metcalf
55. *C. longa* (Bezzemberger) *Bufo melanostictus*
- Genus *Opalina* Purkinje and Valentin

56. *O. plicata* Ghosh *Bufo melanostictus*
 57. *O. scalpriformis* Ghosh *Bufo melanostictus*

Phylum APICOMPLEXA
 Class SPOROZOEAL
 Order EUGREGARINIDA
 Family MONOCYSTIDAE
 Genus *Monocystis* Stein

58. *M. bengalensis* Ghosh *Metaphire posthuma*

Order EUCOCCIDIIDA
 Family HAEMOGREGARINIDAE
 Genus *Haemogregarina* Danilewski

59. *H. berestneffi* Castellani and Willey *Rana tigerina*

Family EIMERIIDAE
 Genus *Eimeria* Schneider

Parasites of birds

60. *E. mitis* Tyzzer *Gallus* sp.
 61. *E. mivati* Edger and Seibold *Gallus* sp.
 62. *E. tenella* (Raillet and Rucet) *Gallus domesticus*

Parasites of mammals

63. *E. ahsata* Honess *Capra hircus*
 64. *E. arloinge* (Marotel) *Capra hircus*
 65. *E. cylindrica* Wilson *Bos indicus*
Bubalus bubalis
 66. *E. deblickei* Douwes *Sus scrofa*
 67. *E. faurei* Moussu and Marotel *Capra hircus*
Ovis sp.
 68. *E. intricata* Spiegel *Capra hircus*
 69. *E. ninakohlyakimovi* Yakimoff and Rostegaieff *Capra hircus*

70. *E. parva* Koltan, Mocsy and Vajda *Capra hircus*

71. *E. polita* Pellerdy *Capra hircus*

72. *E. porci* Vetterling *Sus scrofa*

73. *E. spinosa* Henry *Sus scrofa*

Genus *Isospora* Schneider

74. *I. lacazei* (Labbe) *Passer domesticus*

Family HAEMOPROTEIDAE

Genus *Haemoproteus* Kruse

75. *H. columbae* Kruse *Columba livia*

76. *H. dicruri* de Mello *Dicrurus adsimilis*

77. *H. oryzivora* Anschutz *Copsychus saularis*

Phylum CILIOPHORA

Class KINETOFRAGMINOPHOREA

Order TRICHOSTOMATIDA

Family BALANTIDIIDAE

Genus *Balantidium* Claparede and Lachmann

78. *B. helenae* Bezenberger *Rana tigerina*

79. *B. rotundum* Bezenberger *Rana tigerina*

Class POLYHYMENOPHOREA

Order HETEROTRICHIDA

Family NYCTOTHERIDAE

Genus *Nyctotherus* Leidy

80. *N. ovalis* americana *Periplaneta*

Genus *Nyctotheroides* Grasse

81. *N. cordiformis* (Ehrenberg) *Bufo melanostictus*

Family SICUOPHORIDAE

Genus *Sicuophora* de Puytorac and Grain

82. *S. macropharyngeus* *Rana tigerina*
(Bezenberger)

C. SYMBIOTIC PROTOZOA

Phylum	SARCOMASTIGO- PHORA
Subphylum	MASTIGOPHORA
Class	ZOOMASTIGOPHOREA
Order	TRICHOMONADIDA
Family	DEVESCOVINIDAE
Genus	<i>Devescovina</i> Foa

83. *D. glabra* Grassi *Cryptotermes dudleyi*

84. *D. lemniscata* Kirby *Cryptotermes dudleyi*
Genus *Foaina* Janicki

85. *F. reflexa* Kirby *Cryptotermes dudleyi*

86. *F. solita* Kirby *Cryptotermes dudleyi*

Family	CALONYMPHIDAE
Genus	<i>Stephanonympha</i> Janicki

87. *S. pyriformis* Das *Cryptotermes dudleyi*
and Choudhury

88. *S. silvestrii* Janicki *Cryptotermes dudleyi*

Order	HYPERMASTIGIDA
Family	HOLOMASTIGOTIDAE
Genus	<i>Holomastigotoides</i> Grassi and Foa

89. *H. bengalensis* *Coptotermes travians*
Chakraborty and Banerjee

90. *H. campanula* de *Coptotermes travians*
Mello

91. *H. globosus* de *Coptotermes travians*
Mello

92. *H. magnus* Uttangi *Coptotermes travians*

93. *H. ogivalis* de Mello *Coptotermes travians*

94. *H. ovalis* Uttangi *Coptotermes travians*

95. *H. rayi* Karandikar *Coptotermes travians*
and Vittal

96. *H. reniformis* de *Coptotermes travians*
Mello

97. *H. spheroidalis* *Coptotermes travians*
de Mello

Family	SPIROTRICHO- NYMPHIDAE
Genus	<i>Spirotrichonympha</i> Grassi and Foa

98. *S. froilanoi* *Coptotermes travians*
Karandikar and Vittal

99. *S. roonwali* Das *Coptotermes travians*

Family	EUCONYMPHIDAE
Genus	<i>Pseudotrichonympha</i> Grassi and Foa

100. *P. cardiformis* *Coptotermes travians*
Karandikar and Vittal

101. *P. indica* *Coptotermes travians*
Chakravarty and Banerjee

102. *P. subapicalis* *Coptotermes travians*
Karandikar and Vittal

SYSTEMATIC ACCOUNT

A. FREELIVING PROTOZOA

Phylum	SARCOMASTIGO- PHORA
Subphylum	SARCODINA
Class	LOBOSEA
Order	ARCELLINIDA
Family	ARCELLIDAE

Key to the families

- 1(2) Test rigid with minerals or organic particles
.....Family ARCELLIDAE

- 2(1) Test not rigid and with foreign particles..
..... Family DIFFLUGIIDAE

Key to the genera

- 1(2) Test semispiral in appearance, with curved
or vermiform pellets (or with sand grains
in a single species).....
.....Genus *Lesquereusia*

- 2(1) Test hemispiral, oval or circular with hexagonal markings and without any pellet or sand grains Genus *Arcella*

Genus *Arcella* Ehrenberg

1832. *Arcella* Ehrenberg, *Abh. Preuss. Acad. Wiss.*, Berlin, P. 40.

Diagnosis : Test membranous, rigid, with hexagonal markings, brown or yellow in colour; hemispherical, oval or circular in shape, encrusted with chitinous particle; aperture central, circular and inverted like a funnel.

1. *Arcella discoides* Ehrenberg

1843. *Arcella discoides* Ehrenberg, *Abh. preuss. Akad. Wiss.*, Berlin, p. 139.

Material examined : 3 exs., Mandirghat, South district, 16. xi. 1992, coll. N. C. Sarkar; 2 exs., Sephaijala, West district, 19. xi. 1992, coll. N. C. Sarkar; 2 exs., Jatanbari, South district, 2. xii. 1992, coll. N. C. Sarkar.

Diagnosis : Test smooth, flattened, planoconvex in lateral and circular in front view; height of the dome about one-third to one-fourth of the diameter of the test; aperture large and circular.

Distribution : India : Tripura (West and South districts), Meghalaya and West Bengal; common in freshwater ponds amongst bottom ooze.

Genus *Lesquereusia* Schlumberger

1845. *Lesquereusia* Schlumberger, *Ann. Sci. nat. Zool.* (3), 3, P. 255.

Diagnosis : Test compressed, semispiral in appearance, with interlacing curved or vermiform pellets (test with sand grains in a single species).

2. *Lesquereusia spiralis* (Ehrenberg)

1840. *Diffugia spiralis* Ehrenberg, *Montab. Akad. Wiss.*, Berlin, P. 139.

Material examined : 1 ex., Mandirghat, South District; 16. xi. 1992, coll. N. C. Sarkar; 1 ex., Sephaijala, West district, 19. xi. 1992, coll. N. C. Sarkar.

Diagnosis : Test transparent and composed of closely arranged short curved (vermiform) pellets, neck prominent, sharply turned to one side, aperture circular, contracted and its margin plain and sharply defined.

Distribution : India : Tripura (West and South districts), Andhra Pradesh, Meghalaya and West Bengal; in freshwater amongst bottom ooze.

Family DIFFLUGIIDAE

Key to the genera

- 1(2) Test possessing an axial symmetry, aperture at the extremity of the test (terminal), pseudopodia cylindrical, simple or branching Genus *Diffugia*
- 2(1) Symmetry of test dorso-ventral, oral aperture at one side of the test (eccentric) or ventral, pseudopodia digitate or sharply pointed Genus *Centropyxis*

Genus *Centropyxis* Stein

1859. *Centropyxis* Stein, *Abh. K. Bohm. Gesellsch. Wiss.*, 10, P. 43.
1929. *Centropyxis* : Deflandre, *Arch. Protistenk.*, 67, p. 322.

Diagnosis : As for the key to this genus.

Key to the species

- 1(10) Test swollen at posterior part, oral aperture eccentric.
- 2(3) Test more or less round, beset with few spines, spines resembling scrap or strap *C. aculeata*
- 3(2) Test of varying shape and without any spine.
- 4(5) Test prolonged to the anterior and resembling a flat lens covering oral aperture, a constriction present between oral and posterior part of the test *C. platystoma*
- 5(4) Test not prolonged as above, constriction between oral and posterior part of the test lacking
- 6(7) Test circular in ventral view *C. minuta*

- 7(6) Test more or less elliptical, oval or discoidal in ventral view.
- 8(9) In ventral view flank of posterior part of the test strongly arched, oral aperture always invaginated quite strongly towards posterior part *C. constricta*
- 9(8) In ventral view flank of posterior part of the test little arched, often almost straight, dorsal face of fundus (dome) strongly flattened towards oral aperture
..... *C. aerophila*
- 10(1) Test regularly arched and oral aperture centrally located *C. arcelloides*

3. *Centropyxis aculeata* (Ehrenberg)

1832. *Arcella aculeata* Ehrenberg, *Abh. preuss. Akad. wiss.*, Berlin, p. 40.
1857. *Centropyxis aculeata* (Ehrenberg): Stein, *S. Bohn. Ges. Wiss.*, Prague, 5 (10) : pp. 41-43.

Material examined : 3 exs., Sephaijala, West district, 19. xi. 1992, coll. N. C. Sarkar; 1 ex., Sonamura, South district, 23. xii. 1992, coll. N. C. Sarkar.

Diagnosis : Test compressed, cap-shaped, fundus of test obtusely rounded and furnished with few (usually 4-6) divergent spines at the border, arranged in a single and somewhat regular row; spines usually resembling scrap, test brownish, frequently encrusted with quartz crystals and sometimes with admixture of diatoms and sand particles.

Distribution : India : Tripura (West and South districts), Andhra Pradesh, Meghalaya, Rajasthan and West Bengal; in freshwater tanks amongst vegetation.

4. *Centropyxis aerophila* Deflandre

1929. *Centropyxis aerophila* Deflandre, *Arch. Protistenk.*, 67, p. 330.

Material examined : 2 exs., Unokoti, North district, 10. xi. 1992, coll. N. C. Sarkar; 3 exs., Jatanbari, South district, 2. xii. 1992, coll. N. C.

Sarkar; 2 exs., Sonamura, South district, 23. xii. 1992, coll. N. C. Sarkar; 2 exs., Agartala, West district, 27. xiii. 1992, coll. N. C. Sarkar.

Diagnosis : Test small (usually considerably less than 100 μ m), ovoid; in ventral view flank of posterior part of the test little arched, often almost straight; fundus spheroidal with dorsal face strongly flattened towards oral aperture; aperture semi-circular or elliptical; test chitinous finely punctate and rough, bearing foreign particles, usually vegetable fragments and transparent crystals.

Distribution : India : Tripura (all the three districts), Meghalaya and West Bengal.

Remarks : This species is cosmopolitan in distribution and frequently found amongst tree, ground and rock mosses. In addition to these habitats, Deflandre (1929, 1959) reported this species from *Sphagnum* also. He (*op. cit.*) collected type species amongst tree mosses with two ecological varieties, viz., var. *sylvatica* and var. *sphagnicola* amongst tree mosses and *sphagnum* respectively. The present material collected from Tripura amongst ground and rock mosses resemble the type species only.

5. *Centropyxis arcelloides* Penard

1902. *Centropyxis arcelloides* Penard, *Fauna Rhiz. du bass. du Leman*, p. 309.
1929. *Centropyxis arcelloides* : Deflandre, *Arch. Protistenk.*, 67, p. 367.

Material examined : Sev. exs., Jamirsura, North district, 9. xi. 1992, coll. N. C. Sarkar; 2 exs., Sephaijala, West district, 19. xi. 1992; 3 exs., Jatanbari, South district, 2. xi. 1992, coll. N. C. Sarkar; sev. exs., Sonamura, South district, 23. xii. 1992, coll. N. C. Sarkar.

Diagnosis : Testhemi spherical, brown, chitinous, covered with small, flat siliceous scale like structures; oral aperture centrally located, circular in shape, faintly invaginated, about half the diameter of that of the width.

Distribution : India : Tripura (all the three districts) and Meghalaya.

Remarks : The present material was collected from tree, ground and rock mosses. However, Deflandre (1929) reported this species from moss and *Sphagnum*. Earlier, this species was reported once from India by Das *et al* (1995) who collected the species from rock moss of Mawsmi cave near Cherrapunjee (East Khasi Hills district), Meghalaya. This species appears to be common amongst mosses in Tripura.

6. *Centropyxis constricta* (Ehrenberg)

1841. *Arcella constricta* Ehrenberg, *Abh. Akad. Wiss.*, Berlin.
 1879. *Diffugia constricta* Leidy, *Freshwater Rhizopods of North America*, pl. 18, fig. 29, 30.
 1929. *Centropyxis constricta* : Deflandre, *Arch. Protistenk.*, **67**, p. 340.

Material examined : 2 exs., Jamirsura, North district, 9. xi. 1992, coll. N. C. Sarkar; 1 ex., Sephaijala, West district, 19. xi. 1992, coll. N. C. Sarkar; 2 exs., Jatanbari, South district, 2. xii. 1992, coll. N. C. Sarkar.

Diagnosis : Test elliptical or ovoid in ventral view; oral aperture always invaginated quite strongly towards posterior part; aperture at the border of the test, eccentric, largely elliptical or nearly circular; test covered with closely set sand grains, giving a grey colour to it.

Distribution : India : Tripura (all the three districts) and Meghalaya.

Remarks : The present material was collected from ground rock mosses although it also occurs in *Sphagnum* (Deflandre 1959).

7. *Centropyxis minuta* Deflandre

1929. *Centropyxis minuta* Deflandre, *Arch. Protistenk.*, **67**, p. 349.

Material examined : 4 exs., Jatanbari, South district, 2. xii. 1992, coll. N. C. Sarkar; 3 exs., Sonamura, South district, 23. xii. 1992, coll. N. C. Sarkar.

Diagnosis : Test small, 40-50 μ m in diameter, circular in ventral view and subspherical in lateral view ; oral aperture eccentric and circular.

Distribution : India : Tripura (South district), Meghalaya, Orissa and West Bengal; in moss.

8. *Centropyxis platystoma* (Penard)

1890. *Diffugia platystoma* Penard, *Mem. Soc. Phys. et Hist. Nat. de Geneva*.
 1929. *Centropyxis platystoma* Deflandre, *Arch. Protistenk.*, **67**, p. 338.

Material examined : 2 exs., Sephaijala, West district, 19. xi. 1992, coll. N. C. Sarkar.

Diagnosis : Test prolonged to the anterior end, resembling a flat lens covering oral aperture, test elongated, elliptical in ventral view; a constriction most often visible between 'sleeve' of the test and oral aperture; in lateral view posterior part of the test strongly convex and anterior part more or less flat; oral aperture circular or semi-circular; test chitinous and covered with several silicious particles, quartz particles and small pebbles.

Distribution : India : Tripura (West district); Meghalaya.

Remarks : The present material has been collected from moss. This species is reported for the second time from India. Incidentally first report of this species from this country was made from another North-Eastern states of India, Meghalaya by Das *et al* (1995). However those material were collected from freshwater amongst bottom ooze.

Genus *Diffugia* Leclerc

1815. *Diffugia (Partim)* Leclerc, *Mem. du. Mus.*, **2**, p. 474.
 1958. *Diffugia* Gauthier-Lievre and Thomas, *Arch. Protistenk.*, **103**, p. 241.

Diagnosis : As in the key to the genus.

Key to the species

- 1(6) Test without collar
 2(5) Oral aperture lobed or crenulated, test ovoid or nearly spherical

- 3(4) Oral aperture usually quadrilobed in the form of a cross, but sometimes trilobed, margin of the test without any spine
.....*D. lobostoma*
- 4(3) Oral aperture crenulated, crenulations varying from 8-12, sometimes more, margin of the test provided with 4-10 spines
..... *D. corona*
- 5(2) Oral aperture circular, test elongate, more or less cylindrical and acuminate, pointed extension of the base usually straight
..... *D. acuminata*
- 6(1) Test with collar, collar never recurved exterior or interior, test spherical to subglobose*D. lithophila*

9. *Diffugia acuminata* Ehrenberg

1838. *Diffugia acuminata* Ehrenberg, *Die Infusionsthierehen als Vollkommene Organismen*, Leipzig, p. 131.
1958. *Diffugia acuminata* : Gauthier-Lievre and Thomas, *Arch. Protistenk.*, **103**, p. 323.

Material examined : 2 exs., Sephaijala, West district, 19. xi. 1992, coll. N. C. Sarkar.

Diagnosis : Test elongate, more or less cylindrical and acuminate, without any collar and with pointed 'horn'-like extension at the base; 'horn' straight and differentiated from the base; quartz crystals of varying size embedded in the test; some crystals projecting out of the margin of the test giving an irregular appearance of test margin.

Distribution : India : Tripura (West district), Andhra Pradesh, Meghalaya and West Bengal; in bottom ooze of freshwater ponds.

10. *Diffugia corona* Wallich

1864. *Diffugia corona* Wallich, *Ann. Mag. nat. Hist.*, (3) **13**, p. 244.

Material examined : 1 ex., Sephaijala, West district, 19. xi. 1992, coll. N. C. Sarkar; 2 exs., Agartala, West district, 27. xii. 1992, coll. N. C. Sarkar.

Diagnosis : Test more or less spherical, slightly narrow near oral aperture but widened at base with 4-10 spines, surface of the test smooth and formed of quartz crystals; oral aperture wide, about half the diameter of the test, crenulated, crenulations varying from 8 to 12, sometimes more.

Distribution : India : Tripura (West district) and West Bengal; in freshwater amongst vegetation and bottom ooze.

11. *Diffugia lithophila* (Penard)

1902. *Diffugia hydrostatica* var. *lithophila* Penard, *Fauna rhizopodique du bassin du Leman*, Geneve, p. 274.
1958. *Diffugia lithophila* Gauthier-Lievre and Thomas, *Arch. Protistenk.*, **103**, p. 286.

Material examined : 2 exs., Sephaijala, West district, 19. xi. 1992; coll. N. C. Sarkar; 1 ex., Agartala, West district, 27. xii. 1992, coll. N. C. Sarkar.

Diagnosis : Test spherical to subglobose drawn out to pseudostome in the form of short collar, pseudostome circular, test covered with well arranged stony particles.

Distribution : India : Tripura (West district), Meghalaya and West Bengal; in freshwater amongst bottom ooze.

12. *Diffugia lobostoma* Leidy

1879. *Diffugia lobostoma* Leidy, *Freshwater Rhizopods of North America*, p. 112.

Material examined : 2 exs., Sephaijala, West district, 19. xi. 1992, coll. N. C. Sarkar.

Diagnosis : Test ovoidal, oral aperture usually quadrilobed in the form of a cross, but sometimes trilobed, not enclosed by collar; test covered with angular quartz particles.

Distribution : India : Tripura (West district), Meghalaya, Rajasthan and West Bengal; in freshwater amongst vegetation and in bottom ooze.

Class FILOSEA

Order GROMIIDA

Family EUGLYPHIDAE

Key to the genera

- 1(10) Pseudopods sharply pointed, simple or branched but not anastomosing
- 2(7) Aperture terminal
- 3(4) Test brown or colourless, aperture bordered by an irregularly denticulated membrane Genus *Assulina*
- 4(3) Test hyaline, aperture not bordered by any membrane
- 5(6) Test with a distinct hyaline collar, denticulate or laciniate, aperture bordered by a dentate neck without scale Genus *Tracheleuglypha*
- 6(5) Test without any collar, aperture bordered by regularly arranged serrated or denticulated scales Genus *Euglypha*
- 7(2) Aperture subterminal
- 8(9) Test ovoid, formed of circular, imbricated silicious scales, aperture circular, oblique, invaginated Genus *Trinema*
- 9(8) Test ovoid or circular, formed of non-imbricated oval plates, aperture sub-circular or oval, oblique Genus *Corythion*
- 10(9) Pseudopod finger-like and non-anastomosing, (test chitinous usually transparent, ovate, pyriform or elongate in broad view, composed of circular or oval plates of uniform or various sizes) Genus *Nebela*

Genus *Assulina* Ehrenberg

1871. (1872) *Assulina* (Partim) Ehrenberg, *Abh. Akad. Berlin*, p. 246.
1879. *Assulina* Leidy, *Freshwater Rhizopods of North America*, p. 224.

Diagnosis : Test brown or colourless, ovoid, glabrous, compressed, composed of elliptical, imbricated, silicious scales, arranged more or less regularly in diagonal rows; aperture oval terminal, truncate or with a short neck,

bordered by a thin chitinous finely dentate membrane.

Remarks : This genus is reported for the first time from India.

13. *Assulina muscorum* Greeff

1888. *Assulina muscorum* Greeff in *Sitzber Ges. nat. Marburg*, p. 117-118.
1915. *Assulina muscorum* Cash, Wailes and Hopkinson, *British Freshwater Rhizopoda and Heliozoa*, 3, p. 55.

Material examined : 2 exs., Jamirsura, North district, 9. xi. 1992, coll. N. C. Sarkar; 2 exs., Mandirghat, South district, 13. xi. 1992, coll. N. C. Sarkar; 3 exs., Unokoti, North district, 16. xi. 1992, coll. N. C. Sarkar; 1 ex., Sephaijala, West district, 19. ix. 1992, coll. N. C. Sarkar; 2 exs., Sonamura, South district, 23. xii. 1992, coll. N. C. Sarkar.

Diagnosis : Test small, colourless, oviform, compressed and truncate anteriorly at the aperture, composed of imbricated oval scales usually arranged in alternating diagonal rows, sometimes irregularly; aperture bordered by a thin chitinous membrane with undulate or irregularly denticulated margin.

Distribution : India : Tripura (all the three districts).

Remarks : *A. muscorum* is recorded for the first time from India although this species is reported to the ubiquitous and likely to be found in almost every part of the globe in all latitudes and elevations at which mosses grow freely (Cash, Wailes and Hopkinson, 1905). Test of *A. muscorum* may be brown or colourless. However, test of the present material is exclusively colourless. This species was collected from soil, tree and rock mosses from Tripura.

Genus *Corythion* Taranek

1881. *Corythion* Taranek in *Sitzb. bohm. Ges. Wiss.*, p. 232.
1915. *Corythion* Cash, Wailes and Hopkinson, *British Freshwater Rhizopoda and Heliozoa*, 3, p. 96.

Diagnosis : Test small, ovoid or subcircular, hyaline, compressed, formed of non imbricated, oval, silicious plates, aperture subterminal, ventral or oblique, circular or oval.

Remarks : This genus is reported for the first time from India.

14. *Corythion dubium* Taranek

1881. *Corythion dubium* Taranek in *Sitzb. bohm. Ges. Wiss.*, p. 232.

1915. *Corythion dubium* Cash, Wailes and Hopkinson, *British Freshwater Rhizopod and Heliozoa*, 3, p. 96.

Material examined : 2 exs., Sephaijala, West district, 19. xi. 1992, coll N. C. Sarkar.

Diagnosis : Test ovoid, compressed unsymmetrically, aperture circular or oval, ventral subterminal and oblique.

Distribution : India : Tripura (West district).

Remarks : This species is reported for the first time from India. The present material was collected from mosses grown on rock and brick-built wall.

Genus *Euglypha* Dujardin

1841. *Euglypha* Dujardin, *Zooph. Infus.*, p. 251.

1962. *Euglypha* Decloitre, *Arch. Protistenk.*, 106, p. 51.

Diagnosis : Test hyaline, ovoid or elongated, circular or elliptical in transverse section, formed of circular, oval or scutiform silicious scales, arranged in alternating longitudinal rows regularly imbricated; aperture terminal, bordered by serrated or denticulated scales.

Key to the species

- 1(10) Test without any spine
- 2(5) Aperture bordered with one or two rows of finely serrated scales
- 3(4) Scales of the test oval, rarely circular, aperture usually bordered with one and occasionally with two rows of finely serrated scales*E. tuberculata*

- 4(3) Scales of the test scutiform, aperture bordered with two rows of finely serrated scales*E. scutigera*
- 5(2) Aperture not bordered with serrated scales
- 6(7) Scales bordering aperture terminated by a single semicircular projection*E. rotunda*
- 7(6) Scales bordering aperture not having any semicircular projection
- 8(9) Aperture with an irregularly dentate border formed of eight or nine pointed scales, not shiny at their margin .*E. denticulata*
- 9(8) Aperture not dentate as above and bordered by a single row of pointed scales, always shiny at their margin*E. laevis*
- 10(1) Test furnished with spines
- 11(12) Fundus of the test furnished with a tuft of divergent spines 3-8 in number*E. cristata*
- 12(11) Spines produced from entire surface of the test or from its margin
- 13(14) Lateral margins and crown of the test furnished with acicular spines arranged in a single or double row, attached to the test by small nodules*E. filifera*
- 14(13) Spines needle like and produced from the margins or distributed over the surface of the test*E. ciliata*

15. *Euglypha ciliata* (Ehrenberg)

1848. *Diffugia ciliata* Ehrenberg, *Ber. Acad. Berlin*, p. 379.

1878. *Euglypha ciliata* Leidy, *Proc. Acad. Philad.*, p. 172.

Material examined : 2 exs., Unokoti, North district, 16. xi. 1992, coll. N. C. Sarkar; 1 ex., Jatanbari, South district, 2. xii. 1992, coll. N. C. Sarkar.

Diagnosis : Test oviform, compressed, furnished with short needle like spines which may be produced from margins only or distributed

over entire surface of the test, aperture oval, bordered by scales having 3 or 5 serrations in each.

Distribution : India : Tripura (North and South districts); Sikkim.

Remarks : Penard (1907) was the first to report *E. ciliata* from the moss samples of sikkim Himalaya. Then, after a long gap, this species is hereby reported for the second time from this country. The present collection was made from the wall moss in Tripura.

16. *Euglypha cristata* Leidy

1874(1875). *Euglypha cristata* Leidy, *Proc. Acad. Philad.*, p. 226.

1915. *Euglypha cristata* Cash, Wailes and Hopkinson, *The British Freshwater Rhizopoda and Heliozoa*, 3, p. 19.

Material examined : 1 ex., Unokoti, North district, 16. xi. 1992, coll. N. C. Sarkar.

Diagnosis : Test elongated, not compressed, fundus hemispherical, a tuft of 3-8 divergent spines present at fundus only, aperture circular, bordered by a single row of serrated scales.

Distribution : India : Tripura (North district).

Remarks : This species is recorded for the first time in India. The present material is collected from rock moss and resembles *E. cristata* var. *lanceolata* Playfair, (see Decloitre, 1962), without having any constricted neck.

17. *Euglypha denticulata* Brown

1912. *Euglypha denticulata* Brown, *Scottish Naturalist*, p. 181.

1915. *Euglypha denticulata* Cash, Wailes and Hopkinson, *The British Freshwater Rhizopoda and Heliozoa*, 3, p. 41.

Material examined : 2 exs., Jamirsura, North district, 9. xi. 1992, coll. N. C. Sarkar.

Diagnosis : Test glabrous, oval, sometimes unsymmetrical, composed of elliptical, imbricated scales in alternating longitudinal rows; aperture

small with irregularly dentate border, formed of eight or nine pointed scales, not shiny at their margin.

Distribution : India : Tripura (North district), Meghalaya and West Bengal; in moss.

18. *Euglypha filifera* Penard

1890. *Euglypha filifera* Penard, *Mem. Soc. Geneve*, 31, pp. 179-180.

1915. *Euglypha filifera* Cash, Wailes and Hopkinson, *The British Freshwater Rhizopoda and Heliozoa*, 3, p. 26.

Material examined : 2 exs., Unokoti, North district, 16. xi. 1992, coll. N. C. Sarkar.

Diagnosis : Test elongate, ovoid, slightly compressed, a few long acicular spines produced from the lateral margins and crown of the test and arranged in a single or sometimes double rows; spines attached to the test by small hemispherical nodules; aperture bordered by finely serrated scales.

Distribution : India : Tripura (North district).

Remarks : This species is reported for the first time from India. The material has been collected from moss samples.

19. *Euglypha laevis* (Ehrenberg)

1845. *Diffugia laevis* Ehrenberg, *Ber. Acad. Berlin*, p. 307.

1849. *Euglypha laevis* Perty, *Mitth. nat. Ges. Bern.*, p. 163.

Material examined : 3 exs., Jamirsura, North district, 9. xi. 1992, coll. N. C. Sarkar.

Diagnosis : Test oviform, glabrous, aperture elliptical to subcircular, bordered by a single row of scales pointed terminally, shiny at their margin and having wider gap in between their free ends; body scales oval and slightly imbricated.

Distribution : India : Tripura (North district), Andhra Pradesh, Meghalaya and West Bengal; in moss.

20. *Euglypha rotunda* Wailes

1911. *Euglypha rotunda* Wailes, *Proc. roy. Irish Acad.*, **31**, p. 17.
 1915. *Euglypha rotunda* Cash, Hopkinson and Wailes, *The British Freshwater Rhizopoda and Heliozoa*, **3**, p. 31.

Material examined : 2 exs., Mandirghat, South district, 16. xi. 1992, coll. N. C. Sarkar; 1 ex., Unokoti, North district, 16. xi. 1992, coll. N. C. Sarkar; Jatanbari, South district, 2. xii. 1992, coll. N. C. Sarkar; sev. exs., Sonamura, South district, 23. xii. 1992, coll. N. C. Sarkar.

Diagnosis : Test oval, without any spine, width of test about half of its length, aperture circular bordered by 8 scales, possessing one denticulate projection, body scales oval, about twice as long as broad, slightly imbricated, imbrication of test scales displaying a hexagonal or rectangular pattern on the surface.

Distribution : India : Tripura (South and North districts), Meghalaya and West Bengal; in moss.

21. *Euglypha scutigera* Penard

1911. *Euglypha scutigera* Penard, *Proc. roy. Irish Acad.* **31**, pp. 41-42.
 1915. *Euglypha scutigera* Cash, Hopkinson and Wailes, *The British Freshwater Rhizopoda and Heliozoa*, **3**, p. 7.

Material examined : 2 exs. Sonamura, South district, 23. xii. 1992, coll. N. C. Sarkar.

Diagnosis : Test oviform, without any spine, and not compressed; aperture circular, bordered by two rows of finely serrated scales 8-10 in each row; scales of the test scutiform, disposed of in alternate longitudinal rows.

Distribution : India : Tripura (South district), Meghalaya and West Bengal; in moss.

22. *Euglypha tuberculata* Dujardin

1841. *Euglypha tuberculata* Dujardin, *Zooph. Infus.*, pp. 251-252.
 1915. *Euglypha tuberculata* Cash, Hopkinson and Wailes, *The British Freshwater Rhizopoda and Heliozoa*, **3**, p. 13.

Material examined : 2 exs., Jamirsura, North district, 9. xi. 1992, coll. N. C. Sarkar; 3 exs., Sonamura, South district, 23. xii. 1992, coll. N. C. Sarkar.

Diagnosis : Test elongate-oviform, glabrous and not compressed; aperture circular, bordered by one or two rows of 8-12 finely serrated scales; body scales round or oval, imbricated, presenting a regular hexagonal design.

Distribution : India : Tripura (South and North districts), Meghalaya and West Bengal; in vegetation and in bottom ooze.

Genus *Tracheleuglypha* Deflandre

1953. *Tracheleuglypha* Deflandre, *Traite de Zoologie*, **1** (2), p. 133.

Diagnosis : As in the key to the genus.

23. *Tracheleuglypha dentata* (Vejdowsky)

1882. *Euglypha dentata* Vejdowsky, *Thier Org. Brunnenv. Prag.*, pp. 38-39.
 1890. *Sphenoderia dentata* Penard, *Mem. Soc. Geneve*, **31**(1), p. 185.
 1953. *Tracheleuglypha dentata* (Vejdowsky) Deflandre, *Traite de Zoologie*, **1** (2), p. 133.

Material examined : 4 exs., Jamirsura, North district, 9. xi. 1992, coll. N. C. Sarkar.

Diagnosis : Test oval or pyriform, test scales circular or elliptical, imbricating, often presenting a hexagonal design; aperture bordered by transparent chitinous dentate membrane drawn out into finger like processes.

Distribution : India : Tripura (North district) and West Bengal; in moss and in freshwater amongst vegetation.

Genus - *Nebela* Leidy

1874. *Nebela* Leidy, *Proc. Acad. Philad.*, p. 156.

Diagnosis : Test usually transparent, more or less compressed, ovate, pyriform or elongate in broad view, composed of chitinous or oval platelets of uniform or variable sizes.

24. *Nebela collaris* (Ehrenberg)

1848. *Diffugia collaris* Ehrenberg, *Monatsb. Akad. Wiss. Berlin*, p. 218.

1879. *Nebela collaris* (Partin) Leidy, *Proc. Acad. Philad.*, p. 162.

Material examined : 1 ex., Mandirghat, South district, 16. xi. 1992, coll. N. C. Sarkar.

Diagnosis : Test pyriform in broad view, with a convex aperture and oblong in side view, aperture smooth, always notched and with well defined lips.

Distribution : India : Tripura (South district), Sikkim; in moss.

Genus *Trinema* Dujardin

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, unsymmetrical, oviform or elongate, compressed anteriorly covered with circular silicious plates, oral aperture circular, oblique or invaginated.

Key to the species

- 1(2) Test elongate, small, usually homogeneous in appearance *T. lineare*
- 2(1) Test ovoid, tapering both in broad and narrow views, covered with easily distinguishable circular plates
..... *T. enchelys*

25. *Trinema enchelys* (Ehrenberg)

1938. *Diffugia enchelys* Ehrenberg, *Die Infusionsthierehen, als Vollkommene Organismen*, Leipzig, p. 132.

1878. *Trinema enchelys* Leidy, *Proc. Acad. Philad.*, p. 172.

Material examined : 2 exs., Rajnagar, South district, 13. xi. 1992, coll. N. C. Sarkar.

Diagnosis : Test hyaline, ovoid, compressed anteriorly, covered with silicious circular plates, aperture circular, subterminal, oblique and invaginated surrounded by very minute scales.

Distribution : India : Tripura (South district), Andhra Pradesh, Meghalaya, Sikkim and West Bengal; in moss and aquatic vegetation.

26. *Trinema lineare* Penard

1890. *Trinema lineare* Penard, *Mem. Soc. Geneve*, 31, p. 187.

Material examined : 1 ex., Rajnagar, South district, 13. xi. 1992, coll. N. C. Sarkar; 3 exs., Unokoti, North district, 16. xi. 1992, coll. N. C. Sarkar; 1 ex., Sephaijala, West district, 19. xi. 1992, coll. N. C. Sarkar; 2 exs., Jatanbari, 2. xii. 1992, coll. N. C. Sarkar.

Diagnosis : Test small, hyaline, elongate, smooth, composed of small circular plates, distinguishable near the edges where they may appear as minute undulations; aperture circular, oblique, invaginated.

Distribution : India : Tripura (all the three districts), Meghalaya and West Bengal; in moss, *Sphagnum* and aquatic vegetation.

Phylum CILIOPHORA

Class KINETOPHAG-
MINOPHOREA

Order PROSTOMATIDA

Key to the families

- 1(2) Body barrel shaped bearing armoured plates in longitudinal rows
.....Family COLEPIDAE
- 2(1) Body oval or flask-shaped, without bearing any armoured plates
- 3(4) Body oval, cytostome round or oval, sometimes in shallow atrium, oral basket made up of double trichites ending deep in cytoplasm
.....Family PRORODONTIDAE
- 4(3) Body usually flask-shaped or flattened, with truncate anterior end, cytostome on apical nonciliated ridge
.....Family SPATHIDIIDAE

Family PRORODONTIDAE

Genus *Prorodon* Ehrenberg

1833. *Prorodon* Ehrenberg, *Abhandl. d. Konigl. Akad. d. Wissensch. zu Berlin, a. d. j.*, 1833 (1835), pp. 145-336.
1927. *Prorodon* Ehrenberg, *emend* Kahl. *Arch. Protistenk.*, **60**, p. 44.

Diagnosis : Uniform ciliation throughout the body; mouth at or closely adjacent to anterior pole; oral basket made up of double trichites; cytostome not surrounded by heavier cilia; macronucleus spherical, oval, sometimes band-like and curved, contractile vacuole terminal.

27. *Prorodon teres* Ehrenberg

1838. *Prorodon teres* Ehrenberg, *Die Infusionsthierchen als Vollkommene Organismen*, Leipzig, p. 316.
1930. *Prorodon teres* : Kahl, *Urtiere oder Protozoa* (in Dahl's *Tierwelt Dtsch.*), Jena, pt. 18, p. 80.

Material examined : 3 exs., Sonamura, South district, 23. xii. 1992, coll. A. K. Das.

Diagnosis : Body ovoid, both anterior and posterior ends considerably round; mouth polar, pharyngeal basket slightly conical with trichites, extending about one-fourth distance from anterior end; macronucleus spherical with single micronucleus; contractile vacuole single and terminal.

Distribution : India : Tripura (South district), Meghalaya, Orissa and West Bengal; in freshwater ponds.

Family COLEPIDAE

Genus *Coleps* Nitzsch

1817. *Coleps* Nitzsch, *Neue Schrift d. naturf. Ges. in Halle*, **3**, p. 3.

Diagnosis : Body barrel-shaped, cuticular surface longitudinally and transversely furrowed forming regularly arranged quadrangular ectoplasmic plates; anterior end truncate, surrounded by teeth-like projections; posterior end rounded, often with spinous projections; cytostome apical, surrounded with slightly longer cilia.

28. *Coleps hirtus* (Muller)

1786. *Cercaria hirta* O. F. Muller, *Havnae et Lipsiae*, p. 128.
1817. *Coleps hirtus* Nitzsch, *Neue Schrift d. naturf. Ges. in Halle*, **3**, p. 4.

Material examined : Sev. exs., Agartala, West district, 27. xii. 1992, coll. A. K. Das.

Diagnosis : Body barrel-shaped, body length about twice the body width; ectoplasmic plates 18-20 in number; posterior extremity provided with 3 spinous projections; macronucleus spherical, subcentral, contractile vacuole single, located at posterior end of the body.

Distribution : India : Tripura (West district), Jammu and Kashmir, Meghalaya, Rajasthan and West Bengal; cosmopolitan, in freshwater ponds.

Family SPATHIDIIDAE

Genus *Spathidium* Dujardin

1841. *Spathidium* Dujardin, *Histoire Naturelle des Zoophytes Infusoires*, Paris, 678 pp.
1930. *Spathidium* : Kahl, *Urtiere oder Protozoa* (in Dahl's *Tierwelt Dtsch.*), Jena, pt. 18, p. 149.

Diagnosis : Flask or sack-shaped, compressed, anterior part slightly narrowed into a neck and truncate, cytostome occupying whole of anterior end, ciliation uniform, contractile vacuole posteriorly located.

29. *Spathidium muscicola* Kahl

1930. *Spathidium muscicola* Kahl. *Arch. Protistenk.*, **70**, p. 377.

Material examined : 1 ex., Jatanbari, South district, 2. xii. 1992, coll. A. K. Das; 1 ex., Sonamura, South district, 23. xii. 1992, coll. A. K. Das.

Diagnosis : Body flask-shaped with truncate anterior end; cytostome narrow, slit-like, occupying anterior end almost completely; macronucleus long, band-shaped, posterior portion of which often recurved.

Distribution : India : Tripura (South district) and West Bengal; in ground and rock moss.

Order COLPODIDA
Family COLPODIDAE

Body typically reniform, with distorted ciliary rows; no conspicuous ciliary tuft present at anterior end.

Genus *Colpoda* O. F. Muller

1773. *Colpoda* O. F. Muller, *Verminum Terrestrum et Fluviatilium seu Animalium Infusorium*, etc. Havniae et Lipsae, pp. 56-57.

1791. *Colpoda* Gmelin, *Systema Naturae* (ed. 13), 1, p. 38-94.

Diagnosis : Body kidney-shaped, laterally flattened, anterior end rounded, twisted from left to right and curved on ventral surface; cytostome present in ventral depression, leading into peristomeal cavity and giving rise to a diagonal groove at dorsal side; a ciliated area present in right edge of cytostome.

30. *Colpoda cucullus* Muller

1773. *Colpoda cucullus* O. F. Muller, *Verminum Terrestrum et Fluviatilium seu Animalium Infusorium*, etc. Havniae et Lipsiae, p. 58.

1838. *Colpoda cucullus* Ehrenberg, *Die Infusionsthierehen als Vollkommene Organismen*, Leipzig, pp 347-348.

Material examined : Sev. exs., Jamirsura, North district, 9. xi. 1992, coll. A. K. Das; sev. exs., Rajnagar, South district, 13. xi. 1992, coll. A. K. Das; sev. exs., Sonamura, South district, 23. xii. 1992, coll. A. K. Das; sev. exs., Agartala, West district, 27. xii. 1992, coll. A. K. Das.

Diagnosis : Body typically kidney shaped, cytostome located about the middle of the body; frontal dentations 8-10, meridians 29-34; macronucleus oval, contractile vacuole single and posterior.

Distribution : India : Tripura (all the three districts), Andhra Pradesh, Assam, Jammu and Kashmir, Karnataka, Maharashtra, Madhya Pradesh, Meghalaya, Orissa, Punjab, Tamil Nadu, Uttar Pradesh and West Bengal.

Subclass HYPOSTOMATIA
Order NASSULIDA
Family MICROTHORACIDAE

Key to the genera

- 1(2) Body more or less oval with delicate keeled armour, oral depression posterior ventral, with a stiff ectoplasmic lip on right side and a small tooth at left margin, cytopharynx lacking..... Genus *Microthorax*
- 2(1) Body semilunar or sickle-shaped with longitudinal furrow; oral field groove-like, located little above the middle of the body, cytopharynx tubular Genus *Drepanomonas*

Genus *Drepanomonas* Fresenius

1858. *Drepanomonas* Fresenius, *Abh. Senkenb. naturf. Ges.*, 2, p. 216.

Diagnosis : As in the key.

31. *Drepanomonas dentata* Fresenius

1858. *Drepanomonas dentata* Fresenius, *Abh. Senkenb. naturf. Ges.*, 2, pp. 216-217.

1920. *Drepanomonas dentata* : Ghosh, *Report Sci. Convension Indian Ass. Cult. Sci.* for 1918, p. 144.

Material examined : 2 exs., Unokoti, North district, 16. xi. 1992, coll. A. K. Das; 3 exs., Sonamura, South district, 23. xii. 1992, coll. A. K. Das.

Diagnosis : Body semilunar, dorsal margin convex, ventral margin concave and both anterior and posterior ends sharply pointed; two longitudinal ciliated grooves present on the dorsal side; macronucleus spherical and situated little behind or above the peristome.

Distribution : India : Tripura (North and South districts); Meghalaya and West Bengal; in freshwater.

Genus *Microthorax* Engelmann

1862. *Microthorax* Engelmann, *Zeitschr. f. Wiss. Zool.*, 11, p. 347.

Diagnosis : As in the key.

32. *Microthorax pusillus* Engelmann

1862. *Microthorax* Engelmann, *Zeitschr. f. Wiss. Zool.*, 11, p. 347-393.

Material examined : Sev. exs., Sonamura, South district, 23. xii. 1992, coll. A. K. Das.

Diagnosis : Body small, ovoid, left border slightly sigmoid and right border more or less straight, oral depression on dorsal side, macronucleus spherical, contractile vacuoles two and located below the middle half of the body.

Distribution : India : Tripura (South district), Meghalaya and West Bengal; in freshwater.

Order CYRTOPHORIDA

Family CHILODONELLIDAE

Diagnosis : Body with pronounced anterior "beak" to the left, thigmotactic zone broad.

Genus *Chilodonella* Strand

1928. *Chilodonella* Strand, Arch. Naturgesch., 92, p. 31.

1931. *Chilodonella* : Kahl, *Urtiere oder Protozoa* (in Dahl's *Tierwelt Dtsch.*), Jena, pt. 21, pp. 234-235.

Diagnosis : Ovoid, dorsal surface convex, ventral surface flat and with ciliary rows, a cross row of bristles on anteriorly flattened dorsal surface, oral opening round, cytopharyngeal trichites forming a tube, no oral membrane.

33. *Chilodonella cucullulus* (Muller)

1773. *Kolpoda cucullulus* Muller, *Verminum terrest. fluviatil. S. animal infusor., etc. historia*, Havnae et Lipsae, p. 169.

1833. *Chilodonella cucullulus* Ehrenberg, *Abandl. d. Konigl. Akad. d. Wisseuch. zu Berlin, a. d. g.*, 1833 (1835), p. 169.

1931. *Chilodonella cucullulus* : Kahl, *Urtiere oder Protozoa* (in Dahl's *Tierwelt Dtsch.*), Jena, pt. 21, p. 235.

Material examined : Sev. exs., Agartala, West district, 27. xii. 1992, coll. A. K. Das.

Diagnosis : Body dorsoventrally flattened, cytopharynx straight, 19-20 ciliary rows; macronucleus oval, contractile vacuoles many and scattered.

Distribution : India : Tripura (West district), Meghalaya, Orissa, Jammu and Kashmir, Maharashtra, Rajasthan and West Bengal.

Class OLIGOHYMENOPHOREA

Subclass HYMENOSTOMATIA

Order HYMENOSTOMATIDA

Key to the families

- 1(2) Prebuccal cavity or "vestibulum" conspicuous leading to equatorially located buccal cavity, two peniculi in buccal cavity; cytostome not expansible, contractile vacuoles two Family PARAMECIIDAE
- 2(1) Prebuccal areas shallow or absent, three peniculi in buccal cavity, cytostome expansible, contractile vacuole single Family FRONTONIIDAE

Family PARAMECIIDAE

Genus *Paramecium* Hill

1752. *Paramecium* Hill, *History of Animals Including the Several Classes of Animalcula Visible Only be the Assistance of Microscope Vol. 3, Complete Body of Natural History*, Osborne, London, 584 pp.

1773. *Paramecium* Muller, O. F., *Vermium terrest. et fluviatil. A. animal, infusor., etc. historia*, Havnae et Lipsae, parts I & II, p. 54.

1931. *Paramecium* Kahl, *Urtiere oder Protozoa*, (in Dahl's *Tierwelt Dtsch.*), Jena, pt. 21, p. 289.

Diagnosis : Body cigar-shaped, peristome long, broad and slightly oblique, cytopharynx moderately long, with a row of very fine cilia attached to its dorsal wall.

34. *Paramecium caudatum* Ehrenberg

1833. *Paramecium caudatum* Ehrenberg, *Abhandl. d. Konigl. Akad. de Wissensch. zu Berlin*, pp. 268, 323.

1931. *Paramecium caudatum* : Kahl, *Urtiere oder Protozoa* (in Dahl's *Tierwelt Dtsch.*), Jena, pt. 21, p. 291.

Material examined : 1 ex., Mandirghat, South district, 16. xi. 1992, coll. A. K. Das; 2 exs., Sephaijala, West district, 19. xi. 1992, coll. A. K. Das ; 1 ex., Agartala, West district, 27. xii. 1992, coll. A. K. Das.

Diagnosis : Body cigar-shaped, anterior end broader and rounded, posterior end gradually

tapering, body-length around three times of body width, cytopharynx typical as for the genus; macronucleus egg-shaped, micronucleus single and compact lying close to macronucleus, contractile vacuoles two with radiating canals, one lying within anterior one-third and the other within posterior one-third of the body.

Distribution : India : Tripura (South and West districts), Meghalaya, Jammu and Kashmir, Orissa, Rajasthan, Uttar Pradesh and West Bengal; in freshwater.

Family FRONTONIIDAE

Genus *Frontonia* Ehrenberg

- 1838. *Qursaria Partim*, Ehrenberg, *Die Infusionsthierchen als Vollkommene Organismen*, Leipzig, p. 325.
- 1838. *Frontonia* subgenus, Ehrenberg, *ibid*, p. 329.
- 1858. *Frontonia* Claparede and Lachmann, *Etudes sur les infusoires et les rhizopodes*, Geneve, pp. 259-60.

Diagnosis : Body ellipsoid with both ends rounded; cytostome lying in the anterior third of the ventral surface, large undulating membrane in the left oral margin; macronucleus oval or ellipsoidal, central and obliquely placed; contractile vacuole single, centrally located, with or without radiating canal.

35. *Frontonia leucas* (Ehrenberg)

- 1838. *Bursaria leucas* Ehrenberg, *Die Infusionsthierchen als Vollkommene Organismen*, Leipzig, p. 329.
- 1858-61. *Frontonia leucas* Claparede and Lachmann, *Etudes sur les infusoires et les rhizopodes*, Geneve, pp. 259-60.

Material examined : 1 ex., Unokoti, North district, 16. xi. 1992, coll. A. K. Das; 1 ex., Sonamura, South district, 23. xii. 1992, coll. A. K. Das.

Diagnosis : Body elongated or ovoid, rounded at both ends, cytostome carrying three rows of cilia; post oral groove extending to the posterior part of the body, macronucleus elliposid with several micronuclei, contractile vacuole single with long radiating canals and located at the middle of the body.

Distribution : India : Tripura (North and South districts), Jammu and Kashmir, Maharashtra, Meghalaya, Orissa, Rajasthan, West Bengal; in freshwater.

Subclass PERITRICHIA

Order PERITRICHIDA

Family VORTICELLIDAE

Diagnosis : Stalk contractile; colonial (except in two genera); in colonial forms zooids not independently contractile (except in one species).

Genus *Vorticella* Linnaeus

- 1767. *Vorticella* Linnaeus, *Systema Naturae*, 1, (12 th ed), p. 1317.
- 1838. *Vorticella* Ehrenberg, *Die Infusionsthierchen als vollkommene Organismen*, Leipzig, p. 269.

Diagnosis : Shape resembling inverted bell, solitary, may be in clusters but not in colonies, attached posteriorly to any substratum by a simple, undivided, elongated, thread-like pedicle, with contractile axial filament macronucleus more or less elongated, band-shaped, with a micronucleus lying close to it.

Key to the species

- 1(2) Body cylindrical, nucleus long, band-shaped, lying longitudinally *V. aequilata*
- 2(1) Body irregularly globose, nucleus elongated, lying transversely *V. kahli*

36. *Vorticella aequilata* Kahl

- 1935. *Vorticella aequilata* Kahl, *Urtiere oder Protozoa* (in Dahl's *Tierwelt Dtsch.*), Jena, pt. 30, p. 725.

Material examined : Sev. exs., Rajnagar, South district, 13. xi. 1992, coll. A. K. Das; sev. exs., Sephaijala, West district, 19. xi. 1992, coll. A. K. Das.

Diagnosis : Body cylindrical, cuticular margin striated, peristomeal margin wider than the

maximum body-width; stalk short, macronucleus elongated, band-shaped, lying longitudinally, contractile vacuole single.

Distribution : India : Tripura (South and West districts).

Remarks : This species is reported for the first time from India and found to be attached mainly with submerged algae in freshwater pool.

37. *Vorticella kahli* Stiller

1931. *Vorticella kahli* Stiller, *Acta biol.*, 2.

1935. *Vorticella kahli* : Kahl, *Urtiere oder Protozoa* (in Dahl's *Tierwelt Dtsch.*), Jena, pt. 30, p. 726.

Material examined : Sev. exs., Rajnagar, South district, 13. xi. 1992, coll. A. K. Das.

Diagnosis : Body irregularly globose, pellicle distinctly annulated, peristome somewhat everted, peristomeal groove clearly visible, stalk short and contractile, nucleus elongated and lying transversely, contractile vacuole not seen.

Distribution : India : Tripura (South district).

Remarks : This species also constitutes first record from India. It has been observed to be attached with algal mass as well as moss grown near the edge of water of freshwater tanks.

Class POLYHYMENOPHOREA

Order HETEROTRICHIDA

Family METOPIDAE

Diagnosis : Anterior part of the body uniquely twisted to left and posterior part sometimes tailed and/or bearing tuft of longer cilia.

Genus *Metopus* Claparede and Lachmann

1888. *Metopus* Claparede and Lachmann, *Mem. Inst. Nat. Genevois*, 5, p. 1.

1932. *Metopus* : Kahl, *Urtiere oder Protozoa* (in Dahl's *Tierwelt Dtsch.*), Jena, pt. 25, p. 405.

Diagnosis : Body elongated, asymmetrical due to torsion at anterior left, band-like anterior peristome never spiralling; cytostome subanterior or subequatorial, anterior body part shorter than or equal to posterior body part.

Key to the species

- 1(2) Body characteristically sigmoid, macronucleus sausage-shaped, inhabiting freshwater *M. es*
- 2(1) Body ovoid to spheroidal, macronucleus spherical or oval, inhabiting moss *M. muscicola*

38. *Metopus es* Muller

1786. *Metopus es* Muller, O. F., *Animalcule infusoria fluvialia et marina, etc., historia*, Havnae et Lipsiae, p. 126.

1932. *Metopus es* : Kahl, *Urtiere oder Protozoa* (in Dahl's *Tierwelt Dtsch.*), Jena, pt. 25.

Material examined : 1 ex., Sephaijala, West district, 19. xi. 1992, coll. A. K. Das; 1 ex., Jatanbari, South district, 2. xii. 1992.

Diagnosis : Body characteristically sigmoid (S-like), comparatively large and slender, dimensions of the present material 105-137 μm x 50-60 μm , cytoplasm colourless, pellicular striations prominent; macronucleus single and sausage-shaped, contractile vacuole single, terminal and without any raising edge.

Distribution : India : Tripura (West and South districts), Andhra Pradesh, Meghalaya, Orissa, Rajasthan and West Bengal ; in freshwater.

39. *Metopus muscicola* sp. nov.

Diagnosis : Body ovoid to spheroidal, both anterior and posterior ends broadly round, body-length 76.2-96.3 (89) μm , body-width 50.6-74.5 (64.9) μm , peristome sub-equatorial and funnel-like, separating anterior part from posterior one, posterior part wider and more enlarged than the anterior one, adoral zone of membranellae not spiralling, cytostome small,

undulating membrane not visible in fixed specimens, cytoplasm colourless, macronucleus single, large, spherical or oval having dimensions 13.3-24.9 (18.8) μm x 13.3-20.2 (17.2) μm , located sometimes in anterior half on the level of peristome and sometimes in posterior half, contractile vacuole not observed.

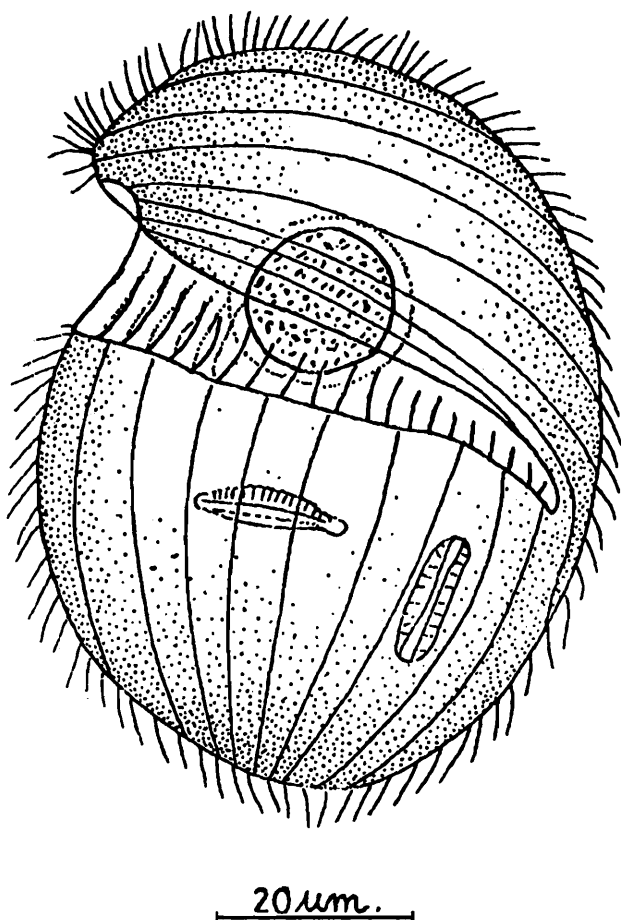


Fig. 1. *Metopus muscicola* sp. nov.

Type material

Holotype : 1 ex., on slide (Reg. No. Pt. 2271), Sonamura, South district, Tripura, India, 23. xii. 1992, coll. A. K. Das, collected from ground (soil) moss.

Paratype : 4 exs., on 4 slides (Reg. No. Pt. 2272-75), other data as for the holotype.

Remarks : Little over 50 species of *Metopus* have been described so far from the globe. Even then, the present species of *Metopus* is quite distinct from all those congeners in body shape, particularly in having wider and more enlarged

posterior part of the body than that of anterior one and broadly rounded posterior end.

However, *M. ovalis* and *M. barbatus* resemble the present species to some extent in having oval body and, rounded anterior and posterior ends. But, in both the species neither posterior part of the body is wider nor posterior end broadly round. Moreover, characteristic contractile vacuole of both these species is lacking in the present one. *M. ovalis* further differs from the present species in having slightly reddish cytoplasm.

Available literature reveals that the present one is the only moss inhabiting species of *Metopus* while all other species of this genus are, so far, reported from fresh, brackish and marine water environs.

Order OLIGOTRICHIDA

Key to the families

- 1(2) Circlet of apical membranellae open
..... Family HALTERIIDAE
- 2(1) Peristomeal field entirely apical with circlet
of apical membranellae closed
..... Family STROBILIDIIDAE

Family Halteriidae

Genus *Halteria* Dujardin

1841. *Halteria* Dujardin, *Histoire nat. Zoophytes infusoires*, Paris, p. 414.

1932. *Halteria* : Kahl, *Urtiere oder Protozoa* (in Dahl's *Tierwelt Dtsch.*), Jena, pt. 25, p. 504.

Diagnosis : More or less globose and constant in form, oral aperture terminal, eccentric, associated with a wreath of large cilia; a zone of long, stiff springing bristles developed around the equatorial region of the body.

40. *Halteria grandinella* (O. F. Muller)

1773. *Trichoda grandinella* O. F. Muller, *Verminum terrest. et fluvialil S. animal infusor., etc., historia*, Havnae et Lipsiae, p. 77.

1932. *Halteria grandinella* : Kahl, *Urtiere order Protozoa* (in Dahl's *Tierwelt Dtsch.*), Jena pt. 25, p. 505.

Material examined : Sev. exs., Jatanbari, South district, 2. xii. 1992, coll. A. K. Das.

Diagnosis : Body subglobose, oral groove bearing about 7 bristles, 15 frontal and 7 adoral membranellae; springing bristles very long and fine, forming central girdle; macronucleus oval to kidney-shaped; contractile vacuole single and located at the anterior half of the body.

Distribution : India : Tripura (South district), Meghalaya, West Bengal; common in stagnant water of ponds.

Family STROBILIDIIDAE

Genus *Strobilidium* Schewiakoff

1893. *Strobilidium* Schewiakoff, *Mem. Acad. Sci. de St. Petersb.*, (7) **41**, pp. 1-201.

1932. *Strobilidium* : Kahl, *Urtiere oder Protozoa* (in Dahl's *Tierwelt Dtsch.*), Jena, pt. 25, p. 508.

Diagnosis : Turnip-shaped, oral apertur apical and without cytopharynx, macronucleus horse-shoe shaped and located at the anterior end.

41. *Strobilidium gyrans* (Stokes)

1887. *Strombidium gyrans* Stokes, *J. roy. micros. Soc.*, **7**, pp. 35-40.

1932. *Strobilidium gyrans* Kahl, *Urtiere oder Protozoa* (in Dahl's *Tierwelt Dtsch.*), Jena pt. 25, p. 510.

Material examined : Sev. exs., Sonamura, South district, 13. xii. 1932, coll. A. K. Das.

Diagnosis : Body turnip-shaped or pyriform, posterior end truncate or with knob-like projection, anterior end of the body provided with a crown of cilia; macronucleus horse-shoe shaped, contractile vacuole single and located below the middle of the body.

Distribution : India : Tripura (South district), Meghalaya, Rajasthan and West Bengal.

Order HYPOTRICHIDA

Key to the families

- 1(2) Ventral cirri generally small and inconspicuous and, typically arranged in helically spiralled rows
.....Family SPIROFILIDAE

2(1) Ventral cirri typically heavy and conspicuous and arranged in specific localised groups.

3(4) Distinctive rows of right and left marginal cirri present, (adoral zone of membranellae restricted to anterior third or quarter of the elongated body)
.....Family OXYTRICHIDAE

4(3) Marginal cirri absent or greatly reduced

5(6) Oral ciliature prominent, usually extending more than half the length of the body, transverse and fronto-ventral cirri tremendously developed, dorsal surface not ribbed, ridged or humped.
.....Family EUPLOTIDAE

6(5) Oral ciliature poorly developed, oral membranellae located centrally and inconspicuously on the ventral surface of the body, dorsal surface often distinctly ribbed, ridged or humped
.....Family ASPIDISCIDAE

Family SPIROFILIDAE

Genus *Stichotricha* Perty

1852. *Stichotricha* Perty, *Zur Kenntniss Kleinster Lebensformen nach Bau, Funktionen, Systematic, mit Specialverzeichniss der in der Schweiz beobachteten*, Jent & Reinert, Bern, 228 pp.

1979. *Stichotricha* : Corliss, *The Ciliated Protozoa*, 2nd Ed., Pergamon Press, p. 308.

Diagnosis : Body slender, peristome bearing part beak-like/narrowed, peristome extending over one-fifth of the body length.

42. *Stichotricha socialis* Gruber

1880. *Stichotricha socialis* Gruber, *Zeitschr. f. Wiss. Zool.*, **33**.

1932. *Stichotricha socialis* : Kahl, *Urtiere oder Protozoa* (Dahl's *Tierwelt Dtsch.*), Jena, pt. 25, p. 557.

Material examined : Sev. exs., Unokoti, North district, 16. xi. 1992, coll. A. K. Das; 2 exs., Sephaijala, West district, 19. xi. 1992, coll. A. K. Das.

Diagnosis : Body slender, ovoid, anterior end gradually attenuated and posterior end rounded;

peristome extending more than half of the body; four spiral rows of ventral cirri present, living in gelatinous colonial tubes.

Distribution : India : Tripura (North and West districts), Meghalaya and West Bengal; in freshwater.

Family OXYTRICHIDAE

Genus *Oxytricha* Bory

1926. *Oxytricha* Bory, *Essai d'une Classification des Animaux Microscopiques*, Paris, 104 pp.
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, caudal cirri short or absent; marginal cirri may or may not be continuous along posterior border; macronucleus bipartite, rarely single or in four parts.

43. *Oxytricha fallax* Stein

1859. *Oxytricha fallax* Stein, *Der Organismus Infusionsthier*, Leipzig, 1, p. 189.
1932. *Oxytricha fallax* : Kahl, *Urtiere oder Protozoa* (in Dahl's *Tierwelt Dtsch.*) Jena, pt. 25, p. 602.

Material examined : 1 ex., Rajnagar, South district, 13. xi. 1992, coll. A. K. Das; 2 exs., Jatanbari, South district, 2. xii. 1992, coll. A. K. Das.

Diagnosis : Ellipsoidal, both left and right sides convex; posterior half broader than anterior, posterior region broadly rounded; arrangement of cirri as for the genus; macronucleus usually in two parts; contractile vacuole single and located at the anterior half of the body.

Distribution : India : Tripura (South district), Meghalaya and West Bengal; in freshwater.

Family ASPIDISCIDAE

Genus *Aspidisca* Ehrenberg

1830. *Aspidisca* Ehrenberg, *Abhandl. d. Konigl. Acad. d. Wissensch. zu Berlin, a. d. J. 1830 (1832)*, p. 42.
1932. *Aspidisca* : Kahl, *Urtiere oder Protozoa* (in Dahl's *Tierwelt Dtsch.*), Jena, pt. 25, p. 643.

Diagnosis : Small, ovoid or shield-shaped, dorsal surface conspicuously ridged, cirri strong and long; adoral zone reduced or rudimentary; frontoventral cirri seven; anal cirri five to twelve; macronucleus curved or horse-shoe shaped.

44. *Aspidisca costata* (Dujardin)

1841. *Coccudina costata* Dujardin, *Histoire nat des Zoophytes infusoires*, p. 446.
1858-61. *Aspidisca costata* Claparede and Lachmann, *Etudes sur les infusoires et les rhizopodes*, Geneve, p. 190.

Material examined : 4 exs., Rajnagar, South district, 13. xi. 1992, coll. A. K. Das.

Diagnosis : Body more or less ovate, rounded at both ends; dorsal surface convex with five to six distinct longitudinal ridges; peristome starting from the anterior end of the body and extending up to anal cirri, seven fronto-ventral and five anal cirri present; macronucleus curved; contractile vacuole single and located at posterior half.

Distribution : India : Tripura (South district), Meghalaya, Uttar Pradesh and West Bengal; in freshwater.

Family EUPLOTIDAE

Genus *Euplotes* Ehrenberg

1830. *Euplotes* Ehrenberg, *Abhandl. d. Konigl. Acad. d. Wissensch. zu Berlin, a. d. J. (1830 (1832))*, p. 118.
1932. *Euplotes* : Kahl, *Urtiere oder Protozoa* (in Dahl's *Tierwelt Dtsch.*), Jena, pt. 25, p. 628.

Diagnosis : Body ovoid, peristome well developed and broadly triangular, ventral surface flattened, dorsal surface convex, longitudinally ridged; fronto-ventral cirri more than nine; anal cirri well developed and five in number; caudal cirri four and scattered.

45. *Euplotes muscicola* Kahl

1932. *Euplotes muscicola* Kahl, *Urtiere oder Protozoa* (in Dahl's *Tierwelt Dtsch.*), Jena, pt. 25, p. 637.
1960. *Euplotes muscicola* : Tuffrau, *Hydrobiol.*, 15, p. 45.

Material examined : 2 exs., Jamirsura, North district, 9. xi. 1992, coll. A. K. Das; 2 exs.,

Sonamura, South district, 23. xii. 1992, coll. A. K. Das.

Diagnosis : Body oval, elongated, peristome narrow, extending upto about three-fourth of anterior left of the ventral surface of the body; peristomeal lip slender and rectilinear; dorso-lateral cirri 10, fronto-ventral cirri 9, transverse cirri 5 and caudal cirri 4; macronucleus in the form of inverted 'C'.

Distribution : India : Tripura (North and South districts).

Remarks : *E. muscicola* is reported as a highly cosmopolitan species of humid mosses (Tuffrau, 1960). Never the less, it is not recorded from India till date although ciliates of the moss samples brought from several districts of West Bengal (Das et al, 1993a) and Meghalaya (Das et al, 1995) were studied. Thus this species which has been collected from the ground moss of Tripura constitutes new record from India. It needs mention here that the shape of macronucleus of the present material in the form of inverted 'C', which is angular and more closed confirms what Tuffrau (1960) has described. But, such shape of nucleus distinctly differs from that of Kahl's (1932) figures which are shown as wide open arched inverted 'C'-shaped structure.

B. PARASITIC PROTOZOA

Phylum	SARCOMASTIGOPHORA
Subphylum	MASTIGOPHORA
Class	ZOOMASTIGOPHOREA
Order	KINETOPLASTIDA
Family	TRYPANOSOMATIDAE

Diagnosis : Body characteristically leaf-like with single flagellum attached to the body by undulating membrane; kinetoplast relatively small and compact.

Genus *Trypanosoma* Gruby

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

Diagnosis : Body highly flattened, leaf-like, pointed at flagellar end and bluntly rounded or pointed at the opposite end; flagellum arising from a blepharoplast running towards opposite end and making the outer boundary of the undulating membrane; polymorphism common, parasitic in the circulatory system of vertebrates.

Remarks : In all, 7 species of *Trypanosoma* have been collected from Tripura. Out of these, 4 species are from fish hosts and one each from amphibia, bird and mammal hosts respectively.

Key to the species of *Trypanosoma* of fishes

- 1(4) Trypomastigote form monomorphic
- 2(3) Body 'C' to 'S' shaped, cytoplasm uniformly granular, vacuoles concentrated more towards posterior part of the body *T. anabasi*
- 3(2) Body elongated, attenuated at both ends, cytoplasm not uniformly granular, vacuoles small and distributed throughout the body *T. pancali*
- 4(1) Trypomastigote form not monomorphic
- 5(6) Trypomastigote form dimorphic, volutin granules sometimes as compact mass, nucleus located towards posterior end of the body, cell body in large form measuring 22-29 μm *T. batrachi*
- 6(5) Trypomastigote form pleomorphic, volutin granules as above not present, nucleus located at anterior half of the body, cell body in large form measuring 54-75 μm *T. striati*.

46. *Trypanosoma anabasi* Mandal

1978. *Trypanosoma anabasi* Mandal, *Angew Parasit.*, 19, p. 159.

Material examined : Sev. exs., Teliamura, North district, 6. ii. 1991, coll. A. K. Mandal; sev. exs., Ambasa, North district, 4. ii. 1991, coll. A. K. Mandal.

Diagnosis : Trypomastigote form monomorphic, body 'C' to 'S'-shaped, length of

cell body 26-38 μm , cytoplasm uniformly granular, vacuoles scattered throughout the body but more concentrated towards posterior part; nucleus almost oval and located near middle of the body; undulating membrane conspicuous with 6-8 large folds.

Host : *Anabas testudineus* ; site of infection : blood.

Distribution : India : Tripura (North district) and West Bengal.

47. *Trypanosoma batrachi* Qadri

1962. *Trypanosoma batrachi* Qadri, *Parasitology*, 52, p. 225.

Material examined : Sev. exs., Teliamura, North district, 6. ii. 1991, coll. A. K. Mandal.

Diagnosis : Trypomastigote form dimorphic, cytoplasm granular, volutin granules present sometimes as a compact mass, nucleus situated towards posterior end and always encircled with a clear halo; cell body in large form 22-30 μm in length.

Host : *Clarius batrachus* ; site of infection : blood.

Distribution : India : Tripura (North district), Andhra Pradesh, Meghalaya and West Bengal.

48. *Trypanosoma pancali* Mandal

1975. *Trypanosoma pancali* Mandal, *Angew. Parasit.*, 16, p. 92.

Material examined : Sev. exs., Pachartal, North district, 16. vii. 1991, coll. A. K. Mandal.

Diagnosis : Trypomastigote form monomorphic, attenuated at both ends; cytoplasm possessing small vacuoles throughout, volutin granules present and arranged in a linear fashion opposite to undulating membrane; nucleus sausage-shaped; length of cell body 36-40 μm .

Host : *Mastacembelus pancalus*; site of infection : blood

Distribution : India : Tripura (North district) and West Bengal.

49. *Trypanosoma striati* Qadri

1955. *Trypanosoma striati* Qadri, *Parasitology*, 45, p. 60.

Material examined : Sev. exs., Pachartal, North district, 16. vii. 1991, coll. A. K. Mandal.

Diagnosis : Trypomastigote form pleomorphic, with small, intermediate and large forms; cytoplasm granular with very few vacuoles in small forms, less granular with many vacuoles in large forms and intermediate type in intermediate forms; nucleus spherical, oval or pear-shaped, located at the anterior half of the body; cell body in large form 54-75 μm in length.

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

Distribution : India : Tripura (North district), Andhra Pradesh and West Bengal.

Trypanosoma of Amphibians

A single species of *Trypanosoma*, *T. rotatorium* has been collected from the blood films of amphibians of Tripura.

50. *Trypanosoma rotatorium* (Mayer)

1843. *Amoeba rotatorium* Mayer, *Des haematozoaires* (Ph. D. Thesis).

1901. *Trypanosoma rotatorium* Leveran and Mesnil, *C. r. Soc. Biol.*, 53, p. 678.

Material examined : Sev. exs., Paratia, South district, 9. vii. 1991, coll. A. K. Mandal; sev. exs., Ambasa, North district, 27. vii. 1991, coll. A. K. Mandal.

Diagnosis : Trypomastigote form pleomorphic, forms termed as Type I, Type II and Type III; cytoplasm densely granular in the posterior two-third of the body, having 2-3 striated myonemes along longitudinal axis; length of cell body 30-35 μm .

Host : *Bufo melanostictus* and *Rana tigerina*; site of infection : blood.

Distribution : India : Tripura (South and North districts); Andaman Island, Goa, Meghalaya, Orissa and West Bengal.

Remarks : This species was reported earlier by Ray and Choudhury (1983) from Tripura. But, they (*op. cit.*) neither mentioned exact collection locality nor scientific name of the host from which this flagellate had been recovered from this state.

Trypanosoma of Birds

The only species of *Trypanosoma* collected from avian blood from Tripura is *T. avium*.

51. *Trypanosoma avium* Danilewsky

1885. *Trypanosoma avium* Danilewsky, *Biol. Centralbl.*, 5, p. 529.

Material examined : Sev. exs., Pachartal, North district, 16. vii. 1991, coll. A. K. Mandal; sev. exs., Paratia, South district, 8. vii. 1991, coll. A. K. Mandal.

Diagnosis : Trypomastigote form highly pleomorphic; kinetoplast elliptical, stained deep red and situated a long distance away from the posterior end; nucleus oval, located near the middle of the body; free-flagellum short.

Host : *Dicrurus adsimilis*; site of infection : blood.

Distribution : India : Tripura (North and South districts), Delhi, Jammu and Kashmir, Meghalaya and West Bengal.; cosmopolitan in distribution.

Trypanosoma of Mammals

A single species as follows has been recovered from the mammalian blood from the state.

52. *Trypanosoma lewisi* (Kent)

1880. *Herpetomonas lewisi* Kent, *A manual of the infusoria*, London.

1901. *Trypanosoma lewisi* Leveran and Mesnil, *Ann. Inst. Pasteur*, 15, p. 673.

Material examined : Sev. exs., Paratia, South district, 8. vii. 1991, coll. A. K. Mandal.

Diagnosis : Trypomastigote form monomorphic, cell body 21-36 μm in length; nucleus oval, situated at the anterior half of the body.

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

Distribution : India : Tripura (South district), Meghalaya and West Bengal.

Order RETORTOMONADIDA

Family CHILOMASTIGIDAE

Diagnosis : Flagellates with four flagella, of which three anteriorly and one posteriorly directed, the last one undulating in the cytostomal cleft.

Genus *Chilomastix* Alexeieff

1910. *Chilomastix* Alexeieff, *Arch. Zool. Exp.*, 6, N & R, p. 1.

1926. *Chilomastix* : Wenyon, *Protozoology*, 1, Bailliere, Tindal and Cox, p. 621.

Diagnosis : Body pyriform, with a large cytostomal cleft at anterior end; three longer flagella anteriorly directed, fourth flagellum short and undulating within the cleft.

53. *Chilomastix caprae* Fonseca

1915. *Chilomastix caprae* Fonseca, *Mem. Inst. Oswald. Cruz.*, 8, p. 5.

Material examined : Sev. exs., Paratia, South district, 8. vii. 1991, coll. A. K. Mandal; sev. exs., Teliamura, North district, 6. ii. 1991, coll. A. K. Mandal.

Diagnosis : Body small, pear-shaped, 9-10 μm $\times$ 4-6 μm in dimensions; number of flagella and flagellar disposition same as for the genus.

Host : *Capra hircus*; site of infection : rumen.

Distribution : India : Tripura (South and North districts) Meghalaya and West Bengal.

Order TRICHOMONADIDA

Family TRICHOMONADIDAE

Diagnosis : Anterior flagella variable in number, undulating membrane bordered by a flagellum; a definite cytostome present; axostyle often conspicuous and protruding from the posterior part of the body, a filamentous costa arising from the blepharoplast.

Genus *Trichomonas* Donne

1837. *Trichomonas* Donne, *Research microscopiques, etc.*, Paris.
1926. *Trichomonas* : Wenyon, *Protozoology*, 1, Bailliere Tindel and Cox, p. 648.

Diagnosis : More or less pyriform, anterior flagella free and four in number, fifth flagellum posteriorly directed along the outer margin of the undulating membrane, axostyle protruding out of the posterior end of the body; costa lying at the base of the membrane.

54. *Trichomonas ruminantium* Braune

1913. *Trichomonas ruminantium* Braune, *Arch. Protistenk.*, 32, p. 111.

Material examined : Sev. exs., Ampa, South district, 24. i. 1991, coll. A. K. Mandal.

Diagnosis : Body roughly pyriform, small, ranging from 8-17 μm x 5-15 μm in dimension; axostyle rigid and protruding out of the posterior end of the body.

Host : *Capra hircus*; site of infection : rumen.

Distribution : Tripura (South district), Meghalaya and West Bengal.

Subphylum OPALINATA

Class OPALINATEA

Order OPALINIDA

Family OPALINIDAE

Diagnosis : Numerous cilia in oblique longitudinal rows distributed over entire body surface; cytostome absent; nucleus of one kind ranging from one to many.

Key to the genera

- 1(2) Body highly flattened, multinucleate, ellipsoidal in cross section
.....Genus *Opalina*
2(1) Body cylindrical or pyriform, multinucleate, circular in cross section
.....Genus *Cepedia*

Genus *Cepedia* Metcalf

1920. *Cepedia* Metcalf, *Science*, 52, p. 135.

Diagnosis : As in the key to the genus.

55. *Cepedia longa* (Bezenberger)

1904. *Opalina longa* Bezenberger, *Arch. Protistenk.*, 3, p. 138.
1923. *Cepedia longa* Metcalf, *Bull. U. S. Mus.*, 120, p. 168.

Material examined : 4 exs., Paratia, South district, 8. vii. 1991, coll. A. K. Mandal; 1 ex., Ambasa, North district, 29. vii. 1991, coll. A. K. Mandal.

Diagnosis : Body considerably elongated, rounded in front and tapering posteriorly to a point, length 200-600 μm ; endoplasm with thick central zone of compact alveolae and loose peripheral zone; nuclei many, ellipsoidal or spheroidal.

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

Distribution : India : Tripura (South and North districts), Meghalaya and West Bengal.

Genus *Opalina* Purkinje and Valentin

1835. *Opalina* Purkinje and Valentin, *De Phaenomeno generali et fundamentali, etc.*, Bratislaviae, p. 43.
1923. *Opalina* : Metcalf, *Bull. U. S. Mus.*, 120, p. 175.

Key to the species

- 1(2) Body broadly or elongately ovate, slightly longer than broad, tapering and rounded anteriorly, dorsal surface with two or four ridges*O. plicata*
2(1) Body elongated, cylindrical, about three to five times long as broad, ridges on dorsal surface as above lacking
.....*O. scalpriformis*

56. *Opalina plicata* Ghosh

1919. *Opalina plicata* Ghosh, *Proc. Indian Assoc. Cult. Sci.*, 4, p. 102.

Material examined : Sev. exs., Ambasa, North district, 29. vii. 1991, coll. A. K. Das.

Diagnosis : Body broadly or elongately ovate, tapering and rounded anteriorly, wide and rounded posteriorly, dorsal surface with two or four ridges.

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

Distribution : India : Tripura (North district), Meghalaya and West Bengal.

57. *Opalina scalpriformis* Ghosh

1919. *Opalina scalpriformis* Ghosh, *Proc. Indian Assoc. Cult. Sci.*, 4, p. 103.

Material examined : Sev. exs., Paratia, South district, 7. vii. 1991, coll. A. K. Das; sev. exs., Ambasa, North district, 29. vii. 1991, coll. A. K. Das.

Diagnosis : Body elongated, cylindrical, rounded anteriorly and narrower posteriorly, about three to five times long as broad, anterior part of the body with several longitudinal folds or ridges.

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

Distribution : India : Tripura (South and North districts), Goa, Meghalaya, Uttar Pradesh and West Bengal.

Phylum APICOMPLEXA
Class SPOROZOEA
Order EUGREGARINIDA
Family MONOCYSTIDAE

Diagnosis : Trophozoites without any marked differentiation at the anterior end; sporocysts biconical with similar nonappendiculate poles.

Genus *Monocystis* Stein

1848. *Monocystis* Stein, *Arch. Anat. Phys. Wiss. Med.*, pp. 183-223.

Diagnosis : Trophozoites ovoid, solitary, often provided with an inconspicuous micron at the anterior pole; sporocysts as for the family.

58. *Monocystis bengalensis* Ghosh

1923. *Monocystis bengalensis* Ghosh, *J. roy. microsc. Soc.*, p. 423.

Material examined : 2 exs., Paratia, South district, 7. vii. 1991, coll. A. K. Mondal; 1 ex., Manu, North district, 18. vii. 1991, coll. A. K. Mandal.

Diagnosis : Mature trophozoites elongated and club-shaped, dimensions 40-50 μm x 12-30 μm ; ectoplasm very thin and endoplasm highly granular, myonemes indistinct; nucleus rounded with a large irregular karyosome; gametocysts irregularly hemispherical 70-80 μm , in diameter; gametocytes rounded or oval.

Host : *Metaphire posthuma*; site of infection: seminal vesicle.

Distribution : India : Tripura (South and North districts), Meghalaya, West Bengal.

Order EUCOCCIDA

Key to the families

- 1(2) Macrogamete and microgamont usually associated in syzygy during development, microgamont producing 1-4 microgametes (zygote active, life cycle involving two hosts, one vertebrate and other invertebrate (leech) Family HAEMOGREGARINIDAE
- 2(1) Macrogamete and microgamont developing independently, syzygy, absent, microgamont producing many microgametes
- 3(4) Sporozoite typically enclosed in sporocyst within oocyst, zygote non-motile(homoxenous, merogony and gamogony within hosts, sporogony typically outside, sporozoites never in blood cell) Family EIMERIIDAE
- 4(3) Sporozoite naked, with three membrane wall, zygote motile (ookinete), (parasites having sexual phase in insects other than mosquito and asexual cycle in tissue cells of vertebrate host, erythrocyte schizogony lacking, pigmented gametocytes in erythrocytes of vertebrate hosts) Family HAEMOPROTEIDAE

Family HAEMOGREGARINIDAE

Genus *Haemogregarina* Danilewski

1885. *Haemogregarina* Danilewski, *Arch. micr. Anat.*, 24, pp. 558-598.

Diagnosis : Oocyst with 8 or more naked sporozoites, infection of vertebrate host by bite of invertebrates, schizogony occurring in erythrocytes of vertebrates.

59. *Haemogregarina berestneffi* Castellani and Willey

1905. *Haemogregarina berestneffi* Castellani and Willey, *Quart. J. microsc. Sci.*, 49, p. 383.

Material examined : Sev. exs., Paratia, South district, 8. vii. 1991, coll. A. K. Mandal.

Diagnosis : Polar capsule present but polar cap lacking; gametocyte typically elongate and straight, anterior end more or less rounded and narrower while posterior end pointed; cytoplasm homogeneous, little granular at anterior end, nucleus rounded, oval or irregular in shape, situated centrally or little below towards posterior end.

Host : *Rana tigerina*; site of infection : blood.

Distribution : India : Tripura (South district), Maharashtra, Meghalaya, Tamil Nadu and West Bengal.

Family EIMERIDAE

Key to the genera

- 1(2) Each oocyst with two sporocysts and each sporocyst with four sporozoites
.....Genus *Isospora*
- 2(1) Each oocyst with four sporocysts and each sporocyst with two sporozoites
.....Genus *Eimeria*

Genus *Eimeria* Schneider

1875. *Eimeria* Schneider, *Arch. Zool. Exp. Gen.*, 4, p. 493.

Diagnosis : Each oocyst with four sporocysts, each sporocyst with two sporozoites, merogony intracellular, sporogony extracellular, occurring in vertebrates, only few in invertebrates.

Remarks : In all, 14 species of *Eimeria* have been collected from Tripura. Out of these, 3

species have been recovered from the faecal samples of avian hosts and the remaining 11 species from those of mammalian hosts.

Eimeria from Avian Hosts

Key to the species

- 1(2) Oocyst spherical or almost spherical, cyst wall bearing no micropyle*E. mitis*
- 2(1) Oocyst broad, ovoid, cyst wall bearing micropyle
- 3(4) Oocyst small, ellipsoid broad-ovoid, average 10.5 μm x 5.6 μm , sporozoite banana-shaped*E. mivati*
- 4(3) Oocyst comparatively large, broad ovoid, average 23 μm x 19 μm , sporozoite comma-shaped*E. tenella*

60. *Eimeria mitis* Tyzzer

1929. *Eimeria mitis* Tyzzer, *Am. J. Hyg.*, 10, p. 169.

Material examined : Sev. exs., Ambasa, North district, 29. vii. 1991, coll. A. K. Mandal.

Diagnosis : Oocyst almost spherical, colourless and smooth walled, 12-21 μm x 11-19 μm in dimension, micropyle absent, no oocystic residuum but polar granules present; sporocyst ovoid, 4 in number measuring 9-10 μm x 6-6.5 μm ; steida body prominent; sporocystic residuum granular and placed centrally.

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

Distribution : India : Tripura (North district), Madhya Pradesh, Maharashtra, Orissa, Tamil Nadu and Uttar Pradesh.

61. *Eimeria mivati* Edger and Seibold

1964. *Eimeria mivati* Edger and Seibold, *J. Parasit.*, 50, p. 193.

Material examined : Sev. exs., Ampa, South district, 24. i. 1991, coll. A. K. Mandal.

Diagnosis : Oocyst ellipsoid to ovoid, colourless, smooth walled, measuring 11-20 μm x 10-15 μm , micropyle present on the narrower end, no oocystic residuum but polar granule sometimes present under the micropyle; sporocysts

long oval, 4 in number, 7.5-12 μm x 5.0-6.0 μm in dimensions; sporozoites crescent or banana-shaped with pointed anterior and blunt posterior ends, a large eosinophilic granule present towards posterior part of sporozoite.

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

Distribution : India : Tripura (South district) and Uttar Pradesh.

62. *Eimeria tenella* (Railliet and Lucet)

1891. *Cocccidium tenellum* Railliet and Lucet, *Bull. Soc. zool. Fr.*, 16, p. 246.

1909. *Eimeria tenella* Fantham, *Proc. zool. Soc. London*, 14, p. 43.

Material examined : Sev. exs., Ambasa, North district, 29. vii. 1991, coll. A. K. Mandal.

Diagnosis : Oocyst broad ovoid, measuring 19-26 μm x 16-22 μm , cyst wall smooth and thick, micropyle present, oocystic residuum lacking; sporocysts 4 in number, 11 μm x 7 μm in dimension, bearing a steida body on the pointed end; sporozoite comma-shaped enclosing a round hyaline globule close to the broad end; granular sporocystic residuum present.

Host : *Gallus domesticus*; site of infection : intestine.

Distribution ; India : Tripura (North district), Madhya Pradesh, Maharashtra, Orissa, Tamil Nadu, Uttar Pradesh and West Bengal.

Eimeria from Mammalian Hosts

Key to the species

1(14) Parasitic in cattle, goats and sheep

2(3) Parasitic in cattle, oocyst cylindrical or some what subcylindrical, cyst wall single or double layered and smooth.
.....*E. cylindrica*

3(2) Parasitic in goats and sheep, oocysts of different shape, oocyst wall double layered, smooth or rough

4(5) Oocyst wall coarse with transverse stripes, (largest oocyst of all ovine eimerias, average dimension 45. 5 μm x 32. 7 μm)
.....*E. intricata*

5(4) Oocyst wall smooth without any stripe as above

6(7) Oocyst small, average dimension 16. 2 μm x 13. 4 μm , micropyle lacking, (sporocyst ellipsoidal with one end rounded and the other end possessing a definite stieda body)*E. parva*

7(6) Oocyst comparatively large, cyst wall having a micropyle

8(11) Micropyle covered by a micropylar cap

9(10) Oocyst typically ellipsoidal, sporocyst elongate ovoid, 11-17 μm x 6-10 μm in dimension, steida body absent or vestigeal*E. arloingi*

10(9) Oocyst ellipsoid ovoid, sporocyst elongate ovoid, 16-21 μm x 7-10 μm in dimension, steida body absent*E. ahsata*

11(8) Micropyle without any micropylar cap

12(13) Oocyst egg-shaped, 23. 80-38. 34 μm x 18.8-23.8 μm in dimension, sporocyst ellipsoidal, measuring 15-17 μm x 8-10 μm , steida body absent*E. faurei*

13(12) Oocyst ovoid to subspherical, 20.4-26.8 μm x 17 μm -20.4 μm in dimension, sporocyst elongate ovoid, measuring 9-14 μm x 4-10 μm , steida body present.
.....*E. ninakohlyakimovi*

14(1) Parasitic in pigs

15(16) Entire surface of oocyst wall covered with spines*E. spinosa*

16(15) Surface of oocyst wall without any spine

17(20) Oocyst wall double-layered and smooth

18(19) Sporocyst elongate-ovoid, asymmetrical, one side slightly flattened, measuring 13-16 μm x 6-7 μm *E. deblicieki*

19(18) Sporocyst short, broadly ovoid, with a sparse and finely granular residuum, measuring 9-11 μm x 7-8 μm
.....*E. porci*

20(17) Oocyst wall double layered, outer wall scabrous and inner wall smooth
.....*E. polita*

63. *Eimeria ahsata* Honess

1942. *Eimeria ahsata* Honess, Univ. Wyo. Agric. Exp. Sta., 249, p. 3.

Material examined : Sev. exs., Teliamura, North district, 6. ii. 1991, coll. A. K. Mandal.

Diagnosis : Oocyst ellipsoid ovoid and slightly flattened at the micropylar end, measuring 37-45 μm x 22-29 μm , oocyst wall double layered, smooth; micropyle with dome-shaped micropylar cap present; oocystic residuum absent; sporocyst elongate-ovoid, measuring 16-21 μm x 7-10 μm , steida body absent, sporocystic residuum present as scattered granules; sporozoite banana-shaped.

Host : Domestic goat, *Capra hircus*; site of infection : intestine.

Distribution : India : Tripura (North district), Meghalaya, Orissa, Uttar Pradesh, and West Bengal.

64. *Eimeria arloingi* (Marotel)

1905. *Coccidium arloingi* Marotel, Rec. Med. Vet., 33, p. 243.

1909. *Eimeria arloingi* Martin, Rev. Vet. (Toulouse), 34, p. 201.

Material examined : Sev. exs., Paratia, South district, 9. vii. 1991, coll. A. K. Mandal.

Diagnosis : Oocyst typically ellipsoidal, measuring 25.0-37.5 μm x 17.0-25.0 μm ; oocyst wall double layered and smooth, micropyle present and covered by a crescent-shaped polar cap; oocystic residuum absent; sporocyst elongate-ovoid, measuring 11-17 μm x 6-10 μm ; steida body absent or vestigial; sporozoite elongated, lying length-wise, head to tail, within the sporocyst.

Host : Domestic goat, *Capra hircus*; site of infection : intestine.

Distribution : India : Tripura (South district); Andhra Pradesh, Bihar, Madhya Pradesh, Maharashtra, Meghalaya, Punjab, Uttar Pradesh and West Bengal.

65. *Eimeria cylindrica* Wilson

1931. *Eimeria cylindrica* Wilson, Va. Agr. Exp. Sta. Tech. Bull., 42 : p. 1.

Material examined : Sev. exs., Ampa, South district, 24. i. 1991, coll. A. K. Mandal; sev. exs., Agartala, West district, 30. vii. 1991, coll. A. K. Mandal.

Diagnosis : Oocysts cylindrical or subcylindrical, measuring 20-37 μm x 12-17 μm ; oocyst wall double-layered and smooth; micropyle absent, polar granule also lacking; sporocyst elongate ovoid, measuring 9-13 μm x 4-6 μm ; steida body present as a light cap over the narrow end; sporozoites elongate and banana-shaped.

Hosts : Indian cattle, *Bos indicus* and Buffalo, *Bubalus bubalis*; site of infection : intestine.

Distribution : India : Tripura (South and West districts), Haryana, Orissa and Uttar Pradesh.

66. *Eimeria deblickei* Douwes

1921. *Eimeria deblickei* Douwes, Bijdrage tot de Kennis Van enkele darmprotozoen der huisdieren in het bijzonder bij schaaap en varken, Diss., Wtrecht., p. 62.

Material examined : Sev. exs., Teliamura, North district, 27. i. 1991, coll. A. K. Mandal.

Diagnosis : Oocysts ellipsoidal to ovoid, measuring 20-29 μm x 14-20 μm , oocyst wall double-layered and smooth; micropyle absent but polar granules present; sporocyst elongate ovoid, asymmetrical, one side slightly flattened, measuring 13-16 μm x 6-7 μm ; steida body present, sporozoites elongate containing two clear globules.

Hosts : Domestic pig, *Sus scrofa*; site of infection : intestine.

Distribution : India : Tripura (North district); Haryana, Madhya Pradesh and Uttar Pradesh.

67. *Eimeria faurei* (Moussu and Marotel)

1902. *Coccidium faurei* Moussu and Marotel, Archs. Parasit, 6, p. 82.

1909. *Eimeria faurei* : Martin, Rev. Vet., Toulouse, 34, p. 201.

Material examined : Sev. exs., Ampí, South district, 24. i. 1991, coll. A. K. Mandal; sev. exs., Agartala, West district, 30. vii. 1991, coll. A. K. Mandal.

Diagnosis : Oocyst egg-shaped, measuring 23. 80-38. 34 μm x 18. 8-23. 8 μm , oocyst wall double-layered and smooth; micropyle present at the narrower end and without any micropylar cap; oocystic residuum absent, polar granule present, sporocyst ellipsoidal, measuring 15-17 μm x 8-10 μm ; steida body absent; sporozoite elongate.

Hosts : Domestic goat, *Capra hircus* and domestic sheep, *Ovis* sp. ; site of infection : intestine.

Distribution : India : Tripura (South and West districts), Haryana, Madhya Pradesh, Maharashtra, Meghalaya, Orissa, Punjab, Uttar Pradesh and West Bengal.

68. *Eimeria intricata* Spiegel

1925. *Eimeria intricata* Spiegel, *Z. Infektkauk. U. Hygiene de Hasstiere*, 28, p. 42.

Material examined : Sev. exs., Teliamura, North district, 27. i. 1991, coll. A. K. Mandal.

Diagnosis : Oocyst very large, ellipsoidal to ovoid, measuring 37. 4-51. 0 μm x 28. 9-37. 4 μm , oocyst wall double-layered, outer wall very thick and rough; micropyle large and appearing as a wide gap below crescent-shaped polar cap, sporocyst pyramidal, steida body and sporocystic residuum present; sporozoite elongate.

Host : Domestic goat, *Capra hircus*; site of infection : intestine.

Distribution : India : Tripura (North district), Bihar, Madhya Pradesh, Maharashtra, Meghalaya, Orissa, Punjab, Uttar Pradesh and West Bengal.

69. *Eimeria ninakohlyakimovi* Yakimoff and Rostegaieff

1930. *Eimeria ninakohlyakimovi* Yakimoff and Rostegaieff, *Arch. Protistenk.*, 70, p. 185.

Material examined : Sev. exs., Ampí, South district, 24. i. 1991, coll. A. K. Mandal.

Diagnosis : Oocyst ovoid to subspherical, measuring, 20. 4-26. 8 μm x 17. 4-20. 4 μm , oocyst wall double layered and smooth, micropyle present and oocystic residuum absent, sporocyst elongate-ovoid, measuring 9-14 μm x 4-10 μm ; steida body and sporocystic residuum present; sporozoite elongate.

Host : Domestic goat, *Capra hircus*; site of infection : intestine.

Distribution : India : Tripura (South district); Haryana, Madhya Pradesh, Maharashtra, Orissa, Punjab and Uttar Pradesh.

70. *Eimeria parva* Koltan, Mocsy and Vajda

1929. *Eimeria parva* Koltan, Mocsy and Vajda, *Allatorv. Lapok.*, 52, p. 304.

Material examined : Sev. exs., Ampí, South district, 24. i. 1991, coll. A. K. Mandal.

Diagnosis : Oocyst small, ellipsoid, ovoidal or subspherical, measuring 14-19 μm x 12-15 μm , oocystic wall double-layered and smooth; micropyle absent; sporocyst ellipsoidal with one end rounded and the other end possessing a steida body; sporocystic residuum present.

Host : Domestic goat, *Capra hircus*; site of infection; intestine.

Distribution : India : Tripura (South district), Bihar, Haryana, Madhya Pradesh, Maharashtra, Meghalaya, Orissa, Punjab, Uttar Pradesh and West Bengal.

71. *Eimeria polita* Pellerdy

1949. *Eimeria polita* Pellerdy, *Acta Vet. hung.*, 1, p. 101.

1965. *Eimeria cerdonis* Vitterling, *J. Parasit.*, 51, p. 897.

Material examined : Sev. exs., Teliamura, North district, 6. ii. 1991, coll. A. K. Mandal.

Diagnosis : Oocyst broadly ovoid and slightly flattened at anterior end, measuring 27-29 μm x 21-23 μm ; oocyst wall double walled, outer wall scabrous, dark yellow, devoid of striations and inner wall smooth and dark brown; micropyle, micropylar cap and oocystic residuum absent; 1-6 oocystic polar granules present, sporocyst

elongated and steida body plug-like; sporozoite banana-shaped, usually containing 1-2 large globules.

Host : Domestic pig; *Sus scrofa domestica*; site of infection : intestine.

Distribution : India : Tripura (North district); Haryana, Madhya Pradesh and Uttar Pradesh.

Remarks : Gill and Mishra (1967 a, b) recorded *E. polita* from domestic pigs of Uttar Pradesh while *E. cerdonis* has been reported by several workers (Shrivastava and Shah, 1968; Upadhyaya *et al*, 1977, and Mandal, 1980) from the same host from different states of India. However, Pellerdy (1974) synonymised *E. cerdonis* with *E. polita* since, according to him, both species are very much identical. Subsequently Levine (1988) also accepted this view. But in Fauna of India Mandal (1987) maintained separate specific status of *E. cerdonis* and *E. polita* without giving proper justification. The present material in having scabrous oocystic wall resemble *E. cerdonis* as described by Vitterling (1965). Even then, these are treated under *E. polita* in light of discussion made by Pellerdy (*op. cit.*).

72. *Eimeria porci* Vitterling

1965. *Eimeria porci* Vitterling, *J. Parasit.*, **51**, p. 897.

Material examined : Sev. exs., Teliamura, North district, 27. i. 1991, coll. A. K. Mandal.

Diagnosis : Oocyst pear-shaped, distinctly narrow at anterior end, measuring 20-27 μm x 14-18 μm ; oocystic wall double layered, smooth; micropyle, micropylar cap and oocystic residuum absent, polar granules present; sporocyst short, broadly ovoid, measuring 9-11 μm x 7-8 μm with sparse and finely granular residuum; steida body present.

Host : Domestic pig, *Sus scrofa*; site of infection : small intestine.

Distribution : India : Tripura (North district); Madhya Pradesh and Uttar Pradesh

73. *Eimeria spinosa* Henry

1931. *Eimeria spinosa* Henry, *Univ. Calif. Publ. Zool.*, **36**, p. 115.

Material examined : Sev. exs., Teliamura, North district, 27. i. 1991, coll. A. K. Mandal.

Diagnosis : Oocyst ellipsoidal, measuring 16-22 μm x 13-16 μm ; oocystic wall double-layered, entire surface covered with 1 μm long spine; sporont usually lying asymmetrically inside the oocyst; polar granules present, oocystic residuum absent, sporocystic residuum body granular.

Host : Domestic pig, *Sus scrofa*; site of infection : small intestine.

Distribution : India : Tripura (North district), Haryana, Madhya Pradesh, Meghalaya, Orissa and West Bengal.

Genus *Isospora* Schneider

1881. *Isospora* Schneider, *Arch. Zool. Exp. Gen.*, **9**, p. 387.

Diagnosis : Each oocyst with two sporocysts and each sporocyst with four sporozoites, usually parasitic in vertebrates.

Only one species of *Isospora*, *I. lacazei* has been collected from the state.

74. *Isospora lacazei* (Labbe)

1893. *Diplospora lacazei* Labbe, *c. r. Acad. Sci.*, Paris, **117**, p. 407.

1899. *Isospora lacazei* Labbe, *Tierreich Eine Zusammenstellung und Kennzeichnung der Rezenten Tierformen*, **5**, Friedlander & sons, Berlin.

Material examined : Sev. exs., Manu, North district, 19. vii. 1991, coll. A. K. Mandal.

Diagnosis : Oocyst spheroidal or subspherical, oocystic wall double-layered, of which inner one thicker; micropyle and oocystic residuum absent; sporocyst ovoid to pyriform with button-shaped plug at narrow anterior end; sporocystic residuum present; sporozoite bean shaped, merozoites sickle-shaped.

Host : House sparrow, *Passer domesticus*; site of infection : intestine.

Distribution : India : Tripura (North district), Meghalaya and West Bengal.

Family HAEMOPROTEIDAE

Genus *Haemoproteus* Kruse

1890. *Haemoproteus* Kruse, *Arch. Pathol. Anat.*, **120**, p. 541.

Diagnosis : Trophozoites in erythrocytes; merogony (schizogony) in endothelial cells of blood vessels, especially in lungs and erythrocytes, haemozoin pigments visible with light microscope; vectors hippoboscids flies (culicoides or chrysops), parasitic in birds, reptiles and amphibia.

Key to the species

- 1(2) Parasite causing marked displacement of host cell nucleus, (mean number of pigment granules 17, macrogametocytes 14. 5 μm x 3.6 μm in dimensions and 53. 5 μm^2 in area)*H. oryzivorae*
- 2(1) Parasite not causing marked displacement of host cell nucleus
- 3(4) Mean number of pigment thirty, parasitic in columbae*H. columbae*
- 4(3) Mean number of pigment granules fifteen, parasitic in Dicruridae*H. dicruri*

75. *Haemoproteus columbae* Kruse

1890. *Haemoproteus columbae* Kruse, *Arch. Pathol. Anat.*, **120**, p. 359.

Material examined : Sev. exs., Manu, North district, 19. vii. 1991, coll. A. K. Mandal.

Diagnosis : Macrogametocyte halteridial, inner and polar margin amoeboid, outer margin entire, occupying about 60 per cent of the host cell-parasite complex; pigment yellowish-black, discrete, round, scattered, 30 granules per parasite in average; nucleus round oval, median to submedian, host cell relatively unchanged, host cell nucleus atrophied 25. 8 per cent in area.

Host ; *Columba livia*; site of infection : blood.

Distribution : India : Tripura (North district), Delhi, Maharashtra, Meghalaya and West Bengal.

76. *Haemoproteus dicruri* de Mello

1935. *Haemoproteus dicruri* de Mello, *Proc. Indian Acad. Sci.*, **2B**, p. 469.

Material examined : Sev. exs., Paratia, South district, 9. vii. 1991, coll. A. K. Mandal.

Diagnosis : Macrogametocyte halteridial, margin entire, occupying about 60 per cent of the host cell-parasite complex, nucleus submedian, round oval, pigments yellowish brown, 15 granules in average; host cell hypertrophied by 19.2 per cent and host cell nucleus atrophied by 3.4 per cent in area respectively.

Host : *Dicrurus adsimilis*; site of infection : blood.

Distribution : India : Tripura (South district), Goa, Jammu and Kashmir, Meghalaya, Orissa and West Bengal.

77. *Haemoproteus oryzivorae* Anschütz

1909. *Haemoproteus oryzivorae* Anschütz, *Zentralbl. Bakteriologie. Parasitenkunde. Infektionskrankheiten. Original.*, **51**, p. 654.

Material examined : Sev. exs., Pachartal, North district, 13. vii. 1991, coll. A. K. Mandal.

Diagnosis : Macrogametocyte halteridial, rarely broadly sausage-shaped, margin entire occupying about 70 per cent of the host cell-parasite complex; nucleus round ovoid or broadly triangular, median to subterminal, usually located at the outer margin of the parasite, occupying about 9 per cent of the area of the macrogametocyte; pigment granules small, ovoid, yellow to dark, yellow-brown, scattered, 12 granules in average; host cell hypertrophied by 34.6 per cent and host nucleus atrophied by 10.4 per cent in area respectively and markedly displayed to periphery.

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

Distribution : India : Tripura (North district), Andhra Pradesh, Goa, Meghalaya, Orissa and West Bengal.

Phylum CILIOPHORA

Class KINETOFRAGMINOPHOREA

Order TRICHOSTOMATIDA

Family BALANTIDIIDAE

Diagnosis : Vestibulum anteriorly located, cytostome at the base of vestibulum; somatic

ciliation uniform, parasitic in invertebrate and vertebrate hosts.

Genus ***Balantidium*** Claparede and Lachmann

1858. *Balantidium* Claparede and Lachmann, *Etudes sur les infusoires et des rhizopides*, Geneve, p. 247.

Diagnosis : Body oval, ellipsoid to subcylindrical, uniformly ciliated, peristome starting at or near anterior end, cytopharynx not well developed, contractile vacuole and cytopyge terminal.

Key to the species

- 1(2) Body elongated, egg-shaped, peristome not reaching the middle of the body, macronucleus kidney shaped.....
.....***B. helenae***.
- 2(1) Body round or broadly oval, peristome slit like and reaching below the middle of the body***R. rotundum***

78. *Balantidium helenae* Bezenberger

1904. *Balantidium helenae* Bezenberger, *Arch. Protistenk.*, 3, p. 151.

Material examined : 2 exs., Ambasa, North district, 29. vii. 1991, coll. A. K. Mandal.

Diagnosis : Body ovoid, anterior end narrower than the posterior one, 114. 5-140 μm x 48. 4-52 μm ; peristome not reaching up to the middle of the body; macronucleus kidney shaped, micronucleus rounded and located at the notch of macronucleus; contractile vacuole usually single.

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

Distribution : India : Tripura (North district), Meghalaya, Goa and West Bengal.

79. *Balantidium rotundum* Bezenberger

1904. *Balantidium rotundum* Bezenberger, *Arch. Protistenk.*, 3, p. 153.

Material examined : 2 exs., Paratia, South district, 9. vii. 1991, coll. A. K. Mandal.

Diagnosis : Body round or completely egg-shaped, strongly compressed dorsoventrally, with a bulging on the ventral surface, dimension 56. 7 μm x 45 μm ; peristome slit-like, anteriorly located, extended along the right margin, reaching little beyond the middle of the body; macronucleus oval or slightly kidney-shaped; micronucleus distinct and located at the notch lying on the middle or at one end of macronucleus; contractile vacuole single.

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

Distribution : India : Tripura (South district), Meghalaya and West Bengal.

Class POLYHYMENOPHOREA

Order HETEROTRICHIDA

Key to the families

- 1(2) Body ovoid to slightly reniform, plump, sucker on ventral side lacking
.....Family NYCTOTHERIDAE
- 2(1) Body plump-ovoid to ellipsoidal, occasionally tailed, sucker typically present on concave side of the body
.....Family SICUOPHORIDAE

Family NYCTOTHERIDAE

Key to the genera

- 1(2) Body generally less flat, micronucleus most often located above macronucleus, commensal of both invertebrate and vertebrate Genus *Nyctotherus*
- 2(1) Body ovoid, pyriform or reniform, left margin convex, right margin more or less flat, micronucleus always below macronucleus, commensal of anurans
.....Genus *Nyctotheroides*

Genus *Nyctotherus* Leidy

1849. *Nyctotherus* Leidy, *Proc. Acad. Nat. Sci.*, Philadelphia, 1, p. 233.

Diagnosis : As in the key to the genera of the family.

80. *Nyctotherus ovalis* Leidy

1849. *Nyctotherus ovalis* Leidy, *Proc. Acad. Nat. Sci.*, Philadelphia, 1, p. 233.

Material examined : 2 exs., Teliamura, North district, 27. vii. 1991, coll. A. K. Mandal; 1 exs., Ambasa, North district, 29. vii. 1991, coll. A. K. Mandal; 2 exs., Paratia, South district, 9. vii. 1991, coll. A. K. Mandal.

Diagnosis : Body broadly oval, 150-320 μ m in length, divisible into two parts by caryophore diaphragm, anterior part smaller and transparent, posterior part larger and alveolar, infranuclear portion possessing large alveole and numerous inclusions; macronucleus egg-shaped, curved, cytopharynx slightly bent and reaching up to the middle, contractile vacuole single and subterminal.

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

Distribution : India : Tripura (North and South districts), Meghalaya, Punjab, Goa and West Bengal.

Genus *Nyctotheroides* Grasse

1928. *Nyctotheroides* Grasse, *Ann. Protistal.*, 1, pp. 55-68.

Diagnosis : As in the key to the genera of the Family.

81. *Nyctotheroides cordiformis* (Ehrenberg)

1838. *Bursaria cordiformis* Ehrenberg, *Die Infusionsthierchen als Vollkommene Organismen*, Leipzig, p. 328.

1867. *Nyctotherus cordiformis* Stein, *Der Organismus der Infusionsthier nach eigenen Forschungen in Systematischer Reihenfolge Bearbeitet. II.* pp. 338-344.

1928. *Nyctotheroides cordiformis* Grasse, *Ann. Parasitol.*, 1, pp. 55-68.

Material examined : 2 exs., Ambasa, North district, 29. vii. 1991, coll. A. K. Mandal; 1 exs., Paratia, South district, 9. vii. 1991, coll. A. K. Mandal.

Diagnosis : Body reniform, somewhat pointed anteriorly, 104-185 μ m in length; cytopharynx broadly curved, reaching beyond the middle of

the body; macronucleus kidney-shaped, micronucleus located below macronucleus and centrally attached to it.

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

Distribution : India : Tripura (North and South districts), Goa, Meghalaya, Karnataka, Rajasthan and West Bengal.

Family SICUOPHORIDAE

Genus *Sicuophora* de Puytorac and Grain

1969. *Sicuophora* de Puytorac and Grain, *Protistologica*, 4, 1968, pp. 405-414.

Diagnosis : Body ovoid, highly complex along inferior surface, provided with polysaccharide skeletal structure, commensal in anurans.

82. *Sicuophora macropharynges* (Bezenberger)

1904. *Nyctotherus macropharyngeus* Bezenberger, *Arch. Protistenk.*, 3, p. 138.

1973. *Sicuophora macropharynges* Albert, *J. Protozool.*, 20, pp. 51-57.

Material examined : 3 exs., Paratia, South district, 9. vii. 1991, coll. A. K. Mandal.

Diagnosis : Body oval, posterior part of the body distinctly thicker than anterior part; 134-280 μ m in length; a thinner portion at anterior end appearing to project like a frill; cytopharynx large, funnel shaped, posterior portion of which forming a coil in two and a half spiral turns; macronucleus pentagonal, oval or cone-shaped, micronucleus single and placed over macronucleus, macronucleus located near posterior end.

Host ; *Rana tigerina*; site of infection : cloaca.

Distribution : India : Tripura (South district), Maharashtra, Meghalaya, Karnataka, Rajasthan and West Bengal.

C. SYMBIOTIC PROTOZOA

Phylum SARCOMASTIGOPHORA

Subphylum MASTIGOPHORA

Class ZOOMASTIGOPHOREA

Order TRICHOMONADIDA

Key to the families

1(2) Nucleus single, mastigont also single with 3 to 6 flagella
.....Family DEVESCOVINIDAE

2(1) Nucleus multiple, 4 flagella attached to each mastigont Family CALONYMPHIDAE

Family DEVESCOVINIDAE

Key to the genera

1(2) Trailing flagellum 1 to 1.5 times the length of the body, parabasal body spiralled around axostyle or posterior part of nucleus in 1.5 to 5 turns Genus *Devescovina*

2(1) Trailing flagellum exceeding twice the length of the body, parabasal body not coiled around axostyle Genus *Foaina*

Genus *Devescovina* Foa

1905. *Devescovina* Foa, *Atti R. Acad. Lincei* (5), ser. 2, 14, p. 546.

Diagnosis : As in the key to the genus.

83. *Devescovina glabra* Grassi

1917. *Devescovina glabra* Grassi, *Mem. R. Accad. Lincei* (5), 12, p. 334.

Material examined : 5 exs., Bagafa, South district, 18. iv. 1991, coll. D. N. Tiwari.

Diagnosis : Body elongated with pointed posterior end, 48-64 μm x 16-25 μm in dimensions; trailing flagellum cord-shaped, cresta measuring 7.2-8 μm with posteromedial edge longer than anteromedial edge; parabasal body takes two turns around the axostyle, axostyle straight with stout anterior and filamentous posterior end.

Host : *Cryptotermes dudleyi*; location : gut.

Distribution : Tripura (South district), Bihar and West Bengal.

84. *Devescovina lemniscata* Kirby

1926. *Devescovina lemniscata* Kirby, *Univ. Calif. Publ. Zool.*, 29, p. 103.

Material examined : 7 exs., Bagafa, South district, 18. iv. 1991, coll. D. N. Tiwari.

Diagnosis : Body more or less pyriform with bluntly pointed posterior end, 43. 2-51. 2 μm x 17. 6-19. 2 μm in dimensions; trailing flagellum band or ribbon shaped; cresta with broad proximal and pointed distal end; parabasal body taking 1-4 turns around axostyle; axostyle bent or sinuous in posterior portion of the body.

Host : *Cryptotermes dudleyi*; location : gut.

Distribution : Tripura (South district), Bihar and West Bengal.

Genus *Foaina* Janicki

1915. *Foaina* Janicki, *Zeit. Wiss. Zool.*, 92, p. 615.

Diagnosis : Trailing flagellum usually exceeding twice the length of the body; cresta slender, 2. 5-17 μm long; parabasal body usually single, in some species with rami, curved around nucleus.

Key to the species

1(2) Part of parabasal body showing 'U'-shaped bend*F. reflexa*

2(1) Parabasal body short, not 'U'-shaped and restricted to dorsal side of nucleus
.....*F. solita*

85. *Foaina reflexa* Kirby

1942. *Foaina reflexa* Kirby, *Univ. Calif. Publ. Zool.*, 45, p. 206.

Material examined : 4 exs., Bagafa, South district, 18. iv. 1991, coll. D. N. Tiwari.

Diagnosis : Body ovoidal, 24-43. 5 μm x 16-31 μm in dimensions; trailing flagellum ribbon-like, exceeding twice the length of the body; cresta long but narrow; part of parabasal body near blepharoplast showing 'U'-shaped bend; axostyle stout, protruding out of posterior part of the body to a short distance.

Host : *Cryptotermes dudleyi*; location : gut.

Distribution : India : Tripura (South district), Bihar, West Bengal.

86. *Foaina solita* Kirby

1942. *Foaina solita* Kirby, Univ. Calif. Publs. Zool., **45**, p. 182.

Material examined : 3 exs., Bagafa, South district, 18. iv. 1991, coll. D. N. Tiwari.

Diagnosis : Small, dimensions 8-16 μm x 3.2-8 μm ; trailing flagellum cord-like and 2-5 times the length of the body; cresta long but narrow; parabasal body short and restricted to dorsal side of nucleus; axostyle moderately stout with or without enlarged cusp and protruding out of posterior part of the body.

Host : *Cryptotermes dudleyi*; location : gut.

Distribution : India : Tripura (South district), Bihar and West Bengal.

Family CALONYMPHIDAE

Diagnosis : Multinucleated, each nucleus associated with a blepharoplast, a parabasal body and an axial filament.

Genus *Stephanonympha* Janicki

1911. *Stephanonympha* Janicki, Biol. Central., **31**, p. 325.

Diagnosis : Body oval, plastic; nuclei numerous and arranged in the anterior half; karyomastigont present; axial filament forming a bundle.

Key to the species

- 1(2) Nuclei arranged in 2-3 spiral series
.....*S. silvestrii*
- 2(1) Nuclei arranged in 8-9 spiral series
.....*S. pyriformis*

87. *Stephanonympha pyriformis* Das and Choudhury

1972. *Stephanonympha pyriformis* Das and Choudhury, Proc. Zool. Soc., Calcutta, **25**, p. 27.

Material examined : 5 exs., Bagafa, South district, 18. iv. 1991, coll. D. N. Tiwari.

Diagnosis : Body pyriform with bluntly pointed posterior end, 64-83.2 μm x 38-52.8 μm in dimensions, nuclei ovoid or slightly elongated, numerous and embedded in 8-9 spiral series, occupying anterior portion of the body and extending about one third of total body length; axial bundle running through the middle of the body and reaching almost its posterior extremity.

Host : *Cryptotermes dudleyi*; location : gut.

Distribution : India : Tripura (South district), Bihar and West Bengal.

88. *Stephanonympha silvestrii* Janicki

1911. *Stephanonympha silvestrii* Janicki, Biol. Central, **31**, p. 325.

Material examined : 6 exs., Bagafa, South district, 18. iv. 1991, coll. D. N. Tiwari.

Diagnosis : Body oval or rounded, 48-80 μm x 36-68 μm in dimensions; nuclei fusiform containing distinct chromatin granules embedded closely in 2-3 spiral series occupying anterior portion of the body, axial bundle running in the same fashion as in the preceding species and reaching almost posterior portion of the body.

Host : *Cryptotermes dudleyi*; location : gut.

Distribution : India : Tripura (South district), Bihar and West Bengal.

Order HYPERMASTIGIDA

Key to the families

- 1(4) Flagella arranged in spiral rows
- 2(3) Spiral rows of flagella 12-40, a mass of dense cytoplasm usually surrounding ovoid nucleus near anterior end of the body
.....Family HOLOMASTIGOTIDAE
- 3(2) Spiral rows of flagella few, arising from a common point near anterior end of the body, nucleus anchored to rostrum by a nuclear sleeve
.....Family SPIROTRICHONYMPHIDAE
- 4(1) Flagella not arranged in spiral rows, (flagella not in tufts, posterior portion of the body not flagellated)
.....Family EUCOMONYMPHIDAE

Family HOLOMASTIGOTIDAE

Genus *Holomastigotoides* Grassi and Foa

1911. *Holomatigotoides* Grassi and Foa, *Rend. R. Accad. Lincei* (5), sem. 1, 20, p. 729.

Diagnosis : As for the family.

Key to the species

- 1(14) Prenuclear zone present
- 2(5) Posterior portion of the body glabrous
- 3(4) Posterior one-fifth of the body without any flagella *H. magnus*
- 4(3) A small portion of the body without any flagella and longer flagella occupying posteriormost portion of the body
..... *H. bengalensis*
- 5(2) Posterior portion of the body not glabrous
- 6(9) Flagella of uniform size
- 7(8) Body exactly spherical in shape
..... *H. spheroidalis*
- 8(7) Body resembling an 'inverted cup' with finger like projection at the anterior end ..
..... *H. ogivalis*
- 9(6) Flagella of the posterior portion of the body much longer
- 10(11) Longer flagella occupying posterior fifth of the body *H. rayi*
- 11(10) Longer flagella occupying only the posterior extremity of the body
- 12(13) Body typically oval, axostyle moderately developed reaching almost middle of the body *H. globosus*
- 13(12) Body reniform, axostyle short
..... *H. reniformis*
- 14(1) Prenuclear zone absent
- 15(16) Body resembling a bell jar without any apical knob, axostyle short but distinct
..... *H. campanula*
- 16(15) Body oval or egg shaped, axostyle lacking
..... *H. ovalis*

89. *Holomastigotoides bengalensis* Chakravarty and Banerjee

1956. *Holomastigotoides bengalensis* Chakravarty and Banerje, *Proc. Zool. Soc. Calcutta*, 9, p. 36.

Material examined : Sev. exs., Santibazar, South district, 17. iv. 1991, coll. D. N. Tiwari; 2 exs., Unokoti, North district, 25. iv. 1991, coll. D. N. Tiwari.

Diagnosis : Body more or less oval, occasionally elliptical, anterior end bluntly pointed resembling a nipple and posterior end rounded; 67. 6-105 μm x 41. 2-70. 5 μm in dimension; flagella of two types, shorter ones covering a major portion of the body in dextrotropic manner, leaving a small glabrous portion without any flagella, longer flagella occupying posteriormost portion of the body; axostyle well developed extending almost up to posterior extremity of the body; nucleus oval in shape and lying anteriorly, prenuclear zone conical and densely granulated.

Host : *Coptotermes travians*; location : gut.

Distribution : India : Tripura (South and North districts), Bihar, Uttar Pradesh and West Bengal.

90. *Holomastigotoides campanula* (de Mello)

1921. *Leidyia campanula* de Mello, *Argqu. Indo. Port. Med. Hist. Nat.*, 1, p. 179.

1927. *Holomastigotoides campanula* de Mello, *Trans. 5th Congr. East Assoc. Trop. Med.*, 2, p. 591.

Material examined : 5 exs., Astabal bridge, Agartala, West district, 12 iv. 1991, coll. D. N. Tiwari; sev. exs., Santibazar, South district, 17. iv. 1991, coll. D. N. Tiwari; 4 exs., Unokoti, North district, 25. iv. 1991, coll. D. N. Tiwari.

Diagnosis : Body shape resembling exactly a bell jar without apical knob; 36. 8-80 μm x 42-105 μm in dimensions; flagella of two types, shorter ones arranged all over the body in dextrotropic rows and longer ones restricted to posterior extremity of the body; axostyle short but distinct; prenuclear zone absent.

Host : *Coptotermes travians*; location : gut.

Distribution : India : Tripura (all districts), Bihar, Diu, Karnataka and West Bengal.

91. *Holomastigotoides globosus* de Mello

1937. *Holomastigotoides globosus* de Mello, C. R. XII Congr. Inst. Zool. Lisb., 2, p. 1370.

Material examined : Sev. exs., Santibazar, South district, 17. iv. 1991, coll. D. N. Tiwari.

Diagnosis : Body perfectly oval, 49-94. 5 μ m $\times$ 35-56 μ m in dimensions; flagella of one type, covering entire body in dextrotropic rows, though flagella of posteriormost region slightly longer, axostyle moderately developed, reaching almost middle of the body, nucleus ovoidal and located near the anterior end of the body; prenuclear zone lacking.

Host : *Coptotermes travians*; location : gut.

Distribution : India : Tripura (South district), Daman Diu, Karnataka and West Bengal.

92. *Holomastigotoides magnus* Uttangi

1962. *Holomastigotoides magnus* Uttangi, J. Karnatak Univ., 7, p. 188.

Material examined : 3 exs., Astabal bridge, Agartala, West district, 12. iv. 1991, coll. D. N. Tiwari; 2 exs., Unokoti, North district, 25. iv. 1991, coll. D. N. Tiwari.

Diagnosis : Body ovoidal, both anterior and posterior ends broadly round, 176. 3-220 μ m $\times$ 94. 3-114. 8 μ m in dimensions; flagella of one type covering major portion of the body dextrotropically leaving a posterior glabrous region devoid of any flagella measuring about one-fifth of the total body length; axostyle fibrous and moderately developed reaching beyond the middle of the body; nucleus round, prenuclear zone distinct in stained preparation.

Host : *Coptotermes travians*; location : gut.

Distribution : India : Tripura (West and North districts), Gujarat, Karnataka and West Bengal.

93. *Holomastigotoides ogivalis* de Mello

1937. *Holomastigotoides ogivalis* de Mello, C. R. XII Congr. Int. Zool. Lisb., 1935, 2, p. 1373.

Material examined : 4 exs., Astabal bridge, Agartala, West district, 12. iv. 1991, coll. D. N.

Tiwari; 2 exs., Unokoti, North district, 25. iv. 1991, coll. D. N. Tiwari.

Diagnosis : Body shape resembling an inverted cup with a blunt finger like elevation at anterior end, 60. 5-94 μ m $\times$ 40. 5-63 μ m in dimensions; shorter flagella covering entire body dextrotropically while longer ones thickly set at posterior extremity of the body; axostyle short but distinct, prenuclear zone present.

Host : *Coptotermes travians* (Haviland), location : gut.

Distribution : India : Tripura (West and North districts) Daman, Gujarat, Karnataka, Uttar Pradesh and West Bengal.

94. *Holomastigotoides ovalis* Uttangi

1962. *Holomastigotoides ovalis* Uttangi, J. Karnatak Univ. Sci., 7, p. 185.

Material examined : 5 exs., Santibazar, South district, 17. iv. 1991, coll. D. N. Tiwari.

Diagnosis : Body oval, anterior end narrowly and posterior end broadly rounded, 102 μ m $\times$ 63 μ m in dimension; flagella longer, arranged in dextrotropic rows covering whole of the body excepting posterior glabrous portion, bearing short 'steriocilia'; nucleus oval located at anterior pole of the body; prenuclear zone and exostyle absent.

Host : *Coptotermes travians*; location : gut.

Distribution : India : Tripura (South district), Bihar, Gujarat.

95. *Holomastigotoides rayi* Karandikar and Vittal

1954. *Holomastigotoides rayi* Karandikar and Vittal, J. Univ. Bombay, 23B, p. 18.

Material examined : 2 exs., Astabal bridge, Agartala, West district, 12. iv. 1991, coll. D. N. Tiwari.

Diagnosis : Body oval with apical pit at anterior end, 77-90. 2 μ m $\times$ 41. 5-52. 5 μ m in dimensions; flagella of two types, smaller ones covering the whole body dextrotropically while longer ones setting irregularly around one fifth of posterior

region of body, axostyle faintly visible; nucleus ovoidal and prenuclear zone distinct in stained preparation.

Host : *Coptotermes travians*; location : gut.

Distribution : India : Tripura (West district), Bihar, Karnataka and West Bengal.

96. *Holomastigotoides reniformis* de Mello

1937. *Holomastigotoides reniformis* de Mello, C. R. XII Congr. Int. Zool. Lisbonne, 1935, p. 1373.

Material examined : 2 exs., Santibazar, South district, 17. iv. 1991, coll. D. N. Tiwari.

Diagnosis : Body reniform in shape, 110. 2 μm x 36 μm in dimensions; flagella one type covering entire body dextrotropically, axostyle short reaching slightly below nucleus; nucleus oval, prenuclear zone granular and distinctly conical.

Host ; *Coptotermes travians*; location : gut.

Distribution : India : Tripura (South district), Bihar and Goa.

97. *Holomastigotoides spheroidalis* de Mello

1937. *Holomastigotoides spheroidalis* de Mello, C. R. XII Congr. Int. Zool. Lisb., 1935, 2, p. 1373.

Material examined : Sev. exs., Astabal bridge, Agartala, West district, 12. iv. 1991, coll. A. K. Das; sev. exs., Unokoti, North district, 25. iv. 1991, coll. A. K. Das.

Diagnosis : Body spherical, 31. 8-52 μm in diameter, flagella one type covering entire body dextrotropically; axostyle well developed, nucleus round and located near a point at anterior end from which flagellar bands seem to diverge out; prenuclear zone distinct.

Host : *Coptotermes travians* (Haviland); location : gut.

Distribution : India : Tripura (West and North districts), Bihar, Daman, Karnataka, Uttar Pradesh and West Bengal.

Family SPIROTRICHO-
NYMPHIDAE

Genus *Spirotrichonympha* Grassi and Foa

1911. *Spirotrichonympha* Grassi and Foa, *Rend. R. Acad. Lincei* (5), 20, p. 727.

Diagnosis : Body elongate, pyriform; flagella deeply embedded in cytoplasm in anterior region, arising from flagellar bands, mass of dense cytoplasm conical and its base indistinct.

Key to the species

- 1(2) Body cone shaped, conspicuously long flagella spreading out from posterior surface in a brush-like manner *S froilanoi*
2(1) Body pyriform with finger like projection at anterior end bearing a hyaline apical cap; disposition of long flagella as above lacking *S roonwali*

98. *Spirotrichonympha froilanoi* Karandikar and Vittal

1954. *Spirotrichonympha froilanoi* Karandikar and Vittal, *J. Univ. Bombay*, 23 (B), p. 2.

Material examined : 3 exs., Santibazar, South district, 17. iv. 1991, coll. D. N. Tiwari; 2 exs., Unokoti, North district, 25. iv. 1991, coll. D. N. Tiwari.

Diagnosis : Body cone-shaped, anterior portion narrowed to a blunt end and posterior extremity broader, 19. 2-51. 2 μm x 14. 4-33. 6 μm in dimension; four flagellar bands originating from centropharoplast, covered by apical operculum; conspicuously long flagella spreading out from posterior surface in a brush-like manner; axostyle distinct and cordlike in post nuclear region, extending obliquely towards posterior extremity but not protruding out from the posterior end of the body.

Host ; *Coptotermes travians*; location : gut.

Distribution : India : Tripura (South and North districts), Bihar, Karnataka, Uttar Pradesh and West Bengal.

Remarks : Barring some exceptions as reported by Das (1976), axostyle of this species usually

does not protrude out of the posterior end of the body as is evidenced in type material (Karandikar and Vittal, 1954) as well as present material.

99. *Spirotrichonympha roonwali* Das

1976. *Spirotrichonympha roonwali* Das, *Acta Protozool.*, 15, p. 116.

Material examined : 2 exs., Astabal bridge, Agartala, West district, 12. iv. 1991, coll. D. N. Tiwari.

Diagnosis : Body pyriform in shape with a finger like projection at anterior end bearing a hyaline cap or operculum, greatest width near the posterior part of the body, 30-40 µm x 18-22 µm in dimensions; axostyle thin, extending beyond the middle of the body; nucleus more or less round and located below anterior third of the body.

Host : *Coptotermes travians*; location ; gut.

Distribution : India : Tripura (West district), Bihar and West Bengal.

Family EUCOMONYMPHIDAE
Genus *Pseudotrichonympha*
 Grassi and Foa

1911. *Pseudotrichonympha* Grassi and Foa, *Rend. R. Acad. Lincei* (5), 20, p. 729.

Diagnosis : Anterior portion consisting of apical cap and campanula; campanular surface covered with three types of flagella, first type shortest and immobile strictly confined to rostral tube, second type longest and arranged below first type in a thick circular band, third type arranged in longitudinal rows in leiotropic manner covering rest of the body excepting short glabrous end.

Key to the species

- 1(4) Campanula medially placed
- 2(3) Body heart-shaped, containing sphaerita like organisms*P. cardiformis*
- 3(2) Body elongated and truncated at both ends*P. indica*

- 4(1) Campanula disposed obliquely at one side of the median axis and distinctly subapical*P. subapicalis*

100. *Pseudotrichonympha cardiformis*
Karandikar and Vittal

1954. *Pseudotrichonympha cardiformis* Karandikar and Vittal, *J. Univ. Bombay*, 23 (B), p. 2.

Material examined : 4 exs., Astabal bridge, Agartala, West district, 12. iv. 1991, coll. D. N. Tiwari; 3 exs., Unokoti, North district, 25. iv. 1991, coll. D. N. Tiwari.

Diagnosis : Body heart-shaped, 105-181 µm × 82. 2-130. 3 µm in dimension, anterior part consisting of bell-like campanula demarcated by a faintly stained circlet-like line from the rest of the body; campanula placed mid-apically at anterior end of body; nucleus spherical and located generally above the middle region of the body; endoplasm sometimes containing wood fragments and sphaerita like micro-organisms.

Host : *Coptotermes travians*; location : gut.

Distribution : India : Tripura (West and North districts), Bihar, Karnataka, Uttar Pradesh and West Bengal.

101. *Pseudotrichonympha indica* Chakravarty and Banerjee

1956. *Pseudotrichonympha indica* Chakravarty and Banerjee, *Proc. Zool. Soc., Calcutta*, 9, p. 42.

Material examined : Sev. exs., Astabal bridge, Agartala, West district, 12. iv. 1995, coll. D. N. Tiwari; 3 exs., Santibazar, South district, 17. iv. 1995, coll. D. N. Tiwari.

Diagnosis : Body much elongated with its broadest part being almost near the middle of the body; 217-301µm x 42-55 µm in dimensions; campanular region very short in comparison to body length; campanula located mid apically as in the preceeding species; nucleus more or less round and located near the middle of the body; endoplasm sometimes containing fragments of wood.

Host : *Coptotermes travians*; location : gut.

Distribution : India : Tripura (West and South districts), Bihar, Uttar Pradesh and West Bengal.

102. *Pseudotrichonympha subapicalis*

Karandikar and Vittal

1954. *Pseudotrichonympha subapicalis* Karandikar and Vittal, *J. Univ. Bombay*, 23(B), p. 8.

Material examined : 3 exs., Santibazar, South district, 17. iv. 1991, coll. D. N. Tiwari; Unokoti, North district, 25. iv. 1991, coll. D. N. Tiwari.

Diagnosis : Body rounded, swollen anteriorly and narrowed posteriorly to a blunt end; 180. 5-200 µm x 65-80 µm in dimensions; campanula distinctly subapical and situated on one side in the anterior portion of the body at right angles to the same; in permanent preparations campanular region usually appearing to be in the form of two to three circles, arranged one within the other; nucleus spherical and usually located towards anterior end of the body.

Host : *Coptotermes travians*; location : gut.

Distribution : India : Tripura (South and North districts), Bihar, Karnataka and West Bengal.

GENERAL REMARKS ON DISTRIBUTION

Species-wise distribution of freeliving, parasitic and symbiotic protozoa of Tripura has already been dealt with under the systematic account of the respective species. District-wise distribution of these protozoa is presented below mentioning only the serial number of the species as specified in the systematic list of this paper in order to avoid repetition of species names.

DISTRICT-WISE DISTRIBUTION

West district : Fr (1, 2, 3, 4, 5, 6, 8, 9, 10, 11, 12, 13, 14, 26, 28, 30, 33, 34, 36, 38, 42); Pa (65, 67); Sy (90, 92, 93, 95, 97, 99, 100, 101); total : 31.

North district : Fr (4, 5, 6, 13, 15, 16, 17, 18, 19, 20, 22, 23, 26, 30, 31, 35, 42, 45); Pa (46, 47, 48, 49, 50, 51, 53, 55, 56, 57, 58, 60, 62, 63, 66, 68, 71, 72, 73, 74, 75, 77, 78, 80, 81); Sy (83, 84,

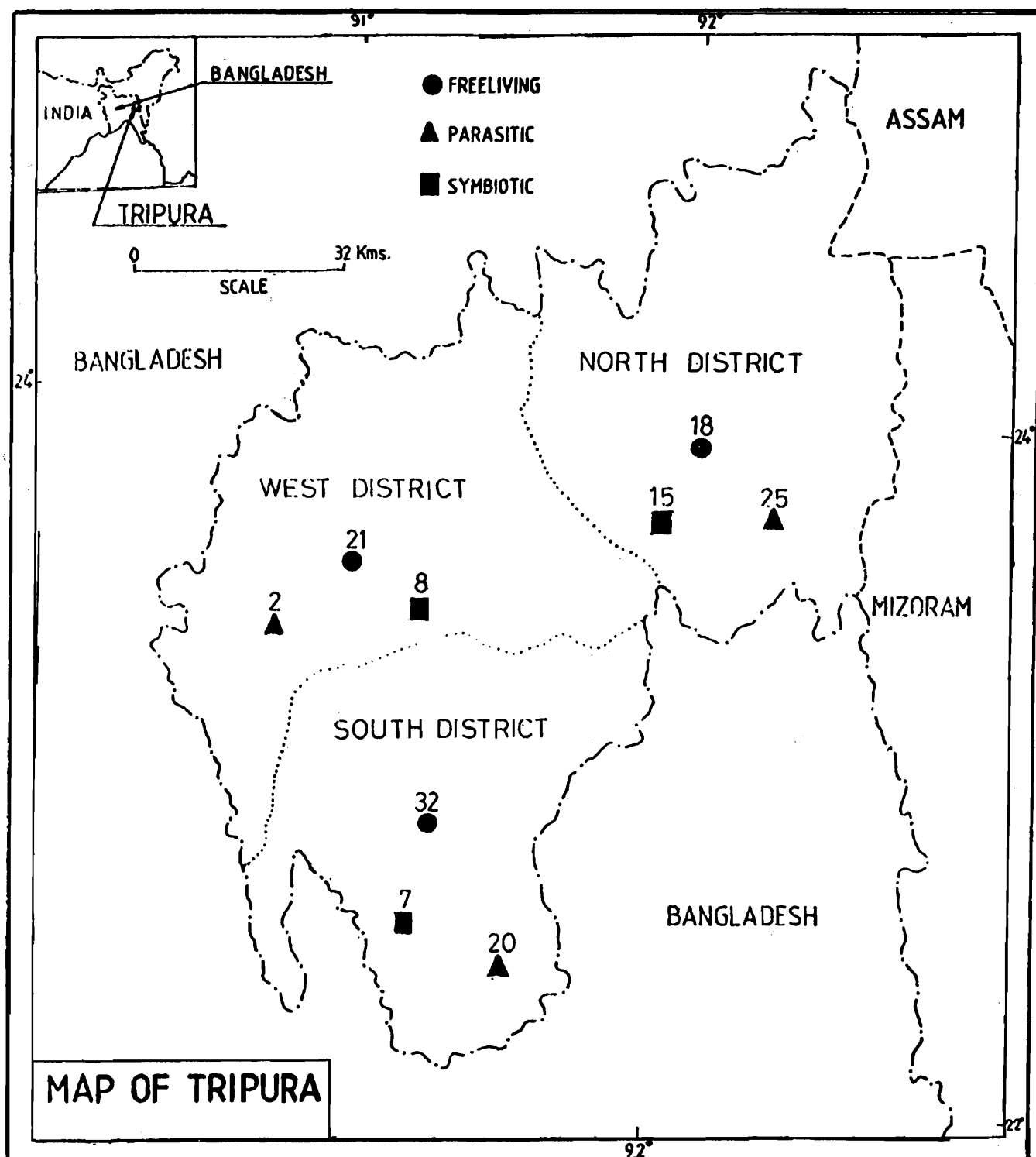
85, 86, 87, 88, 89, 90, 91, 92, 93, 97, 98, 100, 102); total : 58.

South district : Fr (1, 2, 3, 4, 5, 6, 7, 13, 15, 20, 21, 22, 24, 25, 26, 27, 29, 30, 31, 32, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45); Pa (50, 51, 52, 53, 54, 55, 57, 58, 59, 61, 64, 65, 67, 69, 70, 76, 79, 80, 81, 82); Sy (89, 90, 94, 96, 98, 101, 102); total : 59.

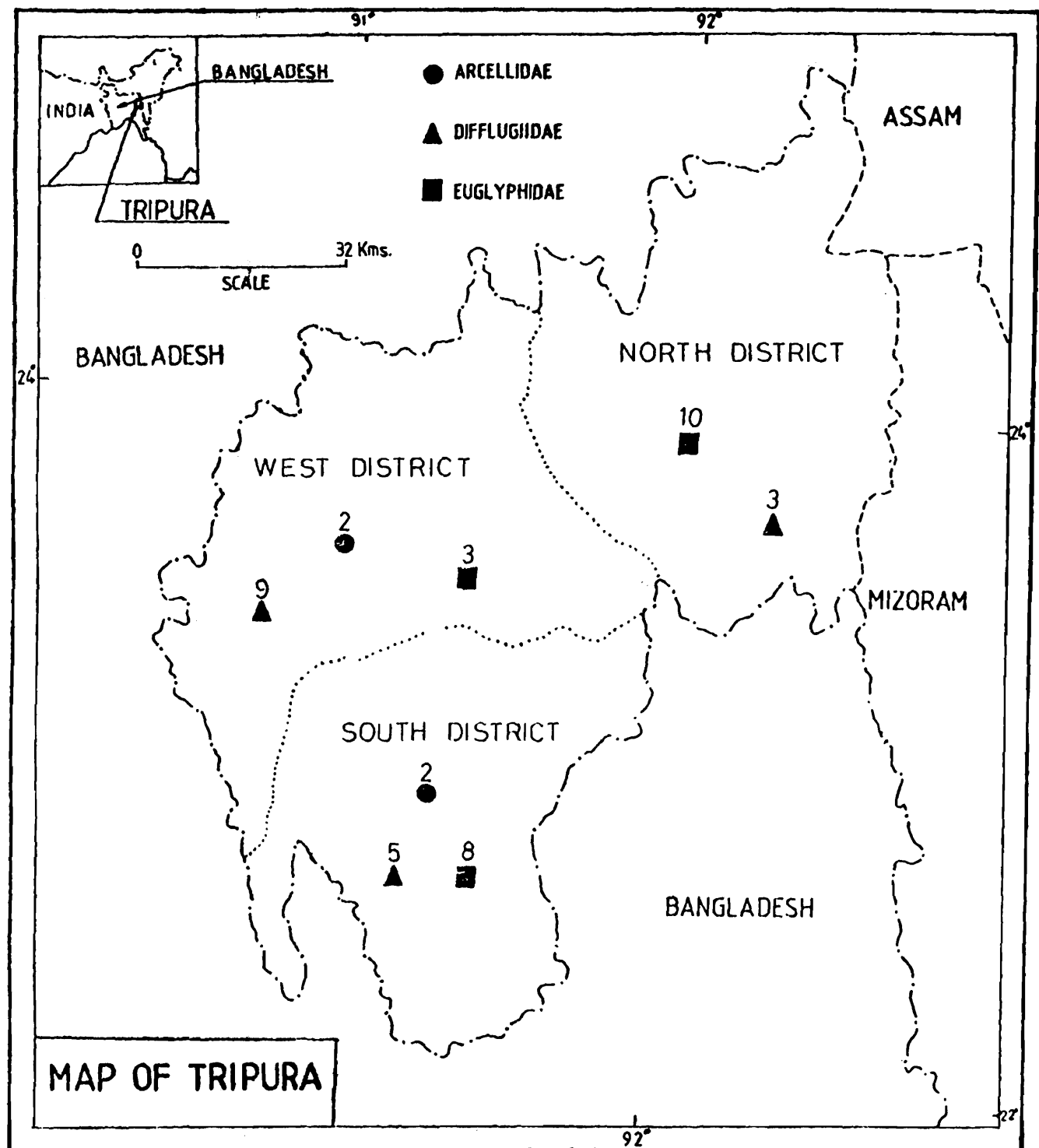
(Fr = freeliving; Pa = parasitic; Sy = symbiotic)

The above distribution list clearly shows that maximum number of protozoan species have so far been collected from the South district. This species diversity is closely followed by the North district. It is also quite evident that the West district is least explored particularly for parasitic protozoa. From this district only two species of coccidian parasites, viz., *Eimeria cylindrica* and *E. faurei* have been collected from the faecal samples of cattle and goats. Careful perusal of distribution list also reveals that out of 102 protozoan species reported from the state only 7 species are found to occur in all the three districts. These include 6 species of freeliving and one species of symbiotic protozoa. Amongst the freeliving, 5 species, viz., *Centropyxis aerophila*, *C. arcelloides*, *C. constricta*, *Assulina muscorum* and *Trinema lineare* are testacid rhizopods, collected from ground-, tree-and rock mosses. The remaining one, *Colpoda cucullus* is an ubiquitous soil inhabiting ciliate which is almost always available in every moss sample of the state cultured in distilled water. The cosmopolitan symbiotic protozoa of the state, viz., *Holomastigotoides campanula* has been recovered from the gut contents of the termite species, *Coptotermes travians*. It needs mention here that list of cosmopolitan species in the state will certainly be long if intensive and repeated surveys for protozoa collections are conducted in major habitats of all the districts.

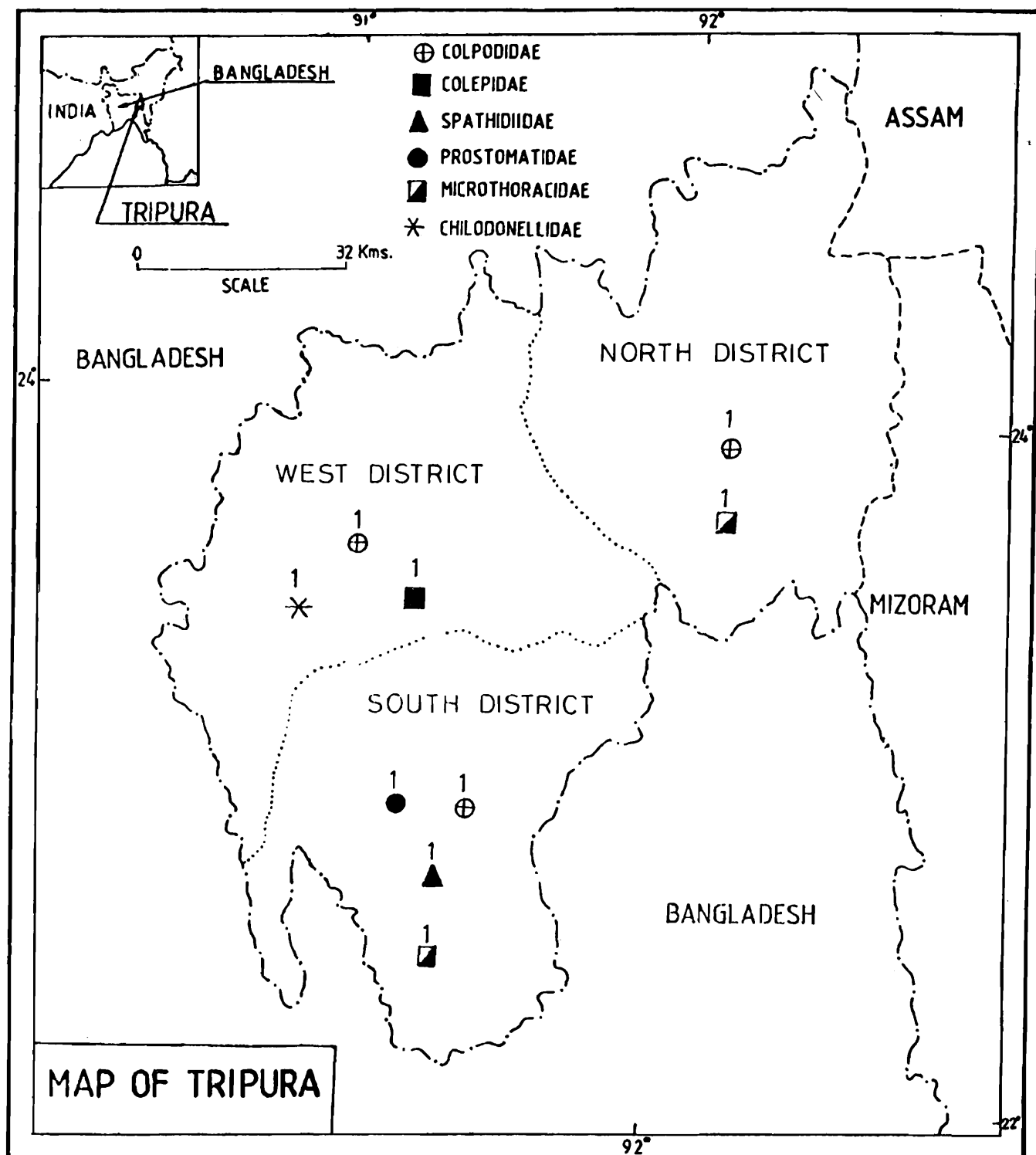
Group-wise details of protozoa of the state along with number of host-species of parasitic and symbiotic protozoa are tabulated as follows (Table 1) for the convenience of analysing protozoan diversity of Sikkim.



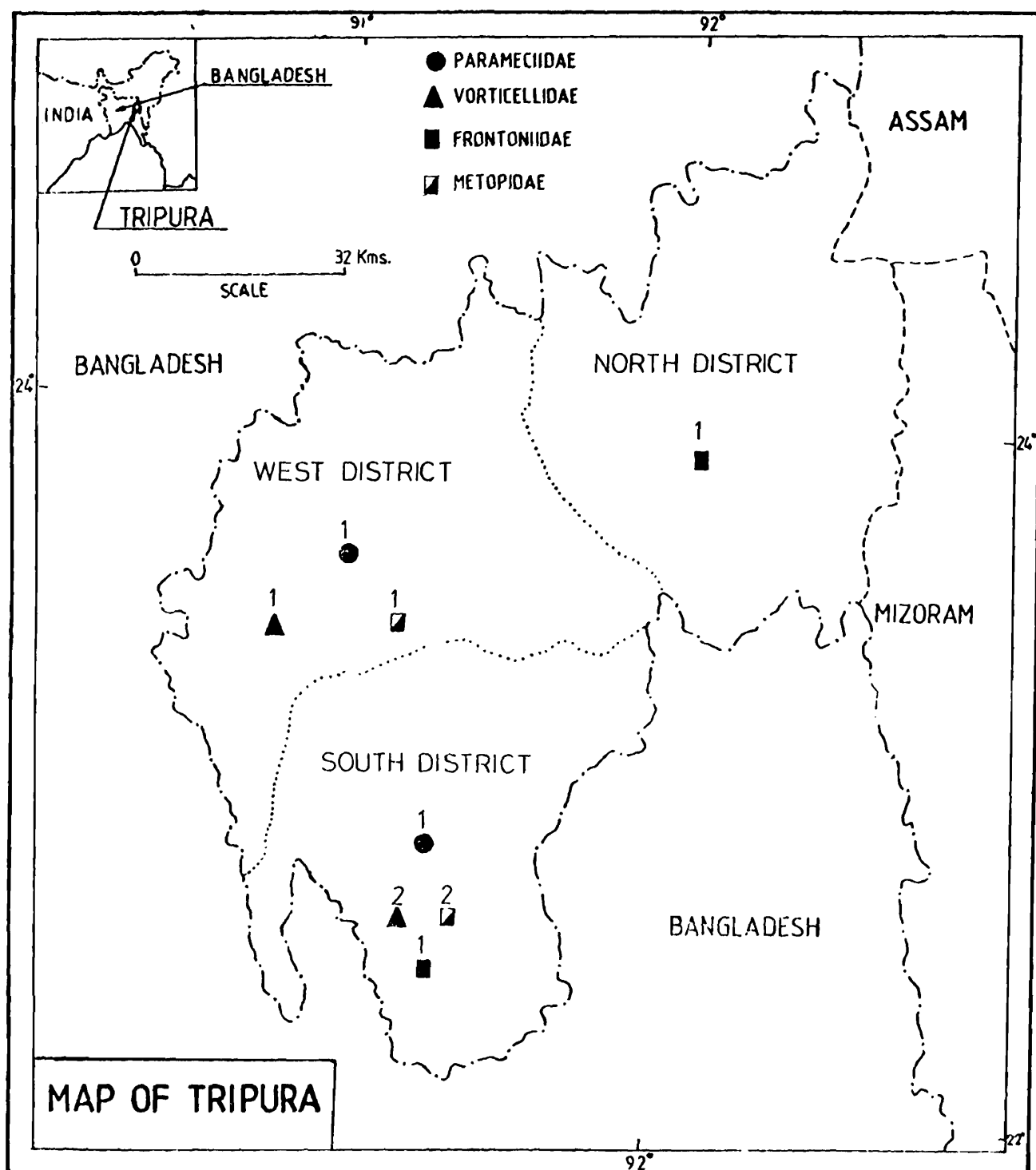
Map 1. Showing district-wise distribution of free-living, parasitic and symbiotic Protozoa of Tripura (in number of species); numerical number indicates number of species of the concerned group.



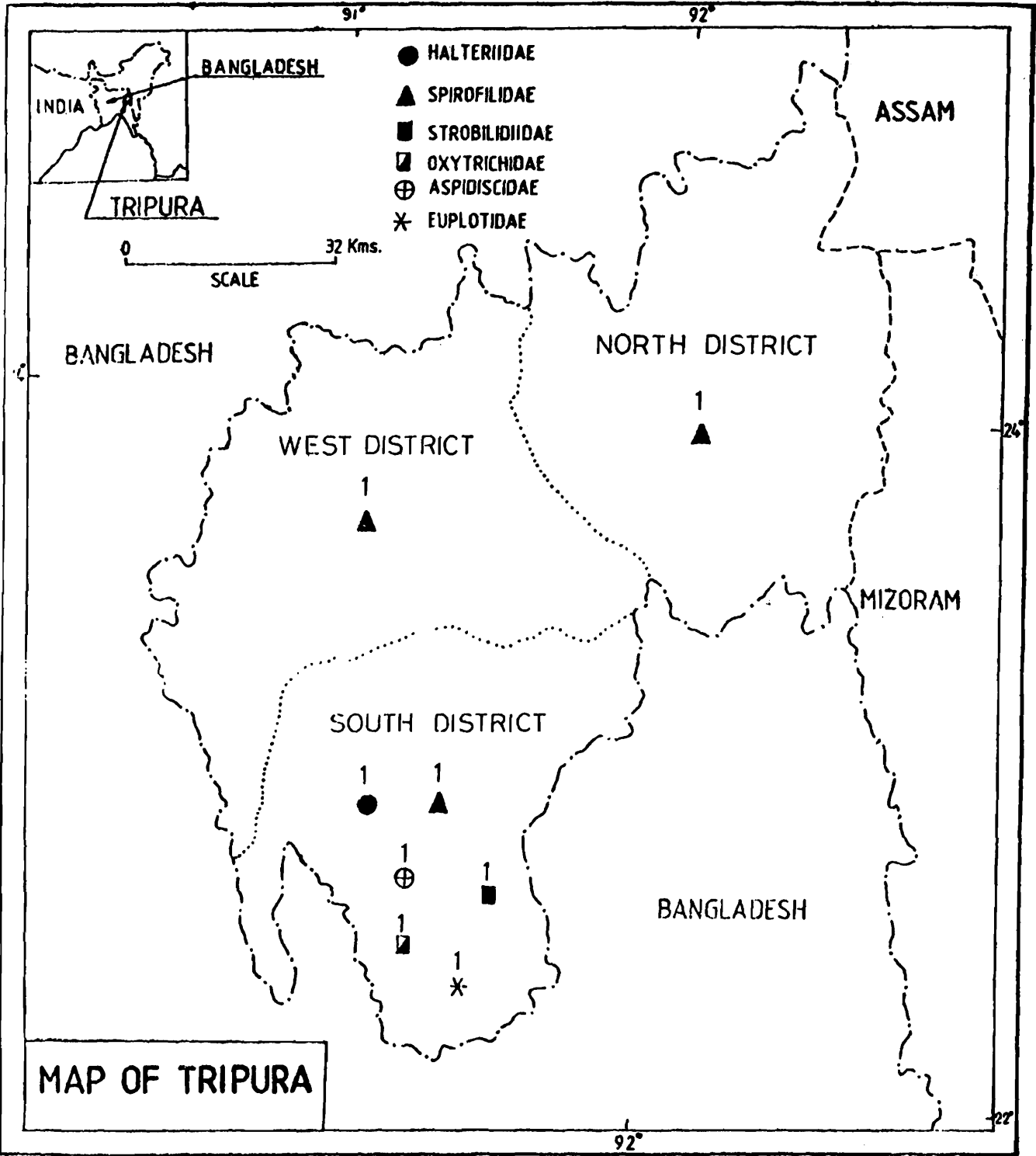
Map 2. Showing family-wise distribution of freeliving testacid rhizopods (in number of species) in each district of Tripura : numerical number indicates number of species of the concerned group.



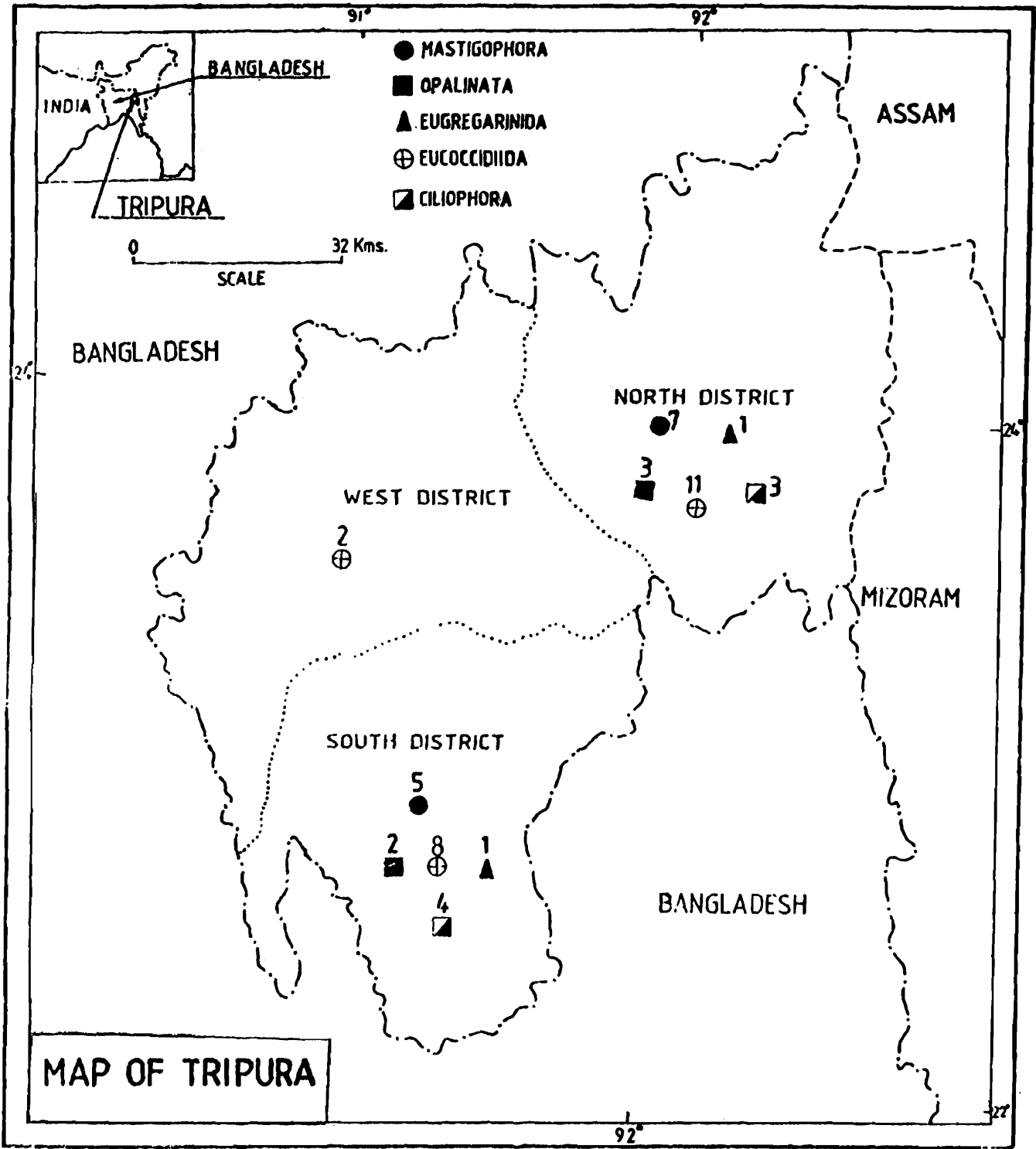
Map 3. Showing family-wise distribution of some freeliving ciliates (in number of species) in each district of Tripura; numerical number indicates number of species of the concerned family.



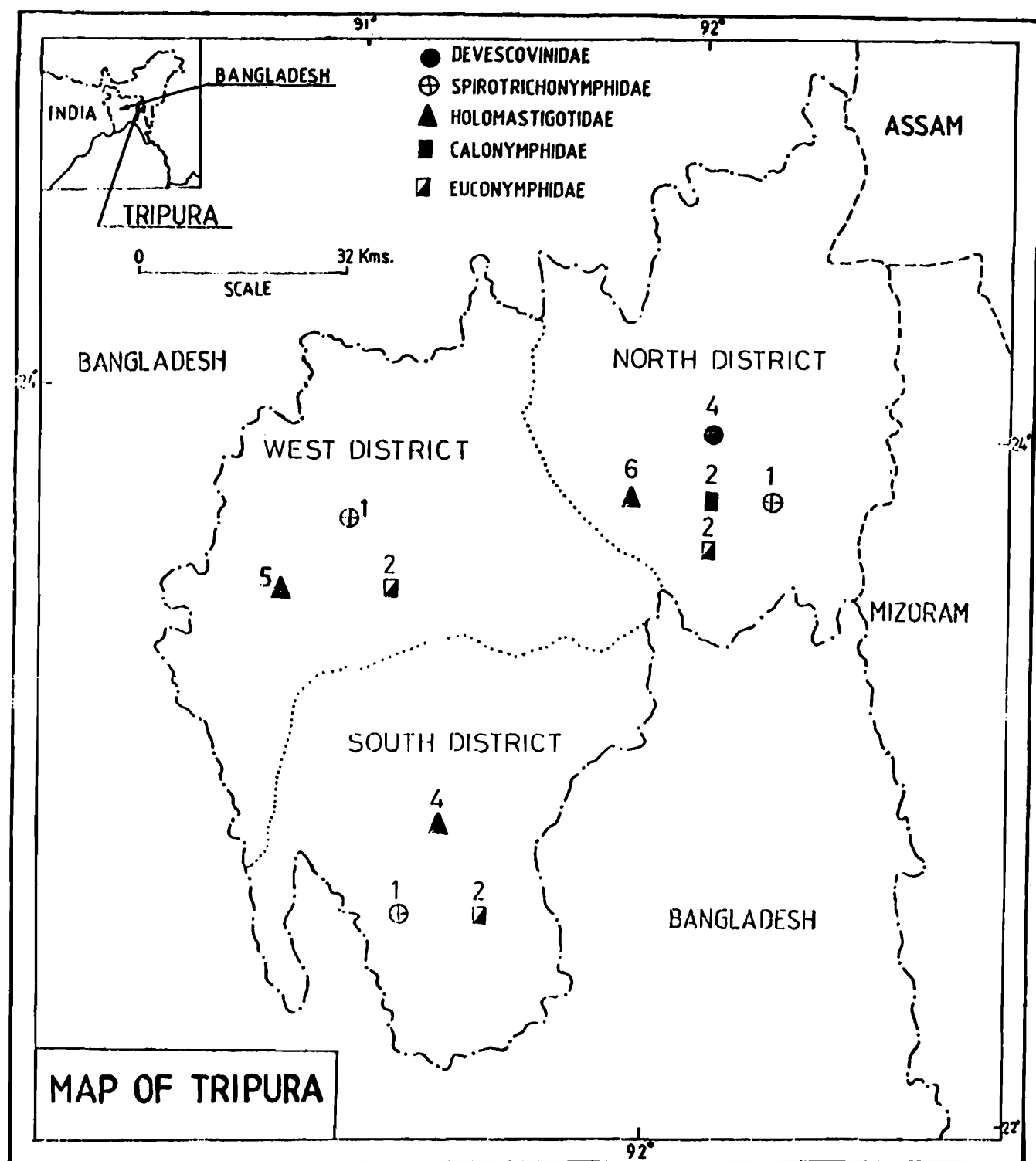
Map 4. Showing district-wise distribution of four families of freeliving ciliates in Tripura (in number of species); numerical number indicates the number of species of the concerned family.



Map 5. Showing district-wise distribution of six families of freeliving ciliates in Tripura (in number of species); numerical number indicates the number of species of the concerned family.



Map 6. Showing family-wise distribution of parasitic Protozoa in each district of Tripura ; numerical number indicates the number of species of the concerned family.



Map 7. Showing family-wise distribution of symbiotic Protozoa of Tripura; numerical number indicates the number of species of the concerned family.

Table 1 : Showing protozoan diversity of Tripura

Group		Number of										
		Family			Genus			Species			Host species	
		Fr	Pa	Sy	Fr	Pa	Sy	Fr	Pa	Sy	Pa	Sy
Phylum	Sarcomastigophora											
Subphylum	Mastigophora		2	5		3	6		9	20	9	2
Subphylum	Sarcodina	3			10			26				
Subphylum	Opalinata		1			2			3		1	
Phylum	Apicomplexa		4			5			20		13	
Phylum	Ciliophora	15	3		17	4		19	5		3	
Total		18	10	5	27	14	6	45	37	20	20*	2

(* less than actual total since 6 host species of the state are found to harbour more than one species of parasite).

It is worth mentioning here that out of 20 host species of parasitic protozoa shown in the table 1, 6 are mammals, 6 birds, 2 amphibians, 4 fishes and 2 invertebrates (earthworm and cockroach). Out of these, 14 species are found to be infested with single and rest with multiple number of parasitic protozoan species, maximum being 9 in goat, *Capra hircus*. All the symbiotic flagellates dealt with in this paper have been collected from two species of termite hosts, viz., *Cryptotermes dudleyi* and *Coptotermes travians*, belonging to the families Kalotermitidae and Rhinotermitidae respectively. The former is found to harbour 6 species and the latter 14 species of symbiotic flagellates in their gut.

SUMMARY

A consolidated taxonomic account of all the freeliving, parasitic and symbiotic protozoa reported and collected so far from Tripura is

presented in the paper. This includes 102 species belonging to 3 phyla, 10 classes, 21 orders, 33 families and 47 genera. Among these, 45 species are freeliving, 37 parasitic and 20 symbiotic. One species of freeliving ciliate *Metopus muscicola* sp. nov. is new to science, 7 species (4 rhizopods and 3 ciliates), all freeliving, are recorded for the first time from India and 93 species constitute new state records.

ACKNOWLEDGEMENT

The authors are grateful to Dr. A. K. Ghosh, ex-Director, Zoological Survey of India for extending every facility in connection with this work, to Dr. J. R. B. Alfred, Director, ZSI and Dr. R. K. Varshney Additional Director (Retd.) of ZSI, for critically going through the manuscript and to Dr. A. K. Mandal, ex-Scientist 'SE', ZSI, for the major collection and part identification of parasitic protozoa of the state.

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TREMATODA : DIGENEA

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INTRODUCTION

Tripura is the second smallest state of India. It is surrounded almost on all sides with Bangladesh except on its north east, having a narrow borders with Assam and Mizoram. Before its accession with India on October, 15, 1949 Tripura was ruled by Maharajas for 1300 years. Tripura became Union Territory on September 1, 1956. Fullfledged state hood was conferred on January 21, 1972. Topographically the state is within the hill areas of north east region. Tripura is having three districts only with 10,486 sq. kms. total land area. Approximately 54.5% of the total land area of this state is under forest cover against 17.2% all India average. As such flora and fauna is very rich both in variety and number. The state is under high rainfall zone with hot and humid tropical climate, an ideal situation for survival and propagation of helminth parasites in general.

Helminth parasites of animals of the state have not so far been studied, proportionate to their importance to livestock, poultry, fishery etc.

Tripura was a princely state in an isolated pocket, so it is but natural that practically no record of helminth parasites are available from this region. But some stray report on helminth parasites are available from Burma and the then Assam region which includes most of the present North Eastern states.

Studies on helminth parasites of Burma, the neighbouring area of Tripura were made rather extensively by Evans and Ranni (1908-1912), Jackson (1921), Bhalerao (1924-25), Meggitt (1927-35), Gogate (1932-39), Chandler (1926), Chatterjee (1936-40) etc. Subsequently most of

the parasites recorded from Burma were also found to be present in vertebrate hosts of other Indian states. So while studying the helminth fauna of Tripura all those literature should be consulted.

The present volume is hoped to be of great help to all those future workers interested to study the helminth parasites of Tripura from livestock, poultry, piggery, fishes etc. These work is mainly based on the collection made by the survey tours undertaken by the scientists of Zoological Survey of India. Earlier records which could be traced in literature have also been included. Diagnostic characters of all the species dealt in the present work along with keys for easy identification of families, genera they belong have been included. Text figures of most of the species have been provided as supplement, for correct diagnosis.

A chapter on general morphological character of adult and larval stages of trematodes and staining, mounting etc., have been included mainly for beginners in 'Fauna of Meghalaya' Trematoda : Digenea. So it is omitted here.

HISTORICAL BACKGROUND

History of studies on trematode parasites from the state of Tripura can not be dealt in isolation. Studies on helminth parasites whatever little have been made on neighbouring regions in North Eastern areas as a whole, should be taken into account. In an earlier work 'Fauna of Meghalaya' part-X, Trematoda : Digenea, history of such studies have been dealt in some detail. So detail is omitted here. Some important records and studies on trematode parasites of the then Assam, infecting human beings were made by Leiper

(1911,1913), Lane, (1915), Buckley (1939) etc. Trematode parasites of elephant, horse cattle, pig etc., were recorded by Gibs (1892), Fiscoeder (1902, 1903), Looss (1907), Pande (1935), Bhalerao (1932, 1935), Thapar (1956), Srivastava and Ghosh (1967), Soota and Ghosh (1977), Gogoi (1974-86), Tandon (1989, 90, 91, 92).

Dr. Veena Tandon in recent years established a vary good centre for studies on helminth parasites at North Easterns Hill University. She and her students added valuable information and are continuing their studies on various aspects of helminth parasites of north eastern hill states. Ray and Tandon (1990) described a new species under the genus *Velasquezotrema* Eduardo and Javellana, 1987 from Tripura. Roy and Tandon (1992) studied the prevalence of as many as 23 species of trematodes from cattle, goat, sheep, pigs etc., from Tripura. They deposited most of these collections in the National Zoological Collection at Zoological Survey of India, Calcutta.

SYSTEMATIC INDEX

- I. Family : DICROCOELIDAE
Odhner, 1910
Subfamily : DICROCOELINAE
Looss, 1899
Tribe : **Dicrocoelinae Yamaguti, 1958**
 1. Genus : ***Dicrocoelium*** Dujardin, 1845
 1. *D. dendriticum* (Rudolphi, 1819)
 - Tribe : **Paradistominae Yamaguti, 1958**
 2. Genus : *Paradistomoides* Travassos, 1944
 2. *P. orientalis* (Narain et Das, 1929) Travassos, 1944
 - Tribe : **Brachylecithinae Yamaguti, 1958**
3. Genus : ***Brachylecithum*** Strom, 1940
 3. *B. cuckooensis* Ghosh and Dutta, 2000
 - Tribe : **Lypersominae Yamaguti, 1958**
4. Genus : ***Lypersomum*** Looss, 1899
Subgenus : *Lypersomoides* Yamaguti, 1971
 4. *L. (L.) tripurensis* Ghosh and Dutta, 2000
 - Subfamily : **EURYTREMATINAE Yamaguti, 1958**
5. Genus : ***Eurytrema*** Looss, 1907
 5. *E. pancreaticum* (Johnson, 1899) Looss, 1907
 - Family : **PROSTHOGONIMIDAE Luhe, 1909**
6. Genus : ***Prosthogonimus*** Luhe, 1899
 6. *P. putschkowskii* Skrjabin, 1912
- III. Family : **PARAMPHISTOMIDAE Fiscoeder, 1901**
 7. Genus : ***Ceylonocotyle*** Nasmark, 1937
 7. *C. scoliocoelium* (Fiscoeder, 1901) Nasmark, 1937
 8. *C. dawesi* Gupta, 1958
 9. *C. dicranocoelium* (Fiscoeder, 1901) Nasmark, 1937
 10. *C. dinniki* Eduardo, 1985
 11. *C. parvipapillatum* (Stiles and Goldberger, 1910)

8. Genus : *Paramphistomum*
Fischoeder, 1901
12. *P. epiclitum* Fischoeder,
1904
13. *P. ichigawai* Fukui,
1922
14. *P. gracile* Fischoeder,
1901
9. Genus : *Cotylophoron* Stiles, and
Goldberger, 1910
15. *C. cotylophorum*
(Fischoeder, 1901)
10. Genus : *Calicophoron* Nasmak,
1937
16. *C. papillosum* (Stiles
and Goldberger, 1910
Nasmak, 1937
- Subfamily : GASTROTHYLACINAE
Stiles and Goldberger,
1910
11. Genus : *Gastrothylax* Poirier,
1883
17. *G. crumenifer* (Crephn,
1847) Poiriar, 1883
12. Genus : *Fischoederius* Stiles and
Goldberger, 1910
18. *F. elongatus* (Poiriar,
1883) Stiles and
Goldberger, 1910
19. *F. cobboldi* (Poiriar,
1883), Stiles and
Goldberger, 1910
13. Genus : *Carmyerius* Stiles and
Goldberger, 1910
20. *C. spatiosus* (Brandes,
1898) Stiles and
Goldberger, 1910
14. Genus : *Velasquezotrema*
Eduardo and Javellana,
1987
21. *V. tripurensis* Ray and
Tandon, 1990
- Subfamily : HELOSTOMATINAE
Skrjabin, 1949
15. Genus : *Helostomatis* (Fukui,
1929) Travassos, 1934
22. *H. sakrei* Bhalerao, 1937
- Subfamily : DIPLODISCINAE Cohn,
1904
16. Genus : *Diplodiscus* Diesing,
1836
23. *D. amphichrus*
Tubangui, 1933
- IV. Family : FASCIOLIDAE
RAILLET, 1893
- Subfamily : FASCILINAE Railliet,
1893
17. Genus : *Fasciola* Linnaeus, 1758
24. *F. gigantica* Cobbold,
1855
- Subfamily : FASCIOLOPSINAE
Odhner, 1910
18. Genus : *Fasciolopsis* Looss,
1899
25. *F. buski* (Lankester,
1857) Stiles, 1901
- V. Family : SCHISTOSOMATIDAE
Poche, 1907
19. Genus : *Schistosoma* Weinland,
1859
26. *S. indicum* Montgomery,
1906

- VI. Family : LECITHODRENDRIDAE Luhe, 1901
 Subfamily : PARABASCINAE Yamaguti, 1958
 Genus : *Parabascus* Looss, 1907
 27. *P. macrorchis* (Gogate, 1939) Skrjabin, 1970
 Subfamily : GANEONIAE Yamaguti, 1958
 21. Genus : *Ganeo* Klein, 1905
 28. *C. tigrinum* Mehra et Negi, 1923
 22. Genus : *Plerogenoides* Travassos, 1921
 29. *P. gastroporus* Luhe, 1902
- VII. Family : GORGODERIDAE Looss, 1899
 Subfamily : PHYLLODISTOMINAE Nybelin, 1926
 23. Genus : *Phyllodistomum* Braun, 1899
 30. *P. almorai* Pande, 1937
- VIII. Family : HAEMATOLOECHIDAE Odening, 1904
 24. Genus : *Haematoloechus* Looss, 1899
 31. *H. almorai* (Pande, 1937) Odening, 1958
- IX. Family : ALLOCREADIIDAE Looss, 1902
 Subfamily : ORIENTOCREADIINAE Yamaguti, 1958
 25. Genus : *Orientocreadium* Tubangui, 1931
 32. *O. batrachoides* Tubangui, 1931
- X. Family : PSILOSTOMIDAE Looss, 1900
 Subfamily : PSILOSTOMINAE Looss, 1909
 26. Genus : *Psilorchis* Thapar et Lal, 1935
 33. *P. indicus* Thapar et Lal, 1935
- XI. Family : DIPLOSTOMIDAE Poirier, 1886
 Subfamily : DIPLOSTOMINAE Monticelli, 1892
 27. Genus : *Neodiplostomum* Railliet, 1919
 34. *N. cuckooi* (Verma, 1936) Bhalerao, 1942
- XII. Family : ECHINOSTOMATIDAE Poche, 1926
 Subfamily : ECHINOSTOMATINAE looss, 1899
 28. Genus : *Echinostoma* Rudolphi, 1809
 35. *E. revolutum* (Froelich, 1902) Looss, 1899
 Subfamily : PEGOSOMINAE Mendheim, 1940
 29. Genus : *Pegosomum* Ratz, 1903
 36. *P. egretti* Srivastava, 1957
 Family : DICROCOELIDAE Odhner, 1910
- Key to the subfamilies*
1. Vitellaria in posttesticular lateral fields
DICROCOELIINAE
 Vitellaria not in posttesticular field 2
2. Vitellaria in pretesticular lateral field
EURYTREMATINAE

Key to tribes of Dicrocoeliinae

1. Acetabulum larger than oral sucker
.....**Dicrocoeliinae**
Acetabulum almost equal to oral sucker 2
2. Testes symmetrical**Paradistominae**
Testes not symmetrical 3
3. Vitellaria commencing behind ovarian zone.
.....**Brachylecithini**
Vitellaria not commencing behind ovarian zone
.....4
4. Vitellaria commencing behind testicular zone
.....**Lypersomini**

Tribe : **Dicrocoeliinae Yamaguti, 1958**

Genus : **Dicrocoelium** Dugardin, 1845

Dicrocoelium dendriticum Stiles and
Hassal, 1898

1819. *Distoma dendriticus* Rudolphi *Entozoaru synopsis*
chi Accedunt martissa duplen et indices locupletissim

1898. *Dicrocoelium dendriticum* : Stiles and Hassal
Arch.Par., 1(1) : 81-99.

Material : Host-Goat.

Diagnosis : Body length 2.1-8. Widest in preequatorial level. Oesophagus short, Caeca extend upto postequatorial zone. Acetabulum smaller than oral sucker. Testes symmetrical, postacetabular, cirrus pouch preacetabular. Genital pore at caecal bifurcation. Ovary posttesticular, vitellaria lateral at middle portion of body, limited to extent, uterus occupy all the space in hind body. Eggs dark brown, 0.36-0.5 x 0.22-0.3.

Distribution : India : Tripura, Meghalaya. Other records : Cosmopolitan.

Tribe : **Paradistominae Yamaguti, 1958**

Genus : **Paradistomoides** Travassos, 1944

Paradistomoides orientalis (Narain et Das,
1929) Travassos, 1944

1929. *Dicrocoelium orientalis* Narain et Das, *J. Bombay Nat. Hist.* 33(2) : 250-251.

1944. *Paradistomoides orientalis* Travassos, *Monogr. Inst. Osw. Cr.* 2 : 357.

Material : Host *Hemiductylus* sp.

Description : Body large, 2.80-2.89 long, 1.44-1.6 wide. Tegument smooth. Ventral sucker 0.20-0.22 in diameter. Oral sucker 0.18-0.1 long, 0.19-0.26 wide, smaller than ventral sucker. Prepharynx absent, pharynx 0.08-0.1 long, 0.09-0.1 wide oesophagus short, intestinal caeca extend a little short of posterior extremity.

Testes two, symmetrical, left testis 0.27-0.29 long; 0.17-0.18 wide, right testis 0.2-0.22 long; 0.18-0.2 wide, Ciccus sac preacetabular. Genital pore prebicular. Ovary post testicular, 0.31-0.32 long, 0.21-0.26 wide, Uterine coils, occupying most of the hind body. Vitellaria follicular, lateral, in extracaecal field, from caecal bifurcation to posterior end of intestinal caeca. Eggs- 32-41 x 16-24. Excretory vesicle tubular.

Distribution : India : Tripura (Sonamura, Paratia, Sepahijhola), Meghalaya, West Bengal, Orissa, Uttar Pradesh, Andhra Pradesh. Other records : Singapore, Burma, Bangladesh

Tribe : **Brachylecithinae Yamaguti, 1958**

Genus : **Brachylecithum** Strom, 1940

Brachylecithum cuckooensis sp. nov.
(Fig. 1)

Material : Host-Cuckoo shrike, 12 exs.

Diagnosis : Elongated body with parallel sides, length 5.23-6.69 breadth 0.46-0.68. Oral sucker subterminal, almost round 0.287 0.37 x 0.027 0.33. Prepharynx absent. Pharynx oval 0.08-0.09 x 0.09-0.01 dorsal to oral sucker. Oesophagus short. Caeca lateral, extend upto 3/4th or more of body length. Acetabulum 0.29-0.37 x 0.37-0.42. Ratio of oral sucker and acetabulum length is almost equal, whereas in breadth the acetabulum is larger. Testes mostly tandem, just below acetabulum, in some specimens seperated by uterine coils. Anterior testis 0.24-0.25 x 0.19-0.23; posterior one 0.025-0.27 x 0.15-0.22. Cirrus sac preacetabular, Genital pre median near caecal bifurcation. Ovary 0.22-0.24 x 0.17-0.21. Post testicular, seperated from testes by uterine coils. Seminal receptacle just below ovary. Vitellaria with limited number of large follicles, lateral, but

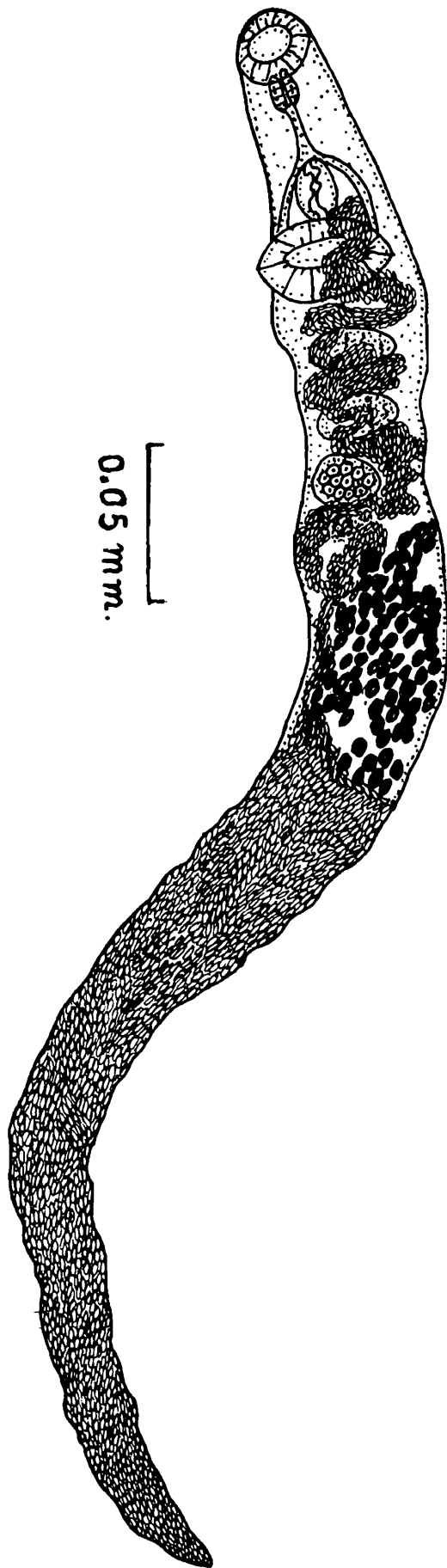


Fig. 1. *Brachylecithum cuckooensis* n.sp.

intrudes in intercaecal area in postovarian zone. Great variation in the distribution of vitellaria was observed in the present lot of specimens. In some cases vitelline follicles are asymmetrical and appears to be unilateral. Number and size of follicles are also variable (Figs.). Uterine coils almost fill up entire post ovarian space, extending upto the posterior end of body, Anteriorly coils pass through gonads upto genital pore. Metraterm discernible. Eggs 0.037-0.041 x 0.029-0.3.

Remarks : More than 80 species have been described under this genus. Present specimens show a very wide range of variation in respect of distribution of vitellaria. Both unilateral and bilateral distribution have been observed. Distribution of vitellaria in the present specimens are similar with species *B. skrjabini* Jaiswal, 1957 and *B. eophonae* (Yamaguti, 1941) from *Corvus splendens* from Andhra Pradesh, India and *Eophona personata personata* from Japan respectively. The present specimens differ from *B. skrjabini* in the following characters. The shape of testes and acetabulum is almost round in *B. sayeedi*, whereas in the present case it is oval. Ratio of suckers is almost equal in *B. sayeedi* whereas in the present species breadth of the acetabulum is much larger; the present specimens also differs from *B. eophonae* in the size and nature of distribution of vitellaria. Sucker ratio is 1: 1.5 in *B. eophonae*, whereas in the present case length wise it is almost equal but breadth is almost 1:2. All the gonads are rounded in *B. eophonae* but testes in the present case is distinctly oval. The present species is distinguishable from all other species in nature and distribution vitellaria, which are very much variable. Considering all these variations the present species is considered new to science and is named as *B. cuckooensis* sp. nov. Types deposited in Zoological Survey of India, Calcutta.

Tribe : **Lypersomini Yamaguti, 1958**

Genus : ***Lypersomum* Looss, 1899**

***Lypersomum (Lypersomoides) tripurensis* sp. nov.**
(Fig. 2)

Material : Host -Pied Moina, *Sternus contra*
3 exs., Location-Intestine.

Diagnosis : Elongated body 4.7-5.07 with tapering rounded extremities. Maximum breadth at testicular level, cuticle smooth, oral sucker oval 0.21-0.24 x 0.26-0.29. Pharynx 0.12-0.18 x 0.16-0.2 oesophagus moderately long. Intestinal caeca extend some distance short of posterior end. Acetabulum much larger than oral sucker 0.64-0.67 x 0.63-0.64. Ratio of oral sucker to ventral sucker almost 1:3. Testes oval, almost symmetrical or oblique, just below acetabulum, separated from one another by uterine coils. Anterior one 0.42-0.46 x 0.35-0.38 and posterior one 0.42-0.43 x 0.25-0.4. Cirrus pouch elongated anterior to acetabulum, with coiled seminal vesicle, pars prostatica and cirrus. Genital pore median just below pharynx. Ovary, oval 0.24-0.25 x 0.18-0.22 situated on the side of posterior testis, separated by uterine coils, Vitellaria follicular, lateral, extending from ovarian zone to some distance beyond post equatorial level, asymmetrical, Uterus extensive, filling up all available vacant space, extending posteriorly upto the terminal end of body length; anteriorly it runs in between testes, dorsal to acetabulum upto genital pore. Mature eggs numerous, oval 0.025-0.032 x 0.016-0.02.

Remarks : Denton and Krissinger (1975) for convenience suggested grouping of the large number of species under this subgenus into three further subgroups mainly on the relative position of gonads and ratio of acetabulum. Accordingly the present species could very well be grouped with those species where gonads are close together and ovary is situated just below the posterior testis. The subgenus *Lypersomoides* Yamaguti, 1971, was having only three species but Denton and Krissinger (1975) emended the subgenus and included 15 species under it, by transferring the species of the genus *Oswaldia* Travassos, 1920, citing the reference of Travassos (1944) who himself synonymised his genus with *Lypersomum*; of course some species under this subgroup is similar to some species of the genus *Zonorchis* Travassos, 1944 and *Conspicuum* Bhalerao, 1936. So further revision of the group is needed.

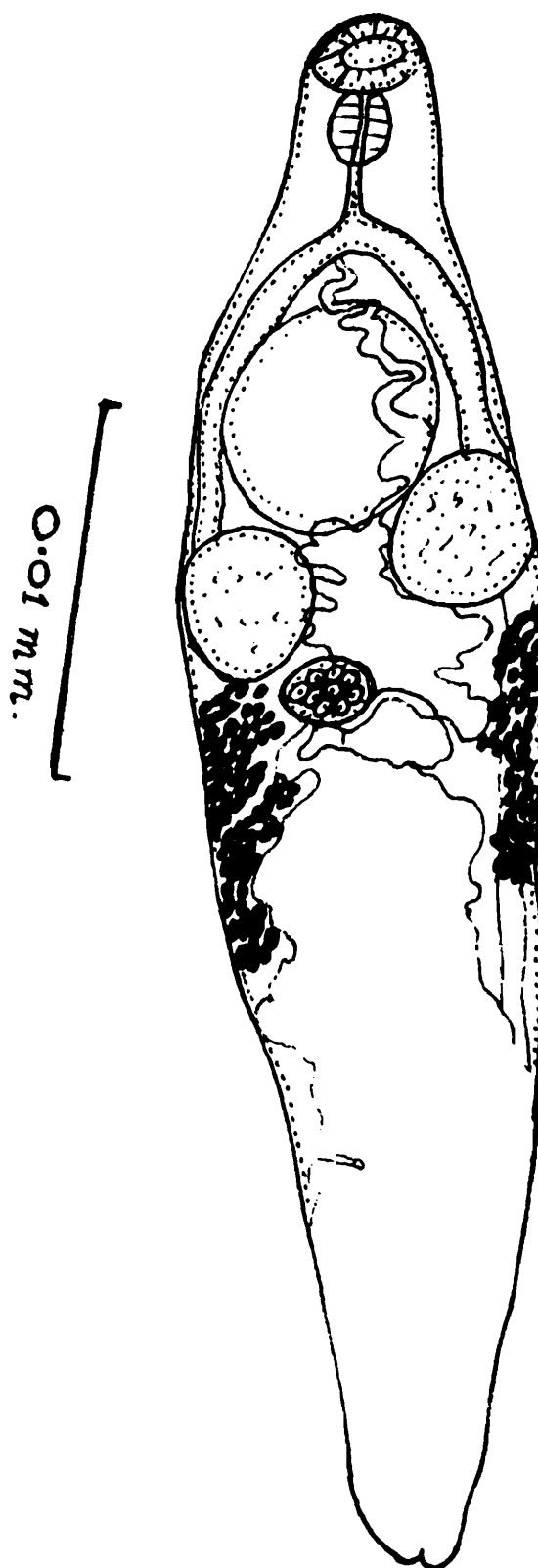


Fig. 2. *Lypersomum (Lypersomoides) tripurensis* n.sp.

The present specimens on account of ratio of suckers and relative position of gonads is near to *L. palwanence* Fischthal and Kuntz, 1973 and *L. corvi* (Yamaguti, 1939) but on account of much larger ventral sucker almost 3 times than oral sucker it differs from both the species. The present species is further distinguishable from *L. corvi* on account of having genital pore near caecal bifurcation, whereas it is below the pharynx in *L. corvi*. It is distinct from all other species of the subgenus on account of almost symmetrical position of testes. Hence the present species is reported as new to science and named *Lypersomum* (*Lyprsomoides*) *tripurensis* sp. nov. Types deposited in Zoological Survey of India, Holotype.

Subfamily : EURYTREMATINAE

Yamaguti, 1958

Genus : *Eurytrema* Looss, 1907

Eurytrema pancreaticum (Janson, 1889)

Looss, 1907

1889. *Distoma pancreatirum* Johnson, *Note explicative des objets deskomaber*, Paris: 92.

1907. *Eurytrema pancreaticum* : Looss, *Ann. Trop. red. Parasit.*, 1: 121-154.

Material : Host-Crow, location-Liver and pancreus.

Diagnosis : Body length 9-12.5, caudal appendage present, cuticle smooth. Acetabulum smaller than oral sucker, pharynx oval, oesophagus straight or bend. Intestinal caeca sinuous. Testes deeply lobed. Cirrus sac anterior to ventral sucker or overlaps it, ovary with 3-4 lobes, uterus extends between testes and ovary. Follicular vitellaria extracaecal, in groups or in continuous mass. Eggs 0.038-0.048 x 0.022-0.032.

Distribution : India : Tripura, Meghalaya, Assam and in all other states.

Elsewhere : Cosmopolitan.

Family : PROSTHOGONIMIDAE Luhe, 1909

Genus : *Prosthogonimus* Luhe, 1899

Prosthogonimus putschkowskii Skrjabin, 1912

1912. *Prosthogonimus putschkowskii* Skrjabin, *Arch Vet. Nauk. S. Pttersburg*, 42 (12) : 1270.

Material : Host-common myna, location-intestine.

Diagnosis : Body length 4.5-8. Greatest breadth around postequatorial level, Cuticle spined, oral sucker 0.25-0.38 Pharynx 0.15-0.25. Oesophagus short. Caeca terminate some distance short of posterior end. Acetabulum 0.82-0.84, larger than oral sucker. Testes prequatorial, symmetrical or slightly oblique. Genital pore at anterior end, left of oral sucker. Ovary pretesticular, with 12-15 lobes. Vitelline follicle in groups, lateral, from middle third of body to some distance short of caecal end. uterine coils at postcaecal end, cover the entire breadth of the body. Eggs 0.019-0.047 x 0.013-0.029.

Distribution : India : Tripura (Paratia), Meghalaya, West Bengal, Uttar Pradesh, Madhya Pradesh.

Other records : Europe, Africa, Russia, China, America.

Family : PARAPPHISTOMIDAE

Fischoeder, 1901

Key to subfamilies

1. Oral diverticula large and prominent; oesophageal bulb present.....
.....HOLOSTOMATINAE
- No oral diverticula 2
2. Pharynx with prominent diverticula; Testis may be one.....DIPLODISCINAE
- Pharynx with no diverticula 3
3. Ventral pouch present.....
.....GASTROTHYLACINAE
- No ventral pouch 4

4. Oral diverticula absent. No genital sucker
.....PARAMPHISTOMINAE

Subfamily : PARAMPHISTOMINAE
Fischöeder, 1901

Key to genera of Paramphistominae

1. Genital, sucker present.....*Cotylophoron*
No genital sucker 2
2. Laural's canal crossing excretory vesicle.
Genital papilla surrounded by muscular calyx
.....*Calicophoron*
Genital papilla not surrounded by muscular
calyx 3
3. Pars musculosa not very strongly developed.
Laural's canals; crossing excretory vesicle
.....*Paramphistomum*
Laural's canal not crossing excretory vesicle
.....4
4. Pars musculosa strongly developed
.....*Ceylonocotyle*

Genus : *Ceylonocotyle* Nasmark, 1937

Key to species

1. Strong oesophageal bulb and lip sphincter
present; Genital atrium with genital sphincter
but without ventral atrium. Vitelline glands in
clusters*C. scoliocoelium*
Vitelline glands not in clusters 2
2. Genital atrium without genital sphincter
.....*C. parvipapillatum*
Genital atrium with genital sphincter 3
3. No ventral atrium*C. dicranocotium*
Ventral atrium present 4
4. No oesophageal bulb*C. dawesi*
Oesophageal bulb present 5
5. Oesophagus with oesophageal sphincter
.....*C. dinniki*

Ceylonocotyle scoliocoelium (Fischöeder, 1901)
Nasmark, 1937

(Fig. 3)

1901. *Paramphistomum scoliocoelium* Fischöeder, Zool. Anz.
Bd. 25(646) : 367-375.

1937. *Ceylonocotyle scoliocoelium* Nasmark Zool. Bidr.
uppsala 16 : 301-565.

Material : Host-Goat, Cattle. Location-Rumen.

Diagnosis : Body length 4.1-7.6 and 1.5-3.2 in breadth. Anterior end somewhat pointed. Oesophagus with oesophageal bulb. Caeca almost straight extending upto the level of ovary. Acetabulum subterminal or ventral 0.76-1.02 in diameter. Ratio in relation to body 1:6.2-6.5. Testes tandem. Ovary post testicular. Laural's canal not crossing the excretory vesicle. Vitelline follicles from caecal bifurcation to little away from caecal ends. Sometime in clusters. Genital atrium with genital sphincters. Eggs 0.096-0.128 x 0.056-0.076.

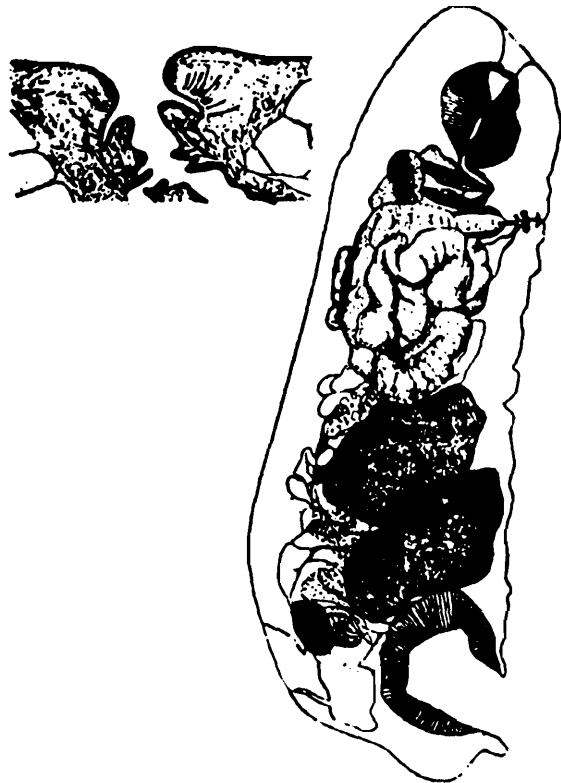


Fig. 3. *Ceylonocotyle scoliocoelium* (Fischöeder, 1901) Nasmark, 1937. Genital atrium *Scoliocoelium* type. After Nasmark, 1937 and sagittal section.

Distribution : India : Tripura, Meghalaya, Mizoram, West Bengal, Punjab, Uttar Pradesh, Tamil Nadu, Kerala.

Other records : Sri Lanka, Indochina, Vietnam.

***Ceylonocotyle dawesi* Gupta, 1958 Syn.
*Orthococlium dawesi***

1958. *Ceylonocotyle dawesi* Gupta, Res. Bull. Punjab Univ. Sci., 140 : 67-93.

Material : Host-Goat. location-Rumen.

Diagnosis : Body length 2.8-4.4; breadth 1.8-2.7. Acetabular opening subterminal, surrounded by a conspicuous ridges. Ventral surface wrinkled, dorsal surface smooth. Ratio of oral sucker length and body 1:4.6-7.3. oesophagus curved, without oesophageal bulb. Caeca extend upto midlevel of acetabulum, Testes tandem, posterior testis may be obliquely situated. Pars muscula muscular; Ovary posttesticular. Laural's canal do not cross excretory canal, opens in front of excretory pore. Genital pore behind anterior end, vitellaria throughout the caecal length. Eggs 0.096-0.0128 × 0.056-0.076.

Distribution : India : Tripura, Assam, Meghalaya, Mizoram, Nagaland, Punjab, Kerala, Tamil Nadu.

Remarks : Mehra (1980) considered the species as synonym of *C. scoliocoelium*. Mukherjee and Chauhan (1965), Gupta, (1992) recognised this as valid species. Tandon (1992) recorded this species from Meghalaya as *Orthococlium dawesi*. This species is considered as valid here.

***Ceylonocotyle dicranocoelium* (Fischöder, 1901), Nasmark, 1937**

1901. *Paramphistomum dicranocoelium* Fischöder Zool. Anz. 25(646) : 367-375.

1937. *Ceylonocotyle dicranocoelium* Nasmark Zool. Bidr. Uppsala 16 : 301-565.

Material : Host-Goat, Cattle.

Diagnosis : Body length 2.9-6.4. Ratio of acetabulum in relation to body length 1: 5.8-7.1.

Pharynx with lip sphincter; oesophagus 6.44-0.69 in length with oesophageal bulb. Testes tandem, lobed. Ovary posttesticular. Genital atrium without genital sphincter, vitellaria extending throughout caecal length.

Distribution : India : Tripura, Meghalaya, Mizoram, Assam, Uttar Pradesh.

Other records : Sri Lanka, Germany.

***Ceylonocotyle dinniki* (Eduardo, 1985)**

1985. *Orthocoelium dinniki* Eduardo Systema Parasit, 7 : 125-158.

Material : *Bos indicus*; *Bos aries*. Location - Rumen.

Description : Body shape conical 3.75-4.87 in sagittal section; whole mounts measures 3.84-5.01. Ratio of body breadth to body length 1 : 245-1 : 27. Oral sucker 0.6-0.63 (0.45-0.72) × 0.6-0.67 (0.6-0.72), oesophagus 0.3-0.49 long; oesophageal sphincter present. Acetabulum subterminal 0.93-1.12 (1.22-1.67) in dorsoventral plain. Ratio with oral sucker 1 : 1.55-1 : 1.77. Testes Tandem. Anterior testis 0.75-1.31 x 0.82-1.23 (0.72-1.31 x 0.76-1.26); posterior testis 0.67-0.93 x 0.67-1.12 (0.67-0.94 x 0.67-1.17); ovary post testicular 0.22-0.27 x 0.22-0.31 (0.22-0.31 x 0.31-0.40). Vitelline glands extends from caecal bifurcation to caecal ends. Laurer's canal opening about 0.31-0.49 anterior to excretory pore. Genital pore just below caecal bifurcation. Eggs 0.113-0.158 x 0.067-0.07.

Distribution : Tripura (Dharamnagar).

Other records : Philippines, China, Japan.

Remarks : Roy and Tandon (1989) recorded this species from Tripura as *Orthocoelium dinniki* Eduardo, 1985, following Price and McIntosh, 1953, Yamaguti (1958,1971) considered the genus *Ceylonocotyle* as synonym of *Orthocoelium*. Mukherjee and Chauhan (1965); Mehra (1980) and Gupta (1993) on the other hand did not recognise the genus *Orthocoelium*. In the present work the genus *Ceylonocotyle* is considered valid.

***Ceylonocotyle parvipapillatum* (Stiles and Goldberger, 1910) Eduardo, 1985**

1910. *Paramphistomum parvipapillatum* Stiles and Goldberger, *Burso Hyg. Lab. U. S. P.ubl. Heal Mar. Hosp. Serv. Washington*, 1-259.

1985. *Orthocoelium parvipapillatum* Eduardo, 1985. *System. Parasit.* 7 : 125-158.

Material : Host-*Bos indicus*, Locality - Rumen.

Description : Body length 3.18-4.57 (5.65-8.13); breadth 1.31-1.57 (2.84-3.44) in dorsoventral plain. Oral sucker 0.56-0.67 (0.54-0.72) x 0.41-0.56 (0.51-0.63) in dorsoventral direction, Oesophagus 0.45-0.63; oesophageal bulb present. Acetabulum subterminal 0.56-0.75 (0.90-1.31) dorsoventrally. Ratio with oral sucker 1 : 1.07-1 : 1.33. Testes tandem, anterior testis 0.63-0.93 x 0.71-1.01 posterior testis 0.75-1.05 x 0.71-1.05. Ovary posttesticular 0.37-0.45 x 0.31-0.49. Laurer's canal opening about 0.22-0.36 anterior to excretory pore. Genital pore just below caecal bifurcation vitelline follicles large, lateral, extending from caecal bifurcation to much beyond caecal ends, upto poerior end of body. Eggs 0.090-0.158 x 0.058-0.090.

Distribution : India : Dharamnagar, Agartala.

Other records : Punjab.

Remarks : This species is considered synonym of *Ceylonocotyle scoliocoelium* in most of the recent work on amphistomes, Eduardo (1985) listed this species as valid from the collection of Nasmark, said to be recorded from *Bubalis bubalis* from Punjab. Since then this is the first record of this species by Rao and Tandon (1989). Authors reexamined a specimen of *O. parvipapillatum* deposited by the authors in Zoological Survey of India Calcutta. The specimen was immature one and almost similar to be of *Ceylonocotyle scoliocoelium* but as no mature specimens were available the authors definite opinion is withheld.

Genus : *Paramphistomum* Fischöeder, 1901**Key to species**

1. Vitellaria from pharyngeal level in anterior end of caecum. Acetabulum diameter in relation with body length 1 : 4-5 ***P. epiclitum***
Acetabulum ratio much higher 2
2. Acetabulum ratio in relation to body length 1:11-16 ***P. gracile***
Vitelline glands not from pharyngeal level... 3
3. Vitelline gland from the level of genital pore to posterior end of body. Acetabulum diameter in relation to body length 1:4-5 ***P. ichigawai***

***Paramphistomum epiclitum* Fischöeder, 1904**

1904. *Paramphistomum epiclitum* Fischöeder *Ctbl. Bl. f. Bakt. U. Par.* 35 : 598-601.

Material : Host-Cattle.

Diagnosis : Body size 7.48-9.52 in length; breadth 2.63-3.23. Acetabulum 1.6-1.78 ratio in relation to body length 1 : 4.41-5.33. Intestinal caeca coiled; number of coils 3-4, extending upto midlevel of acetabulum. Testes lobed, tandem, around mid region. Ovary posttesticular. Laurer's canal crosses excretory canal. Vitelline glands from pharyngeal level to anterior end of acetabulum. Genital atrium with genital papilla. Genital pore post caecal. Eggs 0.12-0.14 x 0.48-0.64.

Distribution : India : Tripura, Meghalaya, Mizoram, Nagaland, Assam.

Other records : Pakistan, Saigon.

***Paramphistomum ichigawai* Fukui, 1922**

1922. *Paramphistomum ichigawai* Fukui *Zool. Mag. (Jap)* 34 : 19-27.

Material : Host-Goat.

Diagnosis : Body size 7.77-10.15 in length; breadth 2.72-3.17. Acetabulum 1.53-2.04 in diameter. Ratio in relation to body length 1 : 4.57-5.72. Intestinal caeca with 3-4 coils. Testes tandem lobed, ovary posttesticular. Laurals canal cross the excretory vesicle. Vitelline glands from caecal bifurcation to posterior end of body. Genital atrium with papillae No ventral atrium and genital sphincter.

Distribution : India : Tripura, Punjab.

Other records : Japan, Australia, Taiwan, Manchuria.

***Paramphistomum gracile* Fiscoeder, 1901**

1901. *Paramphistomum gracile* Fiscoeder Zool. Auz. Bd. 25(646) : 367-375.

Material : Host-Goat.

Diagnosis : Body length 4-15; breadth 2.4-3.2, Acetabulum 1.3-1.8 in diameter. Ratio in relation to body length 1 : 11.9 15.0 Intestinal caeca meeting each other in acute angle. Testes lobed, tandem, ovary post testicular. Vitellaria from the level of genital pore to anterior end of acetabular. Eggs 0.14-0.15 x 0.085-0.86.

Distribution : India : Tripura, Uttar Pradesh. Elsewhere : Sri Lanka, Japan.

Genus : *Cotylophoron* Stiles and Goldberger, 1910

***Cotylophoron cotylophorum* (Fiscoeder, 1901)**
Stiles and Goldberger, 1910
(Fig. 4 & 5)

1901. *Paramphistomum cotylophorum* Fiscoeder, Zool. Auz. Bd. 25(646) : 367-375.

1910. *Cotylophoron cotylophorum* Stiles and Goldberger Hyg. Lab. Bull. 60 : 259.

Diagnosis : Body shape conical to ovoidal. Length 5.1-6.12; breadth 2.5-3.6. Acetabulum 1.53-1.61. Ratio in relation to body length 1:3.15-3.5. Oesophagus short with prominent oesophageal bulb. Intestinal caeca with 6-7 coils, extending upto midlevel of acetabulum. Testes lobed heavily,

diagonally placed, varying in size. Genital atrium in the form of a strong genital sucker. Ovary post testicular. Laurals canal crosses the excretory vesicle, vitelline follicle from caecal bifurcation to midlevel of acetabulum. Eggs 0.125-0.14 x 0.055-0.062.

Distribution : India : Cosmopolitan.

Other records : Africa, Indochina, Philippine.

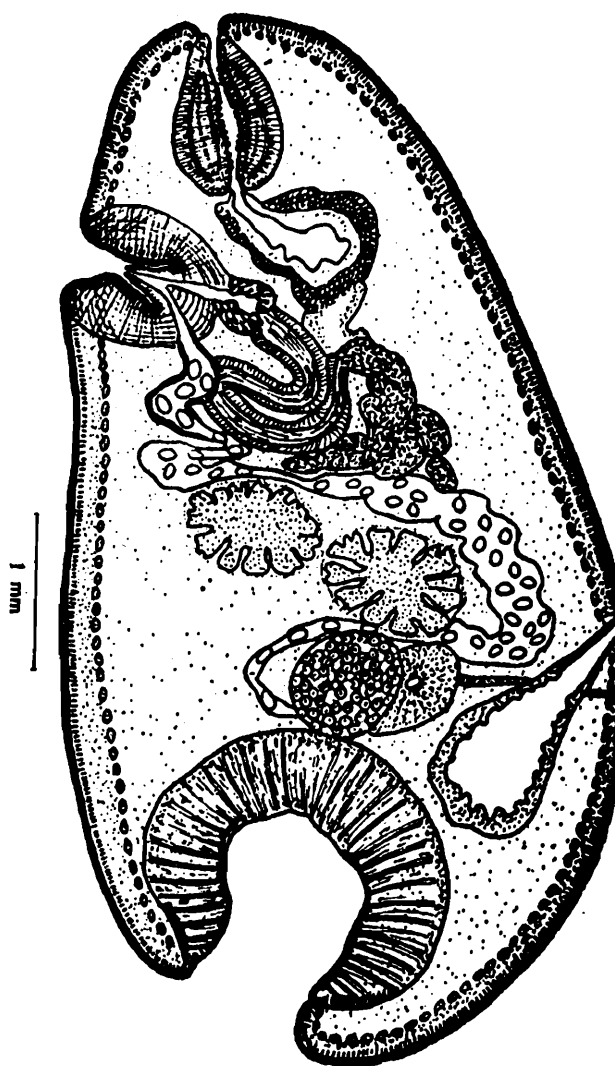


Fig. 4. *Cotylophoron cotylophorum*—thick sagittal section.

Genus : *Calicophoron* Nasmak, 1937

***Calicophoron calicophorum* (Fiscoeder, 1901)**

Key to the species

1. Testes diagonally tandem. Papillae on genital atrium absent *C. calicophorum*
- Testes not diagonally tandem.....2

2. Testes tandem. Papillae present on genital atrium.....*C. papillosum*

1901. *Paramphistomum calicophorum* Fiscoeder Zool. Anz. Bd. 25(646) : 367-375.
1937. *Calicophoron calicophorum* Nasmark Zool. Bidr. Uppsala 16 : 301-565.

Material : Goat, Cattle, Location - Ruman

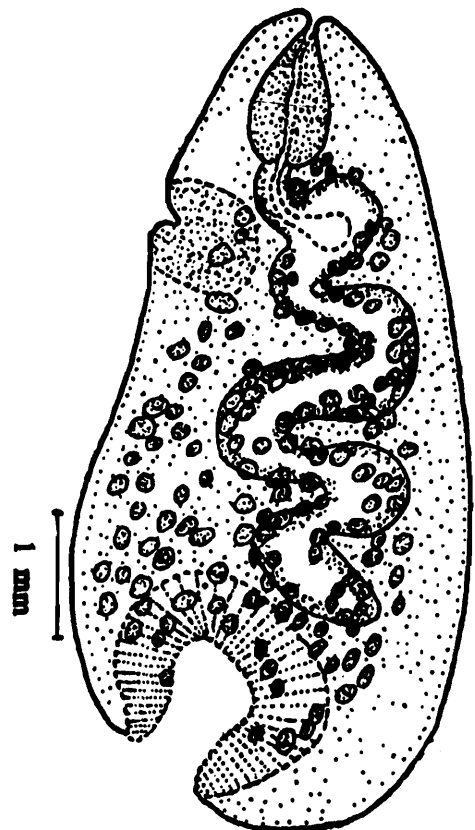


Fig. 5. *C. cotylophorum*—intestinal caecum and vitelline glands.

Diagnosis : Body length 10-15; breadth 5-6. Oral aperture with papillae, Acetabulum 3.0-4.3 in diemeter. Ratio in relation to body length 1:3.3-3.5. Oesophagus 0.96 in length. Testes lobes, lobes further lobated, almost diagonal or side by side. Genital pore at bifurcal zone. Ovary post testicular. Genital atrium present. Eggs 0.125-0.135 × 0.065-0.07.

Distribution : India : Tripura, Meghalaya, Mizoram, Nagaland, West Bengal, Uttar Pradesh.

Other records : Sri Lanka, China, Indochina, Africa, Saigon.

Calicophoron papillosum (Stiles and Goldberger, 1910) Nasmark, 1937

1910. *Paramphistomum papillosum* Stiles and Goldberger Bull. Hug. Lab. U. S. Publ. Heal. Mar. Hosp. Serv. Washington, 1-259.
1937. *Calicophoron papillosum* Nasmark Zool. Bid. Fron. Uppsala 16 : 1-565.

Material : Host-*Bos indicus*, Location-Stomach.

Diagnosis : Gray brown in colour. Body length and breadth 5.12-6.0 x 3.52-3.91. Acetabulum ventrosubterminal 1.8-2.4 in diameter. Ratio in relation to body length 1 : 4.57-5.8 Oesophagus 0.51-0.04 in length. Intestinal caeca coiled, wavy extend upto posterior end of acetabulum. Testes deeply branched, Cauliflower like, tandem; ovary posttesticular, sinistral. Laurals canal crosses the excretory vesicle. Genital atrium with papillated genital sphincter present, vitellaria lateral, from oral sucker to caecal end. Eggs 0.102-0.113 x 0.068-0.074.

Distribution : India : Cosmopolitan.

Other records : Africa, Congo, Indochina, Philippines.

Subfamily : GASTROTHYLACINAE Stiles and Goldberger, 1910

Key to genera of gastrothylacinae

- 1. Uterus crossing from one side to the other near middle level, testes symmetrical*Gastrothylax*
Uterus otherwise 2
- 2. Uterus confined to median field, coiled*Carmyerius*
Testes juxtaposed, not symmetrical 3
- 3. Testes tandem. Ventral pouch extending postequatorial level*Fiscoederius*
Ventral puch not long 4
- 4. Ventral pouch only upto equatorial level*Velasquezotrema*

Genus : *Gastrothylax* Poirier, 1883

Gastrothylax cruminifer (Creplin, 1847)

Poirier 1883

(Fig. 6)

1847. *Amphistoma cruminifer* Creplin Arch. Naturg. Berlin 13(61) : 30-35.

1883. *Gastrothylax cruminifer* : Poirier Bull. de la Soc. Philomathy Paris (1882-83), 7(2) : 73-80.

Material : Host-Goat, cattle.

Diagnosis : Body length 9-18. Anterior end papillated. Ventral sac large, oesophagus 'S' shaped. Caeca wavy, extending upto anterior testes. Testes lobed, symmetrical, placed at caecal end and acetabulum, intertesticular. Uterus crossing to other side at equatorial level. Genital pore prebifurcal, near base of oesophagus. Vitellaria follicular, often dispersed throughout the body or may be confined to lateral side. Eggs 0.11-0.14 x 0.06-0.07.

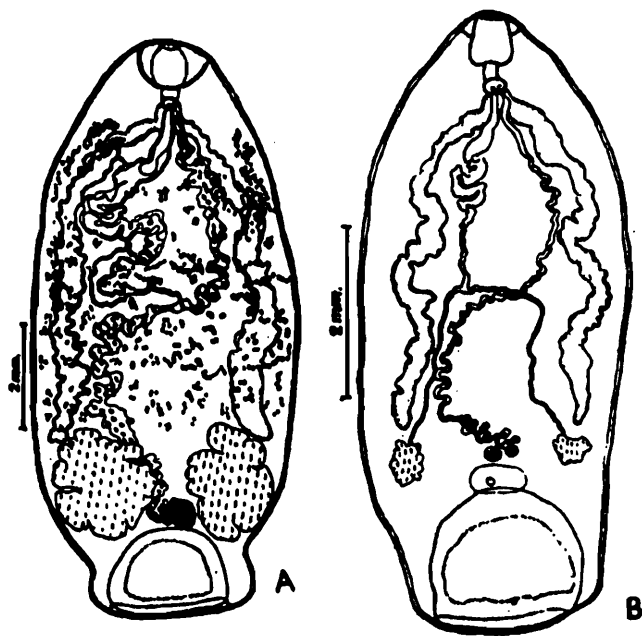


Fig. 6. A—*Gastrothylax cruminifer* (Creplin, 1947). Immature adult.
B—*Gastrothylax cruminifer* (Creplin, 1887). Poirier, 1883. Mature adult.

Distribution : India : Tripura, West Bengal, Uttar Pradesh, Punjab, Andhra Pradesh, Meghalaya, Mizoram.

Other records : China, Burma, Sri Lanka.

Genus : *Fiscoederius* Stiles and Goldberger, 1910

Key to species

1. Caeca short, terminate at equatorial and pretesticular level of body
.....*F. elongatus*
Caeca long 2
2. Caeca extend upto posttesticular or acetabular level*F. cobboldi*

Fiscoederius elongatus (Poirier, 1883) Stiles and Goldberger, 1910
(Fig. 7 & 8)

1883. *Gastrothylax elongatus* Poirier, Bull. de la soc. Philomath. 73-80.

1910. *Fiscoederius elongatus* : Stiles and Goldberger, Hyg. Lab. Bull. 60 : 1-259.

Material : Host-Goat.

Diagnosis : Body length 6-20 maximum breadth 2.8-3.2; slightly constricted at testicular zone. Ventral pouch extending upto testicular level, opening ventral to pharynx. Acetabulum terminal. Ratio between dorso ventral diameter and body length 1 : 4.9. Intestinal caeca wavy, extend upto post equatorial zone. Testes irregularly lobed, preacetabular, tandem. Ovary intertesticular. Uterus along with vasdeferens in the dorsomedian line. Genital pore prebifurcal, at the midlevel of oesophagus, opening into ventral pouch. Follicular vitellaria from caecal bifurcation to testicular zone. Eggs 0.113-0.122 x 0.063-0.068.

Distribution : India : Tripura, Mizoram, Nagaland, West Bengal, Uttar Pradesh, Tamil Nadu, Punjab.

Other records : Japan, Sri Lanka.

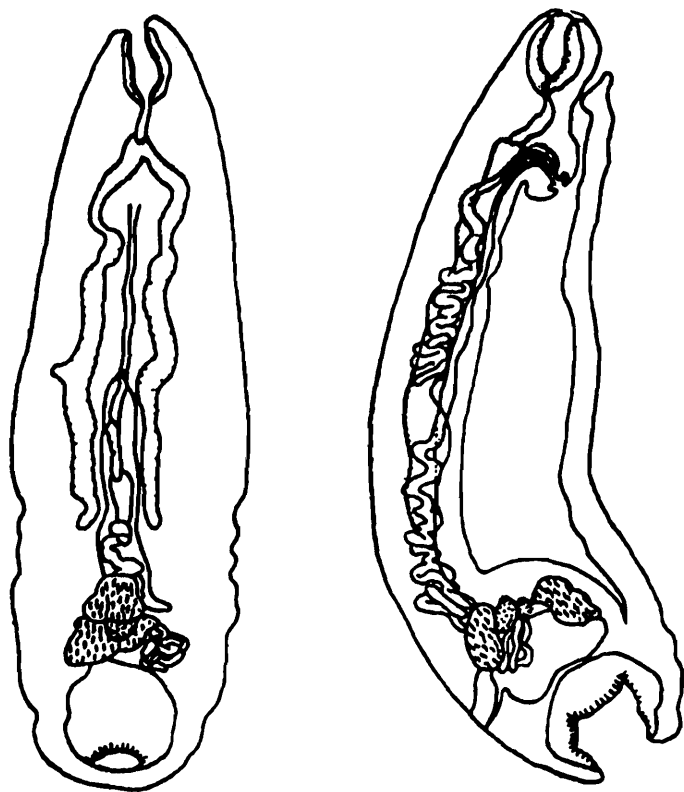


Fig. 7. *Fischoederius elongatus* (Poirer, 1883) seg. Stiles and Gold-berger.

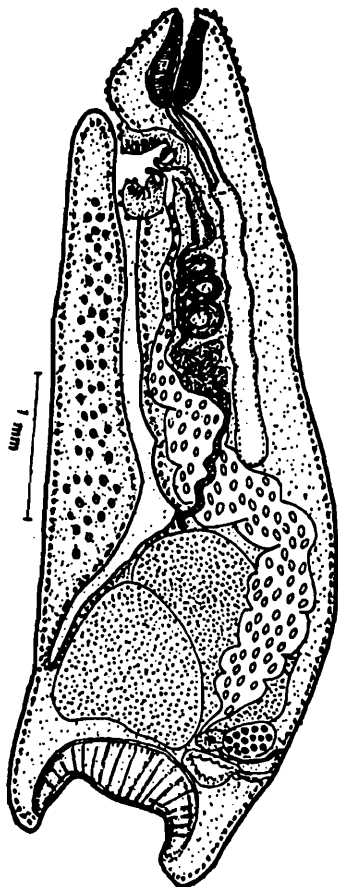


Fig. 8. *Fischoederius elongatus*—thick sagittal section.

Fischoederius cobboldi (Poirier, 1883) Stiles
and Goldberger, 1910
(Fig. 9)

1883. *Gastrothylax cobboldi* Poirier, *Bill. de la Soc. Philomath.* 73-80.

1910. *Fischoederius cobboldi* Stiles and Goldberger *Hyg. Lab. Bull. No. 60* : 259.

Material : Host-Cattle.

Diagnosis : Body length 2.75-15.5 and breadth 1-4.3. Ventral pouch extending upto ovary or

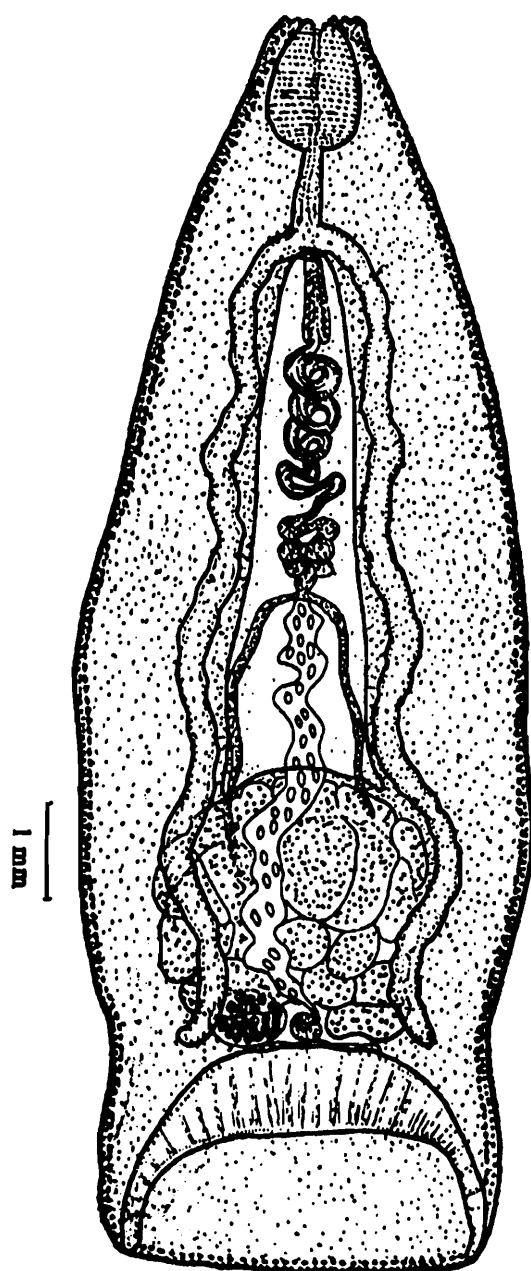


Fig. 9. *F. cobboldi*—dorsal view

testicular region. Caeca wavy upto anterior end of acetabulum. Acetabulum terminal cup-shaped. Ratio between its dorsoventral diameter and length of body 1 : 4.9-6.9. Oesophagus short, 'S' shaped. Testes irregularly lobed, tandem, nearly coinciding. Ovary posterolateral to anterior testis. Genital pore prebifurcal at the tip of genital papilla. Vitellaria follicular from caecal bifurcation to posterior extension of caeca, uterus runs medially upto genital pore. Eggs 0.108-0.117 x 0.054-0.061.

Distribution : India : Assam, Tripura, Meghalaya, West Bengal, Uttar Pradesh.

Other records : Sri Lanka.

Genus : *Carmyerius* Stiles and Goldberger, 1910
(Fig. 10 & 11)

Carmyerius spatiosus (Brandes, 1898) Stiles
and Goldberger, 1910

1890. *Distoma Spatiosus* Brandes *Abh. d. Naturforsch Ges. Sch. zu. Halla.* 21 : 195-225.

1910. *Carmyertus spatiosus* Stiles and Goldberger, *Hyg. Lab. Bull. No 60* : 1-289.

Material : Host-Goat, Sheep.

Diagnosis : Body conical or subelliptical; ventral sac extending upto acetabulum. Acetabulum terminal. Oesophagus without bulb. Caeca extending upto posterior end of testes. Testes symmetrical, lobed, Genital pore opening into ventral sucker, ovary intertesticular, mostly on left side. Vitellaria lateral, from caecal bifurcation to near base of ventral sac. Eggs 0.122-0.125 x 0.06-0.065.

Distribution : India : Tripura, Uttar Pradesh.

Other records : Sri Lanka, Africa.

Genus : *Velasquezotrema* Eduardo and Javellana,
1987

Velasquezotrema tripurensis Roy and Tandon,
1990

1990. *Velasquezotrema tripurensis* Roy and Tandon *Zool. Auz.*, 224 1/2 S. 106-112.

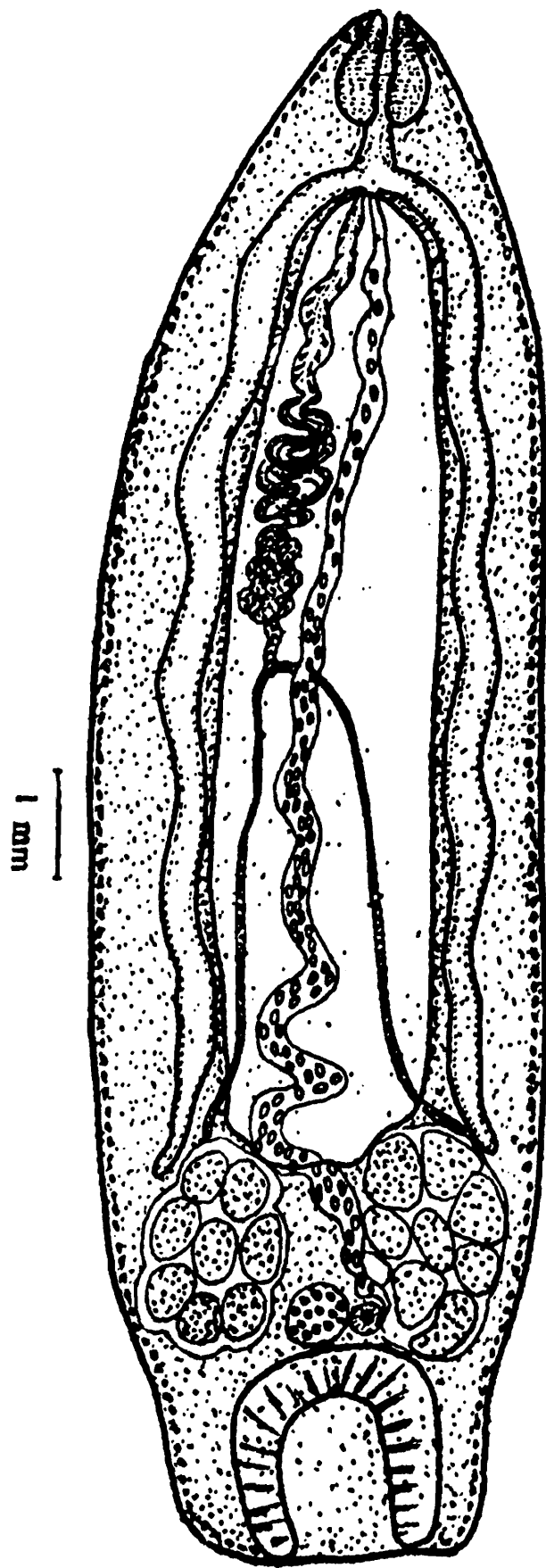


Fig. 10. *Carntyerius spatiosus*—dorsal view.

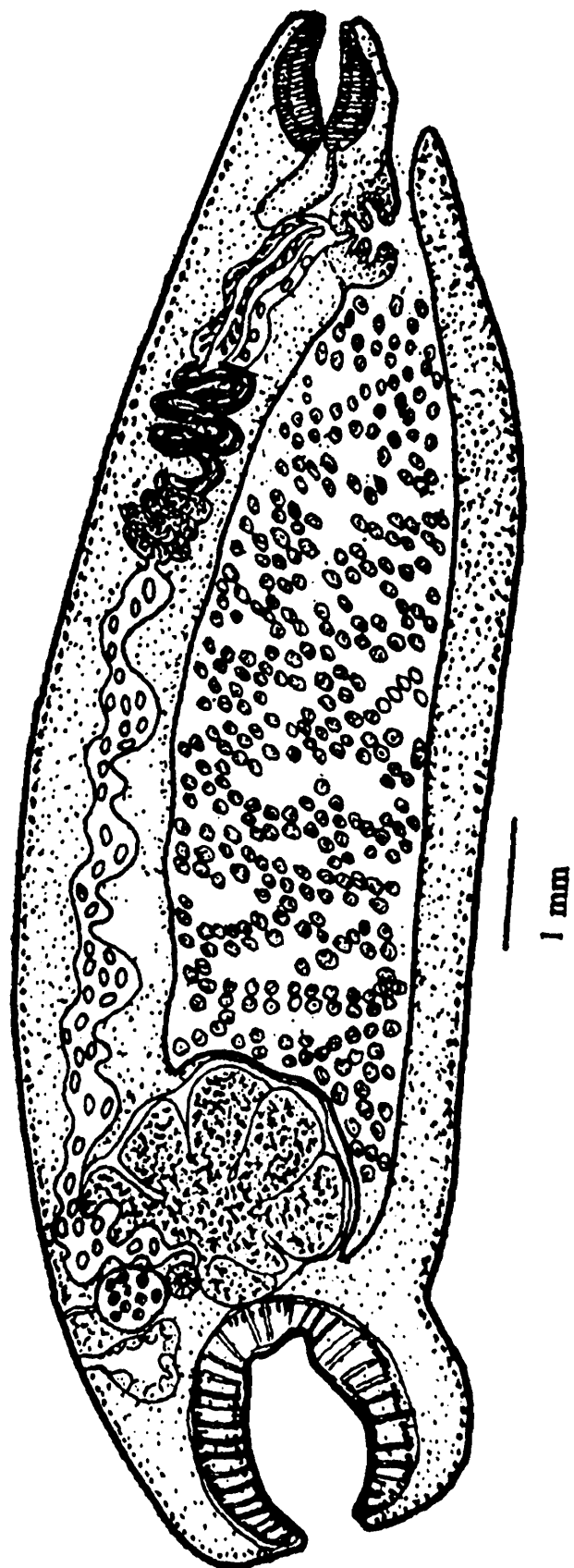


Fig. 11. *C. spatiosus*—thick sagittal section.

Material : Host *Bos indicus* Location - Rumen.

Diagnosis : Body with rounded extremities 6.8-11.7 long and 2.6-3.6 in greatest width around the level of genital pore. Acetabulum subterminal and ventral 0.59-0.86 in diameter. Ratio with body length 1 : 9.3-16.6. Pharynx present 0.32-0.49. Oesophagus 0.18-0.27. Oesophageal sphincter and small glands along side of pharynx and oesophagus present. Caeca irregular, extend upto posterior end of ovary. Testes tandem, or obliquely tandem, postequatorial, between ventral pouch and ovary. Pars prostatica long, parmusculosa moderately developed. Ovary post testicular. Mehlis gland close to ovary, laural's canal not crossing excretory vesicle, opening anterior to excretory pore, uterus median, straight or with to few loose coils. Vitellaria lateral, encroaching into intercaecal region, extend from postcaecal bifurcation to posttesticular region. Genital pore below caecal bifurcation inside ventral pouch. Terminal genitalium protrusible circular in structure; in extended condition it comes out through ventral pouch opening. It appears as a distinct circular disc on body surface. In withdrawn condition this muscular disc provides a deep extending ventral atrium the inner walls of which are provided with papillae. Sphincter papillae weakly developed. Ventral pouch more or less triangular, opening just above caecal bifurcation, extending posteriorly upto equatorial level at pretesticular level.

Remarks : Eduardo and Javellana (1987) established the genus *Velasquezotrema* to accommodate *Fischoedrius brevisaccus* Eduardo, 1981 from Phillipines. They distinguished their genus from allied genera of the subfamily Gastrothylacinae, mainly on account of the limited extend of its ventral pouch, extending only upto middle of body length. The above species is the second species under the genus, collected from *Bos indicus* from Dharamnagar, Tripura.

Distribution : India : Tripura (Dharamnagar).

Subfamily : HELOSTOMATINAE Skrjabin, 1949

Genus : *Helostomatis* (Fukui, 1929)
Travassos, 1934

Helostomatis sakrei Bhalerao, 1937

1937. *Helostomatis sakrei* Bhalerao, *J. Helm.*, 15 : 97-124.

Material : Host-*Colisa fasciatus*; *Ailia coilia*
Location-Intestine.

Description : (Based on two specimens) : Body elliptical, 1.08-1.34 long, 0.49-0.67 wide. Tegument aspinose. Acetabulum large at its posterior end, 0.3-0.31 long, 0.32-0.34 wide. Oral sucker with long diverticles, 0.11-0.12 long, 0.10-0.13 wide. Prepharynx absent, Pharynx 0.12-0.14 long, 0.11-0.13 wide, oesophageal bulb present, intestinal caeca terminating upto the anterior end of acetabulum.

Testes oval, lobed, symmetrical, Left testes 0.18-0.21 long, 0.15-0.16 wide, right testes 0.17-0.18 long, 0.12-0.20 wide. Circus pouch covers the sigmoid seminal vesicle. Genital pore just behind oral sucker.

Ovary trilobed, post testicular, 0.09-0.12 long, 0.06-0.07 wide vitellaria extending in lateral fields from intestinal bifurcation on to caecal end. Uterine coils intercaecal, passing between two testes. Eggs large 0.061-0.073 x 0.045-0.049.

Distribution : India : Tripura (Sonamura), West Bengal, Uttar Pradesh, Madhya Pradesh, Maharashtra.

Other records : Rhodesia, Egypt, Philippines.

Subfamily : DIPLODISCINAE Cohn, 1904

Genus : *Diplodiscus* Diesing, 1836

Diplodiscus amphichrus Tubangui, 1933

1933. *Diplodiscus amphichrus* Tubangui *Philippine. J. Sci.* 52(2) 167-193.

Material : Host *Rana* sp. location-Rectum.

Diagnosis : Body conical, 2.56 long, 1.088 wide. Tegument aspinose. Ventral sucker ventroterminal, 0.56-0.85 in diameter. Oral sucker 0.38-0.31 with oesophageal bulb. Oesophagus long, intestinal caeca extend upto the posterior end of body.

Testis single, median, 0.25 long, 0.14 wide. Seminal vesicle bipertite, cirrus pouch small, enclosing seminal vesicle, genital pore near intestinal bifurcation. Ovary post testicular, 0.24 long, 0.16 wide. Seminal receptacle absent. Vitellaria follicular, extending along caeca, distributed in between oesophageal bulb to ventral sucker. Egg 0.09 x 0.02 x 0.04-0.06. Excretory vesicle saccular.

Distribution : India : Tripura (Seepahijala) Assam, Meghalaya, Nagaland, widely distributed in other States of India.

Other records : Burma, Sri Lanka, Japan, Korea, Philippines.

Family : FASCIOLIDAE Railliet, 1893

Key to subfamilies :

1. Intestinal caeca dendritic, acetabular small; cirrus sac anterodorsal to acetabulum
.....FASCIOLINAE
Intestinal caeca simple.....2
2. Acetabulum much larger than oral sucker; cirrus sac long; extending far behind acetabulum FASCIOLOPSINAE

Subfamily : FASCIOLINAE Railliet, 1893
Stiles and Hassal, 1898

Genus : *Fasciola* Linnaeus, 1758

Fasciola gigantica Cobbold, 1855

1855. *Fasciola gigantica* Cobbold N. Phil. J. n. S., 2(2) : 262-266.

Material : Cow, Buffalo. Location-Liver.

Diagnosis : Body length 2.5-7.5 cm. Cephalic cone short. Caeca branched internally. Oral sucker small. Acetabulum 1.5-2.50 in diameter, larger than acetabulum. Testes branched, tendem. Ovary also branched, pretesticular. Vitellaria lateral, contiguous in posttesticular level. Uterine coils between ovary and acetabulum. Eggs 0.125-0.019 x 0.06-0.12.

Distribution : India : Tripura, Mizoram, Nagaland, Assam, other states of India.

Other records : Burma, Africa, America.

Subfamily : FASCIOLOPSINAE Odhner, 1910

Genus : *Fasciolopsis* Looss, 1899

Fasciolopsis buski (Lankester, 1857)

Stiles, 1901

(Fig. 12)

1857. *Distoma buski* Lankester, Appendix B. Kuchenneister
Gettlob Fieldrichs Himrich, 1857 : 438-443.

1901. *Fasciolopsis buski* Stiles Veterinarian London, 74 : 190-200.

Material : Host-Pig, location- Liver.

Diagnosis : Body length 2.0-7.5 cm. cuticle spinose. Acetabulum larger than oral sucker, ratio 1 : 3.2-3.4. Oesophagus almost absent, caeca simple, without branching, extend upto posterior end in zig zag course. Testes branched, tandem, in post equatorial zone. Ovary pretesticular, branched; uterus between ovary and acetabulum, vitellaria lateral, from acetabular level to posterior end of body. Eggs 0.12-0.16 x .08-0.75.

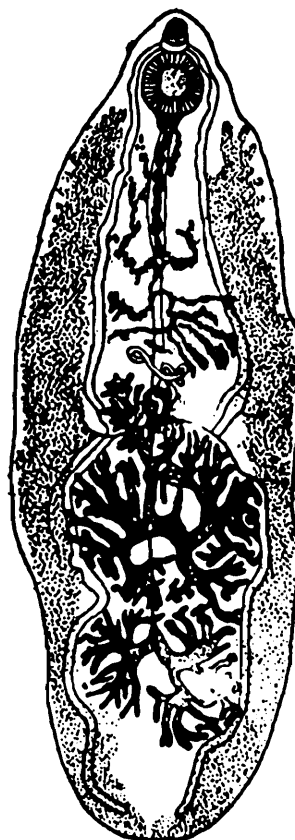


Fig. 12. *Fasciolopsis buski* (Lankester, 1857) Looss, 1899.

Distribution : India : Tripura, Assam, Meghalaya, West Bengal, Bihar, Orissa, Madras.

Other records : China, Thailand, Malay States, Burma, Japan.

Family : SCHISTOSOMATIDAE Poche, 1907

Genus : *Schistosoma* Weinland, 1859

Schistosoma indicum Montgomery, 1966

1966. *Schistosoma indicum* Montgomery, *J. Trop. Vet. Sci.*, 1(2) : 138-174.

Material : Host-Cattle, Buffalo, Location-arteries.

Diagnosis : Male body curved like the letter 'C' Body length 4.1-19.4 x 0.16-0.73. Anterior body 0.54-0.45. Posterior body leaf like with gynaecophoric conal 3.75-18.4 x 0.9-0.5. Cuticle tuberculate, spined. Oral sucker smaller than acetabulum. Acetabulum .04-0.06, pedunculate, oesophagus with oesophageal glands, caeca unite to form common caecum again bifurcate at preacetabular region and unite end blindly some distance before posterior end. Testes 5-16 in alternate, double row, postacetabular. Vesicula seminalis kidney shaped, 0.04-0.08. Ductus ejaculatorious near posterior extremity. Female body cylindrical 4.9-26.4 x 0.08-0.03. Ovary postequatorial, Vitellaria coextensive with common caecum, end near caecal termination. Ootype lined with glandular cells. Genital pore midventral, postacetabular. Eggs oval with terminal spines 0.07-0.1 x 0.027-0.043. Length of spine 0.005-0.013.

Distribution : India : Tripura, Assam, Meghalaya, Mizoram, West Bengal, Uttar Pradesh, Bihar, Andhra Pradesh.

Family : LECITHODENDRIIDAE
(Luhe, 1901) Odhner, 1910

Subfamily : PARABASCINAE Yamaguti, 1958

Genus : *Parabascus* Looss, 1907

Parabascus macrorchis (Gogate, 1939)
Skrjabin, 1970

1939. *Palitrema macrorchis* Gogate, *Rec. Indian Mus.*, 41(1) : 57-60.

1970. *Parabascus macrorchis* Skrjabin, *Trematodes of animals and man* 23 : 1-308.

Material : Host-*Hemidactylus flaviviridis*, Location-Intestine.

Description : Body oval to elliptical, 0.99-1.22 long, 0.53-0.77 wide. tegument spined anteriorly. Ventral sucker preequatorial, 0.06-0.08 long, 0.074-0.09 wide. Oral sucker subterminal, 0.062-0.08 long, 0.078-0.09 wide, almost equal in size, pharynx small, oesophagus long, intestinal caeca long, terminating near posterior end of body.

Testes two, symmetrical, left testis 0.19-0.21 in diameter, right testis 0.23-0.25 long, 0.18-0.2 wide. Cirrus sac well developed, muscular, prostate gland cells present. Genital pore anterolateral to left testis.

Ovary dorsolateral to ventral sucker, 0.13-0.18 long, 0.11-0.14 wide. Eggs 0.016-0.024 x 0.012-0.014.

Distribution : India : Tripura (Sonamura) West Bengal, Meghalaya, Uttar Pradesh.

Subfamily : GANEONIAE Yamaguti, 1958

Genus : *Ganeo* Klein, 1905

Ganeo tigrinum Mehra & Nagi, 1928

1928. *Ganeo tigrinum* Mehra & Nagi *Allahabad Univ. Stud.*, 4 : 63-118.

Material : *Rana cyanophlyctis*, Location-Intestine.

Diagnosis : Body length 3.03-5.2; cuticle spined, oesophagus 0.18-0.31. Caeca extend upto 3/4 of body length. Acetabulum 0.12-0.19 x 0.12-0.15, larger than oral sucker. Testes around in acetabular zone, diagonally tandem. Anterior testis 0.24-0.4 long, 0.24-0.44 wide, posterior testis 0.25-0.48 long, 0.25-0.44 wide. Vesicula seminalis curved, anterolateral to acetabulum 0.24-0.32 long, 0.73-0.88 wide. Spines on terminal part of

ejaculatory duct, genital atrium and metraterm. Ovary posterolateral, overlapping the acetabulum 0.17-0.32 long, 0.17-0.35 wide. Vitellaria follicular, lateral, from posterior end of acetabulum to some distance short of caecal ends. Uterus extensive, extend upto posterior end. Genital pore at oesophageal bifurcation. Eggs 0.026-0.029 x 0.012-0.012.

Distribution : India : Tripura, Meghalaya, Nagaland, West Bengal, Bihar, Uttar Pradesh, Andhra Pradesh, Kashmir, Madhyapradesh.

Other records : Bangladesh, China, Vietnam.

Genus : *Pleurogenoides* Travassos, 1921

Pleurogenoides gastroporus Luhe, 1901

1901. *Pleurogenoides gastroporus* Luhe *Ctbl. Bakt. I. Abt.* 30 : 166-177.

Material : Host - *Rana cyarophhyctis*

Diagnosis : Body small, oval, 0.83-1.36 long, 0.48-0.91 wide. Tegument spinose. Ventral sucker 0.14-0.2 long, 0.13-0.19 wide. Oral sucker subterminal, round, larger than ventral sucker, 0.16-0.2 in diameter. Pharynx 0.07-0.09 long, 0.08-0.09 wide, oesophagus short, followed by intestinal bifurcation. intestinal caeca extend upto the anterior end of testis 0.44-0.64 long.

Testes two, symmetrical, post caecal, left testis 0.09-0.25 long, 0.08-0.19 wide, right testis 0.12-0.25 long, 0.09-0.2 wide. Cirrus pouch, large, retort-shaped, seminal vesicle tubular, well developed pars prostatica, surrounded by large number of prostate gland cells. Genital pore lateral on left body margin, near to oral sucker.

Ovary entire, pretesticular on right side of the body, 0.08-0.18 long, 0.78-0.16 wide. Seminal receptacle placed left side of the ovary. Uterus present in most of the hind body, metraterm well developed united at the anterior left side of the body and forms a genital atrium. Vitellaria follicular, grape like bunches in the neck region. Eggs 0.012-0.02 x 0.008-0.016. Excretory vesicle 'V' shaped, arms reaching anterior end of body.

Distribution : India : Tripura, (Paratia, Seepahijala), Meghalaya, West Bengal, Uttar Pradesh, Andhra Pradesh, Maharashtra.

Other records : Brazil, Bangladesh.

Family : GORGODERIDAE Looss, 1899

Subfamily : PHYLLODISTOMINAE Nybelin, 1926

Genus : *Phyllodistomum* Braun, 1899

Phyllodistomum almorai Pande, 1937

1937. *Phyllodistomum almorai* Pande *Ann. Mag. Nat. History S*, 10, 20 : 250-256.

Material : Host-*Rana cyanophlyctis*

Description : (Based on two specimens) body 2.91-3 long, 1.50-1.68 wide, anterior body tapering and posterior body foliate. Tegument with small tubercle, ventral sucker preequatorial, 0.65-0.67 long, 0.67-0.68 wide, larger than oral sucker. Oral sucker terminal, 0.49-0.51 long, 0.48-0.49 wide, pharynx absent, oesophagus short, intestinal caeca extend upto the posterior end of body. Testes two, symmetrical, lobed right testis 0.36-0.48 long, 0.28-0.4 wide. left testis 0.48-0.52 long, 0.24-0.32 wide. Seminal vesicle saccular; behind intestinal bifurcation, cirrus pouch absent. Genital pore anterior to ventral sucker. Ovary pretesticular, 0.36-0.38 long, 0.27-0.32 wide. Seminal receptacle absent. Vitellaria two compact lobes, situated behind ventral sucker. Uterus occupying most of the hind body. Eggs 0.016-0.028 x 0.012-0.016. Excretory vesicle tubular.

Distribution : India : Tripura (Seepahijala), Uttar Pradesh, Meghalaya, West Bengal.

Other records : Sri Lanka.

Remarks : Odening (1958) considered it as subspecies of *Haematoloechus variegates* (Rud, 1819) Looss, 1899. We consider it as distinct species.

Family : HAEMATLOECHIDAE
Odening, 1904

Genus : *Haematoloechus* Looss

***Haematoloechus almorai* (Pande, 1937)
Odening, 1958**

1937. *Pneumonoeces almorai* Pande *Proc. Indian Acad. Sci.* 6(2) : 109-120.
1958. *Haematoloechus almorai* Odening *Mitt. Zool. Mus. Berlin*, 34(1) : 63-108.

Material : Host-*Rana cyanophlyctis*, Location-Lungs

Description : Body elongate, anterior portion pointed and posterior part rounded, 13.55 long, 1.84 wide. Tegument aspinose. Acetabulum preequatorial, 0.18 long, 0.19 wide. Oral sucker subterminal, 0.38 long, 0.38 wide, larger than acetabulum. Pharynx 0.18 long 0.2, oesophagus short, intestinal caeca extend upto the posterior end of body. Testes two, oblique, posterior to ovary, anterior testis 1.5-68 long, 0.56 wide and posterior testis 1.45 long 0.7 wide. Cirrus sac long, seminal vesicle coiled in anterior part and straight at posterior part. Pars prostatica short, with Prostate gland cells, ejaculatory duct opens into the cirrus sac. Genital pore ventral to pharynx.

Ovary 0.7 long 0.48 wide. Seminal receptacle large. Vitellaria bunchlike, extending along caeca. Uterus occupying most of the body. Eggs 0.024-0.03 × 0.016-0.018. Excretory vesicle 'Y' shaped.

Distribution : India : Tripura (Seepahijala), Uttar Pradesh, Meghala, West Bengal.

Other records : Ceylon.

Family : ALLOCREADIIDAE Looss, 1902

Subfamily : ORIENTOCREADIINAE
Yamaguti, 1958

Genus : *Orientocreadium* Tubangui, 1931

***Orientocreadium batrachoides* Tubangui, 1931**

1931. *Orientocreadium batrachoides* Tubangui *Philippine J. Sc.* 44(3) : 273-283.

Material : Host-*Clarius batrachus*, Location-Intestine.

Description : Body small, 1.82-2.91 long, 0.49-0.52 wide. Tegument spinose, ventral sucker 0.17-

0.17 long, 0.16-0.18 wide, preequatorial. Oral sucker subterminal, 0.14-0.20 long, 0.17-0.2 wide, than ventral sucker, prepharynx long pharynx 0.04-0.1 long, 0.06-0.15 wide, oesophagus short, intestinal caeca extend upto the posterior end of body. Testes two, some what diagonal, anterior testis 0.23-0.26 long, 0.2-0.22 wide, Posterior testis 0.22-0.33 long, 0.2-0.3 wide. External seminal vesicle present, internal seminal vesicle enclosed by large cirrus sac, pars prostatica surrounded by prostate gland cells, cirrus is protrusible. Ejaculatory duct long, opens into genital atrium. Genital pore, preacetabular, median.

Ovary median, situated between acetabulum and anterior testis, 0.14-0.16 long, 0.13-0.14 wide. Seminal receptacle present behind ovary. Uterine coils covers most of the hind body. Vitellaria follicular, beginning at the level of acetabulum to posterior end of body, follicles are confined mainly to the outside of the caeca. Eggs. 0.024-0.028 × 0.012-0.016. Excretory vesicle 'Y' shaped.

Distribution : India : Tripura (Sonamura), West Bengal, Uttar Pradesh, Madhya Pradesh.

Family : PSILOSTOMIDAE Looss, 1900

Subfamily : PSILOSTOMINAE Looss, 1845

Genus : *Psilorchis* Thapar et al, 1935

***Psilorchis indicus* Thapar et Lal, 1935
(Fig. 13)**

1935. *Psilorchis indicus* Thapar et Lal *Proc. Indian Acad. Sci* 2(1) : 88-94.

Material : Host-Jungle owl, owl, kingfisher, Location-Intestine.

Diagnosis : (Based on six specimens) : Body elongate, tapering in both the ends of body, 6.65-8.92 long, 1.08-1.45 wide. Tegument aspinose. Ventral sucker 0.64-0.67 long, 0.72-0.78 wide, situated anterior end of body. Oral sucker smaller than ventral sucker, terminal, 0.12-0.13 long, 0.16-0.27 wide; prepharynx present; pharynx muscular 0.10-0.12 in diameter; oesophagus short; intestinal caeca in the posterior end of body.

Testes tandem, elongate anterior testis 0.75-0.88 long 0.46-0.48 wide; Posterior testis 0.91-0.96 long, 0.43-0.48 wide. Cirrus pouch retortshaped, genital pore between intestinal bifurcation and ventral sucker. Ovary 0.36-0.38 long, 0.36-0.41 wide; seminal receptacle absent. Uterus long, situated mainly in between acetabulum and testis. Vitellaria follicular, extending in between acetabulum to caecal end in extra caecal field. Eggs large, 0.012-0.015 x 0.050-0.082. Excretory vesicle 'V' shaped.

Distribution : India : Tripura (Paratia, Sepahijhala) West Bengal, Uttar Pradesh, Orissa.

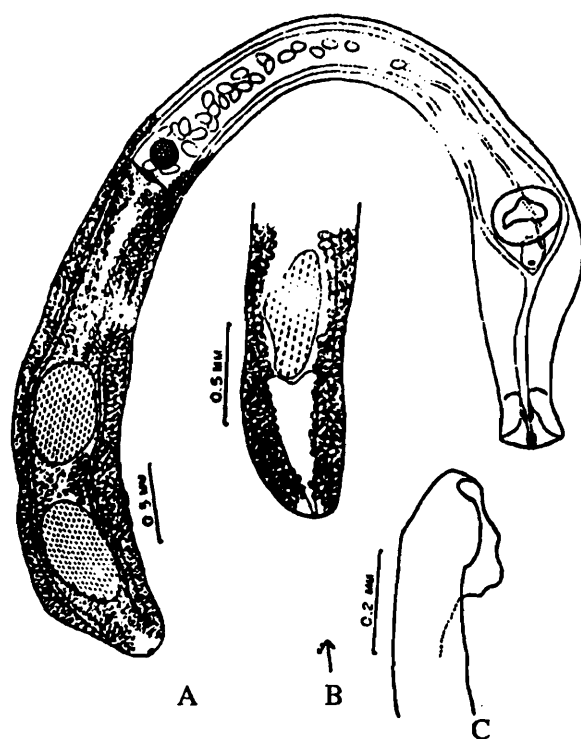


Fig. 13. A—*Psilocollaris indicus* K, S. Singh, 1954. B—Showing posterior end. C—Lateral view of its collar.

Family : DIPLOSTOMIDAE Poirier, 1886

Subfamily : DIPLOSTOMINAE Monticelli, 1892

Genus : *Neodiplostomum* Railliet, 1919

Neodiplostomum cuckooi (Verma, 1936)
Bhalerao, 1942

1936. *Procrassiphiala cuckooi* Verma Allahabad Univ. Stud. 12 : 147-188.

1942. *N. cuckooi* Bhalerao Rec. Indian Mus., 44(2) : 207-216.

Material : Host-Indian roller, Location-intestine.

Diagnosis : (Based on 7 specimens) : Body distinctly two segmented, 1.44-1.50 long, 0.42-0.50 wide. Tegument spinose. Ventral sucker small, 0.08-0.1 long, 0.09-0.1 wide. Oral sucker subterminal, smaller than ventral sucker. 0.06-0.08 long, 0.06-0.07 wide, prepharynx present, pharynx well developed, Oesophagus short, caeca terminating near posterior end of body. Testes tandem, anterior testis 0.12-0.17 long, 0.28-0.32 wide; posterior testis 0.16-0.21 long, 0.33-0.34 wide. Cirrus pouch absent, genital atrium enclosing hermaphroditic duct, formed by the union of ejaculatory duct and uterus. Genital pore terminal. Ovary pretesticular 0.11-0.13 long, 0.17-0.18 wide. Vitellaria follicular, variable in position, distributed in both fore and hind body. Eggs 0.011-0.012 x 0.098-0.01. Excretory system ventroterminal.

Distribution : India : Tripura (Paratia) Uttar Pradesh.

Family : ECHINOSTOMATIDAE Poche, 1926

Key to subfamilies

1. Head collar and oral sucker well developed, vitellaria postacetabular, lateral ECHINOSTOMATINAE
- Head collar and oral sucker not prominent .. 2
2. Vitellaria extending from pharynx to posterior testis. Contiguous in prebifurcal zone PEGOSOMINAE

Subfamily : ECHINOSTOMATINAE Looss, 1899

Genus : *Echinostoma* Rudolphi, 1809

Echinostoma revolutum (Froelich, 1802)
Looss, 1899

(Fig. 14)

1802. *Fasciola revolutum* Froelich Beicrage Natarg. Einoge 29 : 56-60.

1899. *Echinostoma revolutum* Looss, Zool. Jahrb. Syst., 12 : 521-784.

Material : Host-Fowl, Location-Intestine.

Description : (Based on single specimen) : Body elongate 5.92 long; 1.63 wide. Tegument spinose. Ventral sucker anteriorly situated, round 0.92 in diameter. Oral sucker 0.24 long, 0.28 wide. Head collar present with 35-37 spines in double row. Prepharynx present; pharynx muscular; oesophagus long; intestinal caeca extending upto the posterior end of body.

Testes tandem, anterior testis 0.41 long 0.48 wide; posterior testis 0.56 long 0.4 wide. Cirrus pouch anterior to acetabulum, genital pore near intestinal bifurcation.

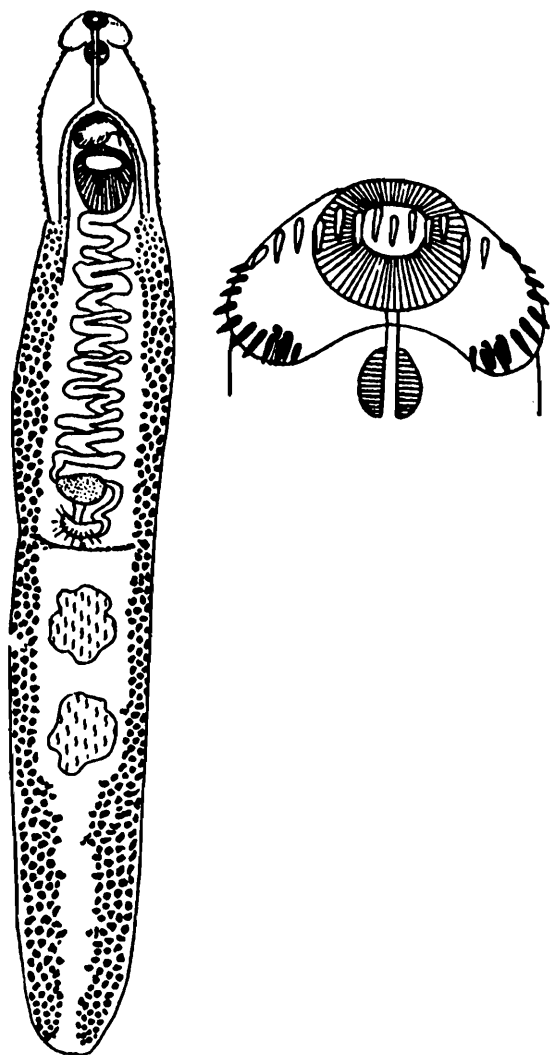


Fig. 14. *Echinostoma revolutum* (Froelich) and its Head Collar.

Ovary pretesticular, 0.24 long, 0.32 wide. Uterus long, distributed in between acetabulum and ovary. Vitellaria follicular, mostly in hind body. Eggs $0.077-0.011 \times 0.053-0.061$.

Excretory arms extending upto anterior end of the body.

Distribution : India : Tripura (Sonamura), West Bengal, Meghalaya, Uttar Pradesh, Tamil Nadu, Orissa.

Other records : Cosmopolitan,

Subfamily : PEGOSOMINAE Mendheim, 1940

Genus : *Pegosomum* Ratz, 1903

Pegosomum egretti Srivastava, 1957

(Fig. 15)

1957. *Pegosomum egretti* Srivastava, Proc. natn. Acad. Sc. India 37(3) B 129-134.

Material : Host-Cattle egret, Location-Intestine.

Diagnosis : (Based on 11 specimens) : Body large, lanceolate, 5.52-7.42 long, 2.04-2.18 wide. Tegument spinose. Head collar present, with a single row of spines. Ventral sucker small, 0.49-0.64 long, 0.65-0.72 wide. Oral sucker very much reduced, pharynx well developed oesophagus long. Intestinal caeca narrow, undulating, terminating near posterior extremity. Testes tandem, anterior testis 0.72-1.2 long, 1.44-2.16 wide, posterior testis 0.86-1.53 long, 1.10-1.6 wide. Cirrus pouch preacetabular, Genital pore anterior to acetabulum. Ovary round, pretesticular, postacetabular, 0.32-0.8 long; 0.4-0.88 wide. Vitellaria, dendritic, confluent, extending from pharynx to posterior end of body. Eggs $0.102-0.123 \times 0.056-0.082$. Excretory vesicle 'Y' shaped.

Distribution : India : Tripura (Paratia), Uttar Pradesh.

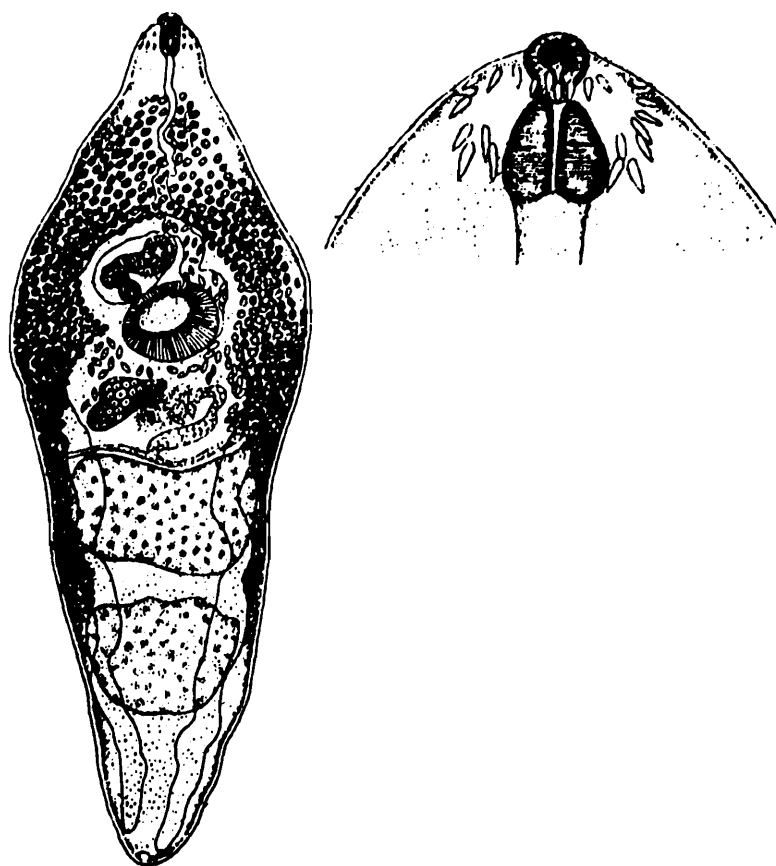


Fig. 15. *Pegosomum egrelli* Srivastava, 1957 and its anterior region.

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SUMMARY

The present volume deals with all the digenetic trematode parasites reported from the state of Tripura. Studies are mainly based on the collections brought by recent survey tours undertaken in Tripura. Records by previous

workers from the state have also been included as far as possible. Diagnostic characters and keys to families, subfamilies, genera and species have been provided. Detail taxonomic status of the species and synonymies have been omitted, as this is beyond the scope of the present work. Diagrams of most of the species have been included for easy identification of species. History of taxonomic studies made from not only Tripura, but all other neighbouring states of North Eastern region, have been very briefly discussed. Selected references on the studies of trematode parasites from Tripura and adjoining regions have been appended.

In all 36 species under 29 genera and 12 families have been included in the present work.

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PLANT PARASITIC NEMATODES (TYLENCHIDA)

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INTRODUCTION

As tylenchids are the parasites of plants, naturally a particular place, having a particular type of forests and agricultural crops, will have definite bearing upon the type of nematodes, will be available there. The topographic nature of most of the parts of Tripura is peculiar in the sense, that most of areas are covered with very low hillocks, locally called 'Tila'. But these tilas don't have rocks, but are mainly constituted with lateritic soil. Most of the tilas as well as the plains are very much fertile and with significant forest cover. When our national forest cover is 19.47% of our total land (Annual report 94-95, Ministry of Env. & Forest), Tripura has fantastically 70% of its land under forest cover, far above the national average. The forests compose, many different kinds of plants and trees, including Teak and Sal (*Soria* sp.). Among the agricultural cultivations rice stands first; beside, other fruits, like pine-apple, Guava, Mango, Jackfruit Orange, Banana etc. are also cultivated. Rubber and tea plantations are also tried now a days.

When the world fauna of tylenchida i. e. the true plant parasitic nematodes consists about 2300 number of species, India has record of about 700 species. The present paper has recorded only 27 species. So far there had not been any survey or other type of work on nematodes of Tripura, and present author could not get any reference in that regard. Quite possibly, far more number of species and genera would be explored, if more effort and time are put for that.

The present record has been prepared depending on the collection made from two survey

tours, conducted in Tripura. Ist led by Dr. A. Chatterjee in the month of April '91 and the other led by Mr. A. K. Mandal in which Mr. S. R. Dey Sarkar had participated.

Recently Dr. B. Mukherjee, a teacher in M. B. College, Agartala has started work on nematodes with his small school of research.

MATERIAL AND METHODS

During survey tours, collections were procured and processed through a series of procedures, a short account of which are given below :

Sampling : Samples of soils about 500 cc (in volume) each time, were collected from rhizosphere of different plants and crop, usually upto a depth of about 20 cm. from surface. The samples were taken in polythene bags, tied and labelled with name of collector, date of collection, name of the locality and record of host plants.

Processing : In the process of extraction and isolation of nematodes from soils, only one sample was taken at a time. The soil was thoroughly mixed and was taken in a plastic bucket. Then the soil was mixed with water (about 7 litres) to prepare an uniform suspension. The soil-water suspension was thoroughly shaken and was put to rest (undisturbed) for about 20 seconds to allow the bigger stones, sands, other heavier material to settle down as sediment. The upper suspension was quickly passed through a coarse sieve to remove the floating debris etc. The filtrate then again was passed through a set of sieves of 100, 200, 300 mesh-size. The residue, from each of the three sieves were taken into a beaker in fresh water.

The aliquot collected in the above manner was subjected to modified Baermann's funnel flotation method (modified by Whitehead and Hemming, 1965).

That is, aliquot of each sample was put on tissue paper on an aluminium net suspended in fresh and clear water in a petridish.

Each sample was allowed to be suspended for 48 hours. Then the debris and sediments on the tissue paper were rejected and the clear water together with nematodes were taken in watch glass and were examined under a low power binocular microscope, and all the nematodes were picked up one by one with the help of a very fine needle, and were transferred to a second watch glass.

Killing fixation and dehydration : The nematodes thus collected, were killed by pouring hot water on them. Excess of water was again drawn out with the help of a fine dropper and the nematodes were fixed in FAA solution. (Formalin (40%) 30 ml, glacial acetic acid 5 ml. absolute alcohol 100 ml, and distilled water 200 ml). The fixed nematodes (at least after 24 hours) were processed by slow glycerine method of dehydration (Thorne, 1961). The nematodes were transferred to 1% glycerine (ethanol 20 parts glycerine 1 part distilled water 79 parts). For quicker dehydration the watch glass with 1% glycerine were placed in a BOD incubator, where temperature were kept at 40°C. After about 7 days these were passed through 5% glycerine (ethanol 95 parts glycerine 5 parts). The nematodes were kept in the glycerine solution till the other component evaporated, and only the glycerine was left. The nematodes were finally taken into pure and dehydrated glycerine.

Mounting, Sealing : Nematodes four to eight were mounted in a drop of pure and dehydrated glycerine on glass slides. Glass-wool supports of the same size as that of nematodes were always used under the cover slips to prevent any pressure on the specimens. The cover slips were sealed with glycil adhesive.

Measurements and Drawings : The measurements were taken under stereoscopic microscope with the help of stage and oculo-micrometer. De Man's formula were used for denoting the dimensions of nematodes. The indices viz. L, a, b, b' etc. were adopted from standard works, on different group of nematodes. Drawings were done with the help of camera lucida.

MORPHOLOGY & TERMINOLOGY

Tylenchida are bilaterally symmetrical, elongate cylindroid, unsegmented pseudo-coelomate animals covered with a cuticular exoskeleton secreted by the hypodermis (= epidermis). They have longitudinal muscles for locomotion, a terminal oral opening surrounded by bilaterally or radially arranged sensilla, protrusible stomatal stylet, a substylet orifice of the dorsal oesophageal gland, a circum-oesophageal or circum intestinal nerve ring, an excretory system with a single duct and renette cell, a pore-like anus directed outward, a true tail (post anal body portion) and they lack a circulatory system and motile cilia. They are phasmidian but also may not have phasmids.

Body wall and cuticle : The body wall consists of external cuticle, hypodermis and somatic muscle layer. The cuticle is the exoskeleton of nematodes. It is noncellular proteinaceous secretion of the hypodermis.

Striae and body annules : In most of the nematodes, the body is transversely striated. The striations may be prominent or faint. The portion between two consecutive striae called body annule. The size shape and number of body annules has great significance in nematode taxonomy.

Lateral fields : Laterally the body cuticle is marked by longitudinal incisures (Lines, involutions) and may or may not be raised into longitudinal ridges or bands, often interrupting the transverse body striations or annules. The lines originate as a narrow area and gradually enlarges in mid body and at the tail end the number and size of the incisures may reduce.

Excretory system : In tylenchids, there is a single excretory cell or renette situated laterally or lateroventrally, usually in the post-oesophageal region, from which an excretory duct leads to the medioventral excretory pore.

Nerve ring and other sense organs : The nerve ring encircles the isthmus of the oesophagus. Different nerve connections are named to use in taxonomic description. The 'hemizonid' is the major latero-ventral commissure near the excretory pore. The 'cephalids' are the anterior ones just behind the cephalic region. The 'hemizonion' occurring a little behind the hemizonid and 'caudalids' in the tail region.

Amphids : There are a pair of lateral chemoreceptors located in the cephalic region, usually close to the oral aperture. The amphid apertures may be slit-like, transversely, longitudinally or obliquely placed on the head.

Derides : In Tylenchidae and Merliniinae, derides are located in the centre of the lateral fields in the form of protuberances (cervical papillae) without any opening outside. In Tylenchoidea and Hexatylinea derides are common, at or near the level of excretory pore.

Phasmids : Phasmids are chemoreceptors on the tail of the tylenchina but may also be located in the preanal region or erratically placed in the body.

Cephalic region : Cephalization or possession of head is suggested by presence of cuticular cephalic frame work and the juxtaposition of the oral opening, sensilla and amphid apertures. The cephalic region (= lipregion) may or may not be marked off from the body by a depression, constriction or expansion. The base of cephalic region is the transverse line passing through the basal plate. Most of the Tylenchina and Hexatylinea have a small six lobed cephalic region but may also be four lobed or bilobed or unlobed. There may be two subdorsal and two subventral, or with two dorsal, two ventral, two latero-dorsal and two latero ventral lobes.

There is a basal plate from which a tubular or inverted funnel-shaped vestibulum extension (=

stylet guiding apparatus) extends into body cavity. The frame work may be low or high arched.

Stoma : The stoma or stomatal cavity is lined with an external cuticle extending upto base of stylet conus. The anterior most region is called prestoma.

Pseudolips or Lip areas : There are no lips in Tylenchida except for two lateral liplet-like structures in some forms. The areas surrounding the oral opening, bearing the sensilla are true lips, usually modified into a oral or labial disc. 'pseudolips' term are used in criconematidae.

Stylet : The stylet or spear of Tylenchida is stomatostylet (that of dorylaimida is an odontostylet). The stylet is composed of two parts; anterior is 'conus' and posterior is 'shaft'. The latter bears three (one dorsal, two subventral) basal knobs; rarely the knobs may be absent. The stylet length varies from 5 μm to 180 μm . The protractor muscles arise from non-contractile oesophageal tissue and lined by the same basal lamina, that covers the oesophagus, are called stylet museles.

Oesophagus (Pharynx) : In most Tylenchida the corpus is divided into precorpus and postcorpus (The equivalent term precorpus and metacarpus). The oesophageal glands form a diverticulum overlapping the anterior intestine. The subventral and dorsal oesophageal glands open into oesophageal lumen, anterior to the oesophago-intestinal and at the base of the stylet. The precorpus has six cells, enclosed by a basement membrane, running longitudinally from median bulb to the base of the stylet. The lumen of precorpus is circular. The postcorpus or median oesophageal bulb is muscular in most cases. The lumen of isthmus is triradiate.

The Tylenchida have three uninucleate oesophageal glands (Salivary), one dorsal and two subventrals. The glands may be enclosed in a basal (terminal) bulb or lie free in body cavity. The oesophago-intestinal valve or caudia is also lined internally with the cuticle.

Intestine : The intestine may be cellular or syncytial and oligocytous. The intestine in Criconematina and most adult Tylenchina is syncytial, means show no lumen. The intestine is divided into two parts, anteriorly short anterior part and next very long mid intestine extends upto rectum.

Tail : The nematodes have true tails *i. e.*, postanal elongation of body. The tail may be elongate filiform or prehensile (in Halenchidae). Its shape may differ between juveniles and adults or between two sexes. In many genera, in adults the tail is short or absent but well developed in juveniles. The male tail in several genera may be enveloped with a bursa (a flap like structure).

Female reproductive system : The females in the suborder Tylenchina is didelphic (double uterus) occasionally the posterior branch is reduced in size or represented by a postvulval uterine sac. The females in the suborders Hexatylinea and Criconematina are monodelphic. In didelphic forms, the two branches of the system are outstretched in opposite directions, from the valva, being amphidelphic, and the monodelphic forms are usually prodelphic.

Vulva : The female gonopore or vulva is a transverse slit like aperture which may be transversely oval or rarely round. In didelphic forms it is usually median or submedian, but in monodelphic forms the vulva usually located near the anus. The presence of lateral vulval membrane and epiptygma are important diagnostic characters.

Vagina : May be a flattened tube provided with dialators and constrictor muscles. The female genital tract comprises of uterus, spermatheca, oviduct and ovary. In bisexual species of Tylenchinae the spermatheca is usually round and axial, may or may not contain spermatozoa.

Male reproductive system : Tylenchids with few exceptions are monorchic (with single testis). The testis are outstretched or may be reflexed at terminal part. Spermatocytes are arranged in one, two or multiple rows. The male accessory genital structures include a pair of cuticularized spicules,

(chitinous structure) a gubernaculum with or without telamon or titillae, a non-papillary (non ribbed) bursa and genital papillae. The male tail is devoid of caudal papillae. The genera, where bursa are present, may have amphids shifted to bursa zone.

A list of abbreviations used universally to express the dimensions and measurements of nematode-body and organs are given below :

- L = total body length in mm. from end to end.
- $a = \frac{\text{body length}}{\text{maximum body width}}$
- $b = \frac{\text{body length}}{\text{oesophageal length}}$
- $b' = \frac{\text{body length}}{\text{distance from head end to posterior end of oesophageal glands.}}$
- $c = \frac{\text{body length}}{\text{tail length}}$
- $c' = \frac{\text{body length}}{\text{body width at anus}}$
- $V = \frac{\text{distance from head end to vulva}}{\text{body length}} \times 100$
- $V' = \frac{\text{distance from cloacal aperture to anterior of testis}}{\text{distance from head end to anus}} \times 100$
- $T = \frac{\text{distance from cloacal aperture to anterior of testis}}{\text{body length}} \times 100$
- m = length of conus as percentage of total stylet length
- o = distance between stylet base and orifice of dorsal oesophageal gland as percentage of stylet length
- MB = distance between anterior end of body and centre of median oesophageal bulb as percentage of oesophageal length
- R = total number of body annules
- Roes = number of annules in oesophageal region

- Rex = number of annules between anterior end of body and excretory pore
- RV = number of annules between posterior end of body and vulva
- RVan = number of annules between vulva and anus
- Ran = number of annules on tail
- VL/VB = distance between vulva and posterior end of body divided by body width at vulva

SYSTEMATIC POSITION OF THE ORDER TYLENCHIDA

Phylum	NEMATODA Rudolphi (Lankester, 1977)
Class	SECERNENTEA Von Linstow, 1905
Syn.	PHASMIDA Chitwood & Chitwood, 1973
Sub-class	TYLENCHIA Inglis, 1983
Order	TYLENCHIDA Thorne, 1949

Key to suborders of order *Tylenchida*

1. Parasite of coelome or coelomic tissues of Annelida amphibia; terminal excretory duct and pore suckerlike*Myenchina*
- Free living or parasites of plants and arthropods, terminal excretory duct and pore not suckerlike 2
2. Mycetophagus or nonroot phytoparasitic, arthropod parasitic cycle present; oesophagus intestinal junction at or anterior to nerve ring; if posterior to it, then either oesophageal base with a prominent stem like extension or two anterior most cells of intestine modified to act as valve, phasmids absent*Hexatyline*
- Fungus feeding absent, arthropod-parasitic cycle absent, single generation cycle, non mycetophagus or root parasitic forms; oesophago intestinal junction well behind

- nerve ring, phasmid may be present or absent 3
3. Female oral aperture generally ‘T’ shaped usually overhung by lateral liplets; postcorpus massive and amalgamated with precorpus. Spermatheca ventral or ventro-lateral to uterine axis, phasmids absent.....*Criconematina*
- Female oral aperture round or oval, postcorpus not massive and not amalgamated. Spermatheca not ventral or ventro-lateral to uterine axis. Phasmids or phasmid like structures present,.....*Tylenchina*

Suborder	TYLENCHINA Chitwood & Chitwood, 1950

Key to superfamilies of *Tylenchina*

1. Phasmids not detectable on tail, phasmid-like structures present much anterior to tail region, dorsal to lateral fields, in female near vulva, tails generally filiform*Tylenchoidea*
- Phasmids present in or near tail region (except for migratory scutella of Hoplolaiminae) in lateral fields not near vulva, tails generally not filiform, if filiform then with distinct phasmids.....2
2. Subventral oesophageal glands enlarged, usually extending past the dorsal gland; sexual dimorphism in anterior region manifest*Hoplolaimoidea*
- Subventral oesophageal glands not enlarged, not extending past the dorsal gland. Sexual dimorphism in anterior region not manifest.*Dolichodoroidea*

SYSTEMATIC LIST OF THE SPECIES DESCRIBED

Sub Order	TYLENCHINA Chitwood and Chitwood 1950
Super family	TYLENCHOIDEA Chitwood and Chitwood 1950

Family	TYLENCHIDAE	<i>R. orientalis</i> Siddiqi and Hussain 1964
Sub-family	TYLENCHINAE	
Genus	<i>Chitinotylenchus</i> Filipjev 1936	Sub-family ROTYLENCHOIDINAE Whitehead 1958
	<i>C. Paragracilis</i> Filipjev 1936	Genus <i>Helicotylenchus</i> Steiner 1945
Super family	DOLICHODOROIDEA Chitwood and Chitwood 1950	<i>H. Crenacauda</i> Sher 1966
		<i>H. dihystra</i> Sher 1961
Family	DOLICHODORIDAE Chitwood and Chitwood 1950	Family ROTYLENCHULIDAE Husain & Khan 1967
Sub-family	TYLENCHORHYNCHINAE Eliova 1964	Sub-family ROTYLENCHULINAE Husain & Khan 1967
Genus	<i>Tylenchorhynchus</i> Cobb 1913	Genus <i>Rotylenchulus</i> Linford & Oliveira 1940
	<i>T. Mashoodi</i> Siddiqi and Basir	<i>R. reniformis</i> Linford and Oliveira 1940
	<i>T. annulatus</i> Golden 1971	Family PRATYLENCHIDAE Thorne 1949
Super family	HOPLOLAIMOIDEA Filipjev 1934	Sub-family HIRCHMANNIELLINAE Fotedar and Handoo 1978
Family	HOPLOLAIMIDAE Filipjev 1934	Genus <i>Hirschmanniella</i> Luc & Goodey 1963
Sub-family	HOPLOLAIMINAE Filipjev 1934	<i>H. mucronata</i> Luc & Goodey 1963
Genus	<i>Hoplolaimus</i> Daday 1905	<i>H. oryzae</i> Luc & Goodey 1964.
	<i>H. indicus</i> Sher 1963	
	<i>H. Columbus</i> Sher 1963	Sub-family PRATYLENCHINAE Thorne 1964
Genus	<i>Scutellonema</i> Andrassy 1958	Genus <i>Pratylenchus</i> Filipjev 1936
	<i>S. Sheri</i> Edward & Rai 1970	<i>P. penetrans</i> Chitwood & Oteifa 1950
	<i>S. Siamense</i> Timm 1965	<i>P. Coffeae</i> Filipjev 1941
Sub-family	ROTYLENCHINAE Golden	Sub-family RADOPHOLINAE
Genus	<i>Rotylenchus</i> Filipjev 1936	Genus <i>Radopholus</i> Thorne 1949
	<i>R. helicus</i> Hussain & Khan 1967	<i>R. Similis</i> Thorne 1949
		Family MELOIDOGYNIDAE Skarbilovich 1959

Sub-family	MELOIDOGYNINAE Skarbilovich 1959	Genus	<i>Criconema</i> Hof manner and Menzel 1914
Genus	<i>Meloidogyne</i> Goeldi 1982		<i>C. degrissei</i>
	<i>M. incognita</i> Chitwood 1949	Sub-order	HEXATYLINA Siddiqi 1980
	<i>M. javanica</i> Chitwood 1949	Super family	ANGUINOIDEA Nicoll 1935
Sub-family	HETERODERINAE Filipjev 1934	Family	ANGUINIDAE Nicoll 1935
Genus	<i>Heterodera</i> Schmidt 1871	Sub-family	ANGUININAE Nicoll 1935
	<i>H. rostochiensis</i> Wollenweber 1923	Genus	<i>Ditylenchus</i> Filipjev 1936
	<i>H. avenae</i> Wollenweber 1924		<i>D. angustus</i> Filipjev 1934
Sub-order	CRICONEMATINA Siddiqi 1980	Super family	TYLENCHOIDEA Chitwood & Chitwood 1950
Super family	TYLENCHULOIDEA Skarbilovich 1947	Family	TYLENCHIDAE Orley 1880
Family	TYLENCHULIDAE Skarbilovich 1947	Sub-family	TYLENCHINAE Oxley 1880
Sub-family	TYLENCHULINAE Skarbilovich 1947	Genus	<i>Chitinotylenchus</i> Filipjev 1936
Genus	<i>Tylenchulus</i> Cobb 1913		
	<i>T. semipenetrans</i> Cobb 1913		<i>Chitinotylenchus paragracilis</i> (Micoletzky 1922) Filipjev 1936
Super family	CRICONEMATOIDEA Taylor 1936		1922. <i>Tylenchus (chitinotylenchus) paragracilis</i> Micoletzky
Family	CRICONEMATIDAE TAYLOR 1936		<i>Material examined</i> : ♂ ♂ 3 from soil round Vindi, Teliamura 12.4.91. ♂ ♂ 2 Pancharatna around brinjal 14.4.91 Coll. A. Chatterjee
Sub-family	MACROPHOSTHONII- NAE Skarbilovich 1959		<i>Diagnosis</i> : Male : Body curved ventrally; cuticle finely striated, lateral field 1/3 of body width, marked with 4 incisures. Head not set off, 3 µm high and 5 µm wide; Cephalic frame work very weak. Tail cylindrical, tip rounded, about 4 anal body diameter long. Stylet slender, knobs minute and separate from each other. Procorpus cylindrical 29 µm. long; median bulb oval 10 × 6.5 µm. Valve inconspicuous, posterior bulb pyriform; one nucleus seen. Testis single spicula tylenchoid Bursa-adanal 18 µm. long.
Genus	<i>Criconemella</i> De Grisse & Loof 1965		
	<i>C. rustica</i>		
	<i>C. onoensis</i>		
Genus	<i>Hemicriconemoides</i> Chitwood and Birch Field 1957		
	<i>H. mangiferae</i>		Female not known.

Measurements : L = 0.41- 0.47 mm, a = 35-39; b = 5.7-5.8; c = 12-14; T = 56-59; stylet 12-12.5 μ m. spicula = 13-15 μ m; gubernacula 7-8 μ m.

Distribution : North District, Tripura.

Super family DOLICHODORIDEA Chitwood & Chitwood 1950

Family DOLICHODORIDAE Chitwood & Chitwood 1950

Sub family TYLENCHORHYNCHINAE Elioiva 1964

Genus *Tylenchorhynchus* Cobb 1913

Key to the species of *Tylenchorhynchus*

- Lip region with 2 annules spermatheca without sperm *T. annulatus*
- Lip region with 3-4 annules Spermatheca with sperm *T. mashoodi*

Tylenchorhynchus annulatus (Cassidy-1930) Golden-1971

1930. *Tylophanynx annulatus* Cassidy

1956. *Tylenchorhynchus martini* Fielding

1971. *T. annulatus* Golden

Material examined : ♀♀ 6 around mango tree, Unakoti, North Dist. Tripura 27.4.91, Coll. A. Chatterjee.

Diagnosis : Female : Body slightly curved on ventral side on fixation, cuticle transversely striated, lateral fields with four incisures, outer incisures crenates, round lip region with two body annules. Stylet of 16-18 μ m length, basal knobs rounded with slight convex anterior surface. Excretory pore opposite to base of isthmus. Reproductive system amphidelphic with non-functional spermatheca. Tail cylindrical, elongate, 3-3.5 anal body long, slightly curved ventrally, consist 20 annules, phasmids on the anterior half of tail, tail terminus unstriated.

Male not known.

Measurements : ♀ : L = 0.64 - 0.69 mm, a = 30-33; b = 5-5.5; c = 14-16; C' = 3.0-3.5; V = 54-56

Distribution : North District Tripura, West Bengal.

Tylenchorhynchus mashoodi Siddiqi & Basir 1959

1960. *Tylenchorhynchus dactylurus* Das

1960. *T. digittatus* Das

1961. *T. elegans* Siddiqi

1968. *T. zae* Sethi & Swarup

Material examined : ♀♀ 5 ♂♂ 2 around Maize, Kumarghat 26.4.91, ♀ 1 around Gourd, Bilonia 23.4.91, Coll. A. Chatterjee.

Diagnosis : Female : Body ventrally curved in posterior half of body. Cuticle with distinct striations, 1-2 μ m apart. Lateral field with four incisures, Lip region continuous with body contour, bearing 3-4 annules. Stylet 16-19 μ m long, with rounded basal knobs. Oesophagus typical of the genus. Reproductive system amphidelphic. Spermatheca with sperm. Tail subcylindrical; with bluntly rounded unstriated terminus, 2.5-4.0 anal body width long. Phasmids at anterior half of tail.

Male : Similar in general morphology. Spicules 18-22 μ m long. Gubernaculum 10-15 μ m long. Tail conoid with acute or sub-acute terminus 2.3-3.0 body-width long. Phasmid in the anterior half.

Measurements : ♀ : L = 0.53-0.71 mm; a = 28-37, b = 4.4-5.8; c = 13-18; V = 50-56

♂ : L = 0.57-0.65 ; a = 27-35; b = 4.5-5.6 ; c = 14-17; T = 36-50

Distribution : North District, South District, Tripura.

Remarks : Baqri and Jairajpuri (1970) redescribed the species with intra specific variations.

Super family **HOPLOLAIMOIDEA**
Filipjev, 1934

Key to families of HOPLOLAIMOIDEA

1. Mature female round or lemon-shaped behind neck; anus terminal; stylet in male larger than that of females, tail non bursate.....2
- Mature female not round or pearshaped; anus not terminal, male with stylet equal or smaller than that of females, tail bursate ...
.....3
2. Excretory pore in mature female opposite or anterior to median bulb; male with large lip cap and large transverse slit-like amphidial structures gall-inciting.....*Meloidogynidae*
- Excretory pores in mature female, behind medium bulb; male with small lip cap, with small oval to round amphidial apertures, not gall-inciting.....*Heteroderidae*
3. Juveniles and females with low arched cephalic frame work; endoparasites of roots
.....*Pratylenchidae*
- Juveniles and females with high arched cephalic frame work; ectoparasites of roots
.....4
4. Mature female swollen, sedentary
.....*Rotylenchulidae*
- Mature female not swollen, migratory
.....*Hoplolaimidae*

Family **HOPLOLAIMIDAE** Filipjev, 1934

Key to the Sub families of HOPLOLAIMIDAE
Filipjev, 1934

1. Phasmids scutellum-like.....*Hoplolaiminae*
- Phasmids pore like.....2
2. Ovary unpaired. Vulva at posterior quarter of body.....*Rotylenchoidinae*
- Ovaries paired. Vulva near or behind mid body.....*Rotylenchulidae*

Sub-family **HOPLOLAIMINAE**
Filipjev, 1934

Key to the genera of Hoplolaiminae

- Stylet knobs tulip-shaped, each with 1-3 anteriorly directed tooth like projections
.....*Hoplolaimus*
- Stylet knobs not tulip-shaped, without tooth like projections.....*Scutellonema*

Genus *Hoplolaimus* Daday, 1905

Key to the species of Hoplolaimus

1. Length of stylet 33 to 40 μm ...*H. indicus*
Length of stylet 45 to 50 μm ...*H. Columbus*
Hoplolaimus indicus Sher 1963

1979 *Basirolaimus indicus* (Sher 1963) Shamsi

1982 *Hoplolaimus arachidia* Maharaju & Das

Material examined : ♀ ♀ 9 ♂ 2 from rhizosphere of jack-fruit, Kunjaban, Agartala, Tripura. 11.4.91, Coll. A. Chatterjee.

Diagnosis : Female : Body ventrally curved upon fixation. Cuticle coarsely annulated. Lateral field with 2-3 incomplete broken incisures. Lip region hemispheroid, marked by 3-4 annules. Basal annule with 6-12 longitudinal striations. Cephalic framework strongly sclerotized. Stylet robust 30-34 μm long; basal knob with 1-3 forwardly directed processes. Oesophageal gland overlapping intestine dorsally and laterally; with 6 nuclei. Reproductive system amphidelphic. Epiptygma single or double. Spermatheca with sperm. Intestine overlapping rectum. Tail round.

Male-Similar to female. Spicules arcuate and cephalated 36-46 μm long. Gubernaculum 12-20 μm long. Tail conoid. Bursa terminal.

Measurements : ♀ : L = 1-1.4 mm; a = 21-35; b = 8.4-9.0; b' = 7.0-8.0; c = 45-73; c' = 0.56-0.68; V = 50-58; o = 10-18.

♂ L = 0.9-1.3 mm; a = 25-35; b = 9-12; b' = 6.2-9; c = 31-37; o = 10-6.

Distribution : Agartala, West District, Tripura, Orissa, W. Bengal.

Remarks : Have been reported to be potential pest of rice in Orissa and W. Bengal.

***Hoplolaimus columbus* Sher, 1963**

1963 *Hoplolaimus columbus* Sher, S. A.

Material : ♀ ♀ 7, ♂ ♂ 5 around ribbed Gourd. Mata Bari, Udaipur, West District 20.4.91, A. Chatterjee.

Diagnosis : Female : Lip region with three cuticular rings and 10-15 longitudinal striations, visible on basal ring. Stylet knobs anteriorly with two tapering protrusions. Oesophageal gland with 6 nuclei. Hemizonion and caudalid not detected, spermatheca absent, Lateral field reduced and with one poorly developed incisure. Intestine blind pouch extending upto caudal part of body. Tail rounded terminally with 17 cuticular rings on ventral side.

Male : General structures are more or less similar with female. Stylet knobs with two anteriorly directed protrusions. Stylet opening subterminal; gubernaculum trough-shaped with distinct titillae. Spicules slightly curved with very slender parus. Bursa commences at level of anterior end of spicules and terminates at end of tail.

♀ L = 1.26-1.83 mm, a = 30-39; b = 9.1-12.4; b' = 6.3-9.7; c = 38-57; V = 52-61; stylet = 40-47 µm.

♂ L = 1.15-1.4 mm; a = 25.9-38.2; b = 9.6-12.2; c = 26.8-33.1 stylet = 40.2-43.5 µm. spicules 36.2-52.3 µm.

Distribution : West District, Tripura.

Key to the species of *Scutellonema*

- Scutella at level of anus
- Tail with 7-12 cuticular ring.....*siamense*
- Scutella behind the anus and tail with 9-10 cuticular ring.....*Sheri*

Genus *Scutellonema* Andrassay 1958

***Scutellonema sheri* Edward & Rai 1970**

Materials : ♀ ♀ 5 around citrus plants. Manubazar, 28.4.91 North District ♀ pine-apple Damru lake island 14.4.91, A. Chatterjee.

Diagnosis : Female-Body ventrally curved, cuticular ring coarse 2 µm apart. Lateral field extends from the level of metacarpus bulb to end of tail, with four incisures; areolation absent even in scutellar region. Lip region semispherical, continuous with body, with three cuticular rings; frame work well developed. Stylet knobs rounded. Excretory pore at level of oesophago-intestinal valve. Hemizonid not detected. Tail terminus rounded, with 9-10 cuticular rings on ventral side. Scutella (diameter 5-7 µm at level of anus.

Measurements : ♀ L = 0.63-0.79 mm; a = 21.0-28.0; b = 4.0-4.8 b' = 5.5-6.0; c = 53-69; V = 57-67 Stylet 21-31 µm o = 12.1-25.

Distribution : North and South District Tripura, Sikkim, Meghalaya.

Remarks : The type was reported from Kalimpong, Sikkim.

***Scutellonema siamense* Timm. 1965**

Material : ♀ ♀ 11 ♂ 3 around pine-apple, Salema 15.4.91; A. Chatterjee.

Diagnosis : Female : Body shape of wide arc. Cuticle coarsely annulated, 2 µm apart. Lateral field with four incisures, outer two crenate, anterior part is areolated. Lip region highly sclerotised, slightly demarcated from body. Lip region high, anteriorly blunt with 3-4 cuticular rings. 6 longitudinal striation on basal ring. Stylet knobs oval, 4.0 µm width; Metenchium shorter than telenchium. Metacarpus ovoid. Hemizonid inconspicuous, immediately anterior to excretory pore. Spermatheca small. Scutella situated immediately behind anus; they retain greenish colour. Tail rounded, with 7-12 cuticular rings.

Male : General body shape same with that of female, Bursa short but wide, reaches tip of tail. Tail terminus digitate.

Measurements : ♀ : L = 0.59-0.72 mm; a = 22.4-26.4; b = 9.6-11.9; b' = 4.5-6.3; c = 39-65; V = 54.5-58; stylet = 24-26 µm.

♂ : L = 0.51-0.66 mm; a = 21.4-29.4; b = 9.5-10.9; b' = 4.5-7.4; c = 36-47;

Style = 22-25 µm; o = 28-32; spicules 22-26 µm Gubernaculum 10-12 µm.

Distribution : North District Tripura

Remark : Reported from Thailand

Key to the species of Rotylenchus

- Oesophageal glands overlap only the commencement part of intestine dorsally and dorsolaterally. Phasmids anterior to anus *R. orientalis*
- Oesophageal gland overlap intestine on all sides and upto a significant distance. Phasmids posterior to anus *R. helicus*

Sub family ROTYLENCHINAE

Genus *Rotylenchus* Filipjev 1936

Rotylenchus orientalis Siddiqi and Husain
1964

1972 *Rotylenchus orientalis* Choi and Geraert.

Material : ♀ ♀ 4 around Mango, Sonamura, 20.4.91, A. Chatterjee.

Diagnosis : Female - Body spirals on fixation. Width of cuticular rings 1.7 µm at the middle part of body. Lateral field occupy one fourth of body diameter and with four incisures. Phasmids on fourth annule anterior to the anus. Lip region continuous with body, conical, with rounded anterior end and 5 annules. Anteriorly directed rounded protrusions of stylet knobs well developed. Procorpus cylindrical, Metacarpus ovate; Esophageal glands form elongated lobe dorsally and dorsolaterally overlaps commencement of intestine. Vulva forms a transverse slit. Reproductive organs paired. Spermatheca distinct. Tail tapers dorsally, with 9-11 annules.

Male - not known.

Measurements : ♀ : L = 0.68-0.76mm; a = 27-32; b = 6.2-6.7; c = 36-56; V = 66-72; Stylet 25-28 µm. o = 62.

Distribution : South District Tripura.

Type locality : Shillong, Meghalaya, South Korea and Philippines.

Rotylenchus helicus Husain & Khan 1967

Material : ♀ ♀ 6 around pumpkin Bagafa. South District. 19.4.91, A. Chatterjee.

Diagnosis : Female - Body curves ventrally in spiral. Width of annular ring 2.0 µm in mid body. Lateral field 2/9 diameter of body, with four incisures. Lip region slightly demarcated from general shape of body, with five body annules. Internal framework moderately developed. Metenchium shorter than telenchium. Stylet knobs rounded, anteriorly concave. Procorpus cylindrical; metacarpus ovoid with distinct valve. Nerve ring immediately behind metacarpus. Excretory pore at level of posterior part of oesophageal glands, latter overlap intestine at all sides for a significant distance. Intestine does not overlap rectum. Phasmids situated three to five body annules, posterior to anus. Length of tail from 1/2 to 3/4 anal diameter of body and with 8-10 annules on ventral side. Spermatheca present. Epiptygma-conspicuous.

Measurements : ♀ : L = 0.67-0.87 mm; a = 25-30; b = 4.8-6.7; c = 56-94; V = 53-68; style = 28-32 µm.

Distribution : South District, Tripura.

Key to the species of Helicotylenchus

- Ventral out-growth of tail absent or poorly defined *H. dihystra*
- Terminus of tail concave in front of ventral outgrowth *H. crenacauda*

Sub family ROTYLENCHOIDINAE
Whitehead 1958

Genus *Helicotylenchus* Steiner 1945

***Helicotylenchus Crenacauda* Sher 1966**1971. *Helicotylenchus pteracercus* Singh1979. *H. indentatus* chaturvedi & Khera

Material : ♀ ♀ 8 around Vindi, Khoai, W. District 12.4.91 and ♀ ♀ 2 soil around Tea plantation, Udaipur 24.4.91; A. Chatterjee.

Diagnosis : Female Body spirally curved. Cuticle transversely striated. Lateral field with four incisures of which the inner two fuse near the middle of tail. Lip region continuous, broadly rounded, marked by four to five annules. Stylet 24-27 µm long. Basal knobs indented anteriorly, oesophagus typical of the genus. Reproductive system amphidelphic. Spermatheca without sperm. Tail with a well developed ventral projection and the dorsal terminal part indented. Phasmids preanal.

Male not known.

Measurements : ♀ : L = 0.5-0.7 mm; a = 20-28, b = 4.7-6.3, b' = 4.0-5.2; c = 30-43; c' = 0.9-1.4; V = 60-65; o = 33-40.

Distribution : West and South District, Tripura.

***Helicotylenchus dihystra* (cobb 1893) Sher 1961**1893. *Tylenchus dihystra* cobb1906. *T. Olae* cobb1930. *T. Spiralis* cassidy1945. *Helicotylenchus nanus* Steiner1968. *H. punicae* Swarup & Sethi

Material : ♀ ♀ 9 around rubber plantation, Udaipur 24.4.91 ♀ ♀ 2 around rubber plantation, Sipahijola, Tripura, 12.4.91; A. Chatterjee.

Diagnosis : Female - Spirally coiled body. Cuticle with distinct transverse striae. Lip region continuous, marked with 4-5 annules; hemispherical. Conspicuous cephalic framework. Lateral fields marked by four incisures. Stylet 24-27 µm long; basal knobs anteriorly concave. Oesophagus with overlapping glands, reproductive system amphidelphic. Spermatheca rounded,

offset, no sperm inside. Tail dorsally convex-conoid; terminus narrow.

Male not known.

Measurements : ♀ : L = 0.5-0.85 mm; a = 21-32; b = 4.5-6.5; b' = 3.7-5.2; c = 34-64; c' = 1.0-1.3; V = 60-66; o = 34-49.

Distribution : West and South District Tripura, West Bengal, Uttarpradesh.

Family ROTYLENCHULIDAE
Husain & Khan, 1967

Sub-family ROTYLENCHULINAE
Husain & Khan, 1967

Genus *Rotylenchulus* Linford & Oliveira, 1940

Rotylenchus reniformis Linford & Oliveria, 1940

1940 *Rotylenchulus reinformis* Linford and Olivera

1960 *R. Stakmani* Husain & Khan.

Material : ♀ ♀ 5 around Lemon, Dharamnagar 29.4.91

♀ ♀ 3 ♂♂ 2 around Pine apple, Moharchhara 16.4.91, Coll. A. Chatterjee.

Diagnosis : Body ventrally curved, Head continuous, lip region conoid, rounded, with five distinct annules. Lateral field with four incisures, more than 1/5th body width. Tail 24 µm long, with rounded tip, Striae coarse towards tip. Two opposed ovaries with two flexures; two rows of oocytes in either side.

L = 0.35 mm; a = 24; b = 3.8; b' = 2.6; c = 14, c' = 2.8; V = 7, stylet = 19 µm, o = 74.

Male - Generally similar to female, more slender, stylet and knobs poorly developed than in females. Oesophagus reduced. Bursa adanal, vestigial. Testis single

L = 0.37 mm; a = 25; b' = 3.9; c = 20; c' = 1.4; stylet = 11 µm; o = 62; spicule = 17 µm; gubernaculum = 7 µm.

Distribution : North and West District, Tripura.

Family PRATYLENCHIDAE
Thorne, 1949

Key to the subfamilies of PRATYLENCHIDAE

- Tails similar between sexes; phasmids near terminus HIRSCHMANNIELLINEAE
- Tails dissimilar between sexes; phasmids not near terminus PRATYLENCHINAE

Sub-family HIRSCHMANNIELLINEAE Fotedar and Handoo, 1978

Key to the species of Hirschmanniella

- Stylet 21-28 μ m long.
- Tail elongate conoid, terminus with a pointed ventral projection*H. mucronata*
- Stylet 16-21 μ m long.
- Tail elongate, terminus with a mucro*H. oryzae*

Hirschmanniella mucronata (Das 1960)
Luc & Goodey 1963

1960. *Radopholus mucronatus* Das

1956. *R. oryzae* Timm

1966. *Hirschmanniella magna* Siddiqi

Material : ♀♀ 3 ♂♂ 4 around paddy, Bilonia. 23.4.91; Coll. A. Chatterjee.

Diagnosis : Female - Slightly ventrally curved body. Lip region continuous, marked by 4-6 annules, low and hemispherical. Lateral field with four incisures, areolated at tail end. Stylet robust 24-28 μ m. long, with rounded basal knobs, anteriorly slightly sloping oesophagus, typical of the genus. Reproductive system amphidelphic. Spermatheca filled with sperm. Intestine slightly overlaps rectum. Pointed tail terminus with ventral mucro. Phasmids subterminal.

Male Similar to female in general shape and size, except in reproductive system and tail shape. Spicules 29-35 μ m long. Gubernaculum 9-14 mm long.

Measurements : ♀ L = 1.6-2.2 mm; a = 57-60, b = 11-14; b' = 4.6-5.7; c = 18-20; c' = 4.1-5.0; V = 48-53; o = 10-16.

♂ L = 1.7-1.8 mm; a = 52-59; b = 12-14; b' = 4.7-5.4; c = 17-21; c' = 4.1-5.0; o = 11-19.

Distribution : Bilonia, South District Tripura; Andhra Pradesh, Bihar (India), Philippines, Thailand.

Remarks : This species has been reported as a potential rice pest from many places.

Hirschmanniella oryzae (Van Breda De Hann 1902) Luc & Goodey 1964-91

1902. *Tylenchus oryzae* Van Breda de Hann

1941. *Totylenchus oryzae* (Van Breda de Hann) Filipjev & Sch. Stek,

1949. *Radopholus oryzae* (Van Breda de Hann) Thorne

1962. *Hirschmannia oryzae* (Van Breda de Hann) Luc & Goodey.

1966. *Hirschmanniella nana* Siddiqi

Material : ♀♀ 2 ♂♂ 2 around paddy, Bilonia. 23.4.91; Coll. A. Chatterjee.

Diagnosis : Female - Body straight or slightly curved ventrally. Transversely striated cuticle 1.2-2.1 μ m apart lateral fields, with four incisures. Lip region continuous with body, low flattened with rounded edge covering 3-4 annules. Stylet robust 17-19 μ m, with rounded basal knobs. Oesophagus typical of the genus. Reproductive system amphidelphic. Spermatheca with sperm. Tail elongate conoid 4.2 to 6.4 anal body width long, terminus mucronate. Phasmids below the mid point of tail.

Male : Genereal features same with that female. Reproductive system with cephalated and arcuate spicules 18-28 μ m long. Gubernaculum 7-9 μ m long. Bursa subterminal; tail with a ventral mucro.

Measurements : ♀ L = 1.13-1.64 mm; a = 50-66; b = 8.8-12; b' = 4.5-7.2; c = 15-19; c' = 4.3-5.5; V = 50-54; o = 15-19.

♂ L = 1.0-1.4 mm; a = 52-60; b = 9.0-11.2; b' = 4.6-5.7; c = 16-18; o = 13-17.

Distribution : Bilonia, South District Tripura; West Bengal; Vietnam, Thailand.

Remarks : The species is widely distributed and is considered a major pest of rice in many countries.

Sub-family PRATYLENCHINAE

Key to the species of *Pratylenchus*

- Tail tip rounded and smooth.....
.....*P. penetrans*
- Tail tip crenate seems to be bifid
.....*P. coffeae*

Sub-family PRATYLENCHINAE Thorne, 1964

Genus *Pratylenchus* Filipjev 1936*Pratylenchus coffeae* (Zimmermann) 1941
Filipjev and Sch. Stek1919. *Pratylenchus musicola* (Cobb)1920. *P. mahogani* Cobb1956. *P. pratensis* apud Yokoo

Material : ♀♀ 3 ♂♂ 4 around gamagrass,
Sonamura, 20.4.91, Coll. A. Chatterjee.

Diagnosis : Female - Body more or less straight. Cuticle distinctly striated transversely. Lateral field with four incisures. Low lip region marked by two annules. Stylet stout 15-18 µm long; basal knobs well-developed. Oesophagus typical of the genus. Reproductive system prodelphic. Spermatheca with sperm posterior to uterine sac, varies in length. Tail tapering slightly; broadly rounded usually indented or crenate.

Male : General morphology similar to female except reproductive system and tail shape. Spicules slender 16-19 µm long; Gubernaculum 4-7 µm long.

Measurements : ♀ L = 0.36-0.65 mm; a = 17.5-30.5; b = 5.0-7.7; c = 13.5-23.7; V = 75.5-82.2

♂ L = 0.40-0.55 mm; a = 23.7-31.5; b = 5.9-7.7; c = 17.6-23.3; T = 37.55

Distribution : South District Tripura.

Pratylenchus penetrans (cobb 1917) Chitwood
and Oteifa 1952

Material : ♀♀ 3 ♂♂ 5 around jack fruit, Ambasa, North district 25.4.91; Coll. A. Chatterjee.

Diagnosis : Female - Lip region slightly set off low with three annules. Stylet knobs broadly rounded, sometimes capped anteriorly. Ovary outstretched, oocytes in single row except for a short zone at anterior end. Spermatheca spherical or nearly so. Posterior uterine branch about one to one and half of vulval body width long and undifferentiated. Tail with 15-27 annules on ventral surface, tail tip rounded and smooth.

Measurements : ♀ : L = 0.34-0.81 mm, a = 19-32; b = 5.3-7.9; c = 15-24; V = 75-84; stylet = 15.0-17.0 µm

♂ : L = 0.3-0.57 mm; a = 23-34; b = 5.4-7.2; c = 15-21; T = 35-57; stylet = 13.0-15.5 µm
spicules = 14.0-17.0 µm; Gubernaculum = 3.9-4.2 µm.

Distribution : North District, Tripura.

Genus *Radopholus* Thorne 1949*Radopholus similis* (cobb 1893) Thorne 19491893. *Tylenchus similis* (cobb)1932. *Anguillulina similis* (cobb 1893) Goodey1936. *Tetylenchus granulosus* (cobb 1893) Filipjev

Material : ♀♀ 8 ♂♂ 4 around Banana. Teliamura 13.4.91

♀♀ 2 ♂♂ 2 around Arecanut, Kailashahar, 25.4.91

♀♀ 6 around banana Bagafa; 19.4.91, Coll. A. Chatterjee.

Diagnosis : Female - Body slightly arcuate ventrally; annules distinct. Lateral field with 4 incisures areolated in extremities; inner two joins near the middle of tail. Lip region hemispherical offset; with 3-4 annules. Strongly sclerotised. Spear about 18 µm. long : well developed basal knobs, indented anteriorly. Median oesophageal bulb oval to round; with prominent valvular apparatus. Oesophageal glands 3, overlapping intestine. Vulva prominent. Paired ovary, outstretched. Spermatheca spherical, functional. Tail with narrow rounded or indented terminus.

Male : Oesophagus and spear degenerated without distinct knobs. Median bulb indistinct. Lip region elevated, 4 lobed, weakly sclerotised. Bursa coarsely crenate enveloping about 2/3 of tail. Spicules strongly cephalated 18-22 μ m long. Gubernaculum rod like with distinct sharp claw like titillae at end.

Measurements : σ : L = 0.59-0.67 mm; a = 31-44; b = 6.1-6.6; b' = 4.1-4.9; c = 8-10; c' = 5.1-6.7;

spear = 12-17 μ m. spicules 19-22 μ m.

Gubernaculum = 8-12 μ m.

$\varnothing$: L = 0.54-0.66 mm; V = 53-58; tail = 57-77 μ m.

spear = 16-19 μ m.

Distribution : North and South District, Tripura.

Key to the species of Meloidogyne

- Lateral field with 2 incisures, fairly wide in perineal pattern.....*M. Javanica*
- Perineal pattern with irregular striae but without lateral line.....*M. incognita*

Family MELOIDOGYNIDAE
Skarbilovich 1959

Genus *Meloidogyne* Goeldi 1892

Meloidogyne incognita (Kofoid & White, 1919) Chitwood 1949

1919. *Oxyuris incognita* Kofoid & White

Material : $\varnothing \varnothing$ 22 $\sigma \sigma$ 10 around Vindi and Binjal, Ampibazar 21.4.91, A. Chatterjee.

Diagnosis : Female Spherical body with projecting neck. Lip region bearing 2-3 annules. Cuticle, at the base of stylet abruptly thickens. Stylet knobs rounded. Excretory pore 10-20 annules behind lip region. Perineal pattern typical "incognite type", with striae closely spaced very wavy to zig-zag, specially dorsally and laterally. Dorsal arch variable. Striae often forked along the lateral line zone.

Male : Body slender cuticle transversely striated. Lateral field with four incisures; outer

bands areolated. Lip region continuous, high, truncate cone-shaped, marked by distinct annules, 1-3 on sub-lateral head sectors and 1-5 on lateral head sectors. Stylet of conus longer than shaft, knobs usually wider than length with toothed or concave anterior margins. Excretory pores posterior to isthmus. Testes one or two. Tail bluntly rounded. With smooth terminus. Spicules slightly curved. Gubernaculum crescentic. Bursa absent.

2nd stage juveniles Lateral field with four incisures, lip region almost continuous, cone-shaped in lateral view, subspherical in dorsal view, marked by two annules in lateral view, three annules in dorsal and ventral view. Head cap wide. Tail tapering towards end.

Measurements : $\varnothing$: L = 0.5-0.72 mm; width 0.3-0.52 mm; stylet = 13-16 μ m width of stylet base = 3-5 μ m; orifice of dorsal oesophageal gland = 2-4 μ m.

σ : L = 1.1-1.9 mm; a = 31-35; stylet = 23-32 μ m width of stylet base = 4.7-6.8

spicules = 28.8-40.0 μ m; gubernaculum = 9.4-13 μ m.

2nd stage juveniles-L = 0.33-0.40 mm; a = 24-31; b = 2-2.1; b' = 6.4-8.4; tail length = 36-53 μ m; stylet = 9.6-11.7 μ m.

Meloidogyne javanica (Treub, 1985)
Chitwood 1949

1885. *Heterodera javanica* Trueb

1890. *Tylenchus (Heterodera) javanicus* (Treab) Cobb 1890.

1903. *Anguillula javanica* (Treub) Laverne

1955. *Meloidogyne javanica javanica* Gillard and Vanden Brande

Material examined : $\varnothing \varnothing$ 14 $\sigma \sigma$ 5 from soil around bitter gourd, Champak Nagar 14.4.91.

$\varnothing \varnothing$ 10 σ 1 from soil around pine apple plants Rangamura 23.4.91 Coll. by A. Chatterjee.

Diagnosis : Female Body almost spherical with projecting neck, rounded posteriorly, but perineal region protruding slightly. Lip region

little wider than adjoining body marked by one annule, behind the head cap. stylet slender, dorsally curved, basal knobs rounded. Perineal pattern oval to pear-shaped, dorsal arch vary from round to moderate height. Striae smooth to wavy. Lateral field marked by two incisures.

Male Lip region rounded, continuous with body, the basal annule wider than first annule. Amphidial apertures distinct. Stylet knob rounded. Lateral field marked with four incisures. Tail shape variable and bluntly rounded ventrally. Phasmids usually at cloacal level. Spicules slightly curved. Gubernaculum crescentic.

Second stage juvenile-Lip region continuous, truncate cone shaped in lateral view, stylet knobs not prominent. Lateral field with four incisures. Tail with finely rounded terminus.

Measurements : ♀ : L = 0.54-0.8 mm; width 0.13-0.58 mm; Stylet = 14-18 µm; stylet knobs = 2.5 µm.

♂ : L = 0.75-1.2 mm; a = 14.3-17.5; stylet = 20-23 µm; stylet knobs = 3.6-5.4 µm; spicules = 21-32 µm; gubernaculum = 7.2-9.4 µm.

2nd stage juvenile : L = 0.38-0.45 mm;

a = 27-36; b = 2.1-3.3; b' = 7.1-8.0; stylet = 9.4-11.4 µm.

Distribution : West District and South District, Tripura.

Sub-family **HETERODERINAE**
Filipjev, 1934

Genus **Heterodera** Schmidt 1871

Heterodera rostochiensis Woolen weber 1923

1927 *Heterodera schachtii* Zimmerman

1929 *H. schachtii* subsp. *rostochiensis* Kemner

Material : ♀ ♀ 6 ♂ ♂ 5 from rhizosphere of Vindi and Brinjal, Matabari, Udaipur, 24.4.91, Coll. A. Chatterjee.

Diagnosis : Female Body sub-spherical with projecting neck containing the oesophagus and part of oesophageal gland. Head small with 1 or 2 annules. Cuticle on the spherical part with

reticulate ridges. No lateral incisures. Hexaradiate head skeleton weakly developed. Stylet a little curved; stylet knobs rounded with marked posterior slope. Median Oesophageal bulb large, with crescentic valvular apparatus. Excretory pore near base of neck, vulva and tail region not set off from the body. Vulva in a circular depression, opposite to neck, named vulval basin, where vulva is transverse slit like. Anus outside vulval basin. Cuticle surface between vulva and anus thrown into about 20 parallel ridges. Colour changes white to golden yellow (in 4-6 weeks) and then to dark brown.

Male : Vermiform with short bluntly rounded tail.

Body strongly curved on fixation. Cuticle with regular annulations. Lateral field with 4 incisures upto tail.

Head rounded, offset, with 6-7 annules. Large oral disc. Lateral lips with amphids. Head skeleton heavily sclerotised. Stylet robust with backward sloping basal knobs. Median oesophageal bulb ellipsoid with crescentic valvular apparatus. Dorsal gland nucleus prominent. Testis single. Stout arcuate spicules, terminating in single pointed tip. Gubernaculum small, Phasmid not seen.

Measurements : ♀ : L = 450-480 µm; width 300-340 µm; a = 1.2-1.5; stylet = 20-27 µm; vulval slit = 10-11 µm anus to vulva = 38-43 µm.

♂ : L = 1.10-1.2 mm; width of excretory pore = 25-29 µm; stylet = 25.1-25.9 µm tail length = 5.3-5.5 µm, spicule length = 33.0-37.0 µm gubernaculum length = 9.5-10.8 µm.

Distribution : West District, Tripura.

Heterodera avenae Wollenweber 1924

1924 *Heterodera schachtii* Var *avenae* Wollenweber

1940 *H. major* (Schmidt 1930) Franklin

Material : ♀ ♀ 12 ♂ ♂ 9 from soil around pine apple, Khoai, 12.4.91; Coll. by A. Chatterjee.

Diagnosis : Female Adult lemon shaped with prominent neck and vulval cone. Lip region with 6 annules and confluent; with a labial disc.

Spear straight 26-32 μm long, basal knobs rounded. Median oesophageal bulb round, with a distinct valvular apparatus. Vulva 12-13 μm long. Zigzag rugose cuticular pattern.

Average cyst size 0.7 $\times$ 0.5 mm. Bullae prominent, crowded beneath vulval cone.

Male : Vermiform 1.1-1.5 mm. long. Body annules distinct about 2 μm wide. Lateral field with 4 incisures, outer bands usually areolated. Lip region rounded, offset with 6 annules. Cephalic frame heavily sclerotized. Anterior tapering part of spear sharply pointed, basal knobs rounded, posteriorly sloping anterior surface. Orifice of dorsal oesophageal gland 3-6 μm behind spear base. Oesophagel glands ventral and ventrolateral to intestine. Excretory pore near oesophago-intestinal junction. Hemizonid distinct, 6-7 annules behind excretory pore. Spicules arcuate, with notched end. Tail end usually twisted.

Measurements : ♀♀ : L = 0.5-0.7 mm; breadth = 0.35-0.5 mm;

♂♂ : L = 1.1-1.5 mm; a = 32-50; b = 7-12; b' = 5.5-6.5; c = subterminal; T = 40-50; spear = 27-30 μm spicules = 33-38 μm .

Distribution : West District, Tripura.

Suborder CRICONEMATINA
Siddiqi, 1980

Key to super families of CRICONEMATINA

Females and juveniles with thick cuticle bearing coarse, round or retrose annules; oesophagus with isthmus broad and amalgamated with basal bulb.....

.....*Criconematoidea*

Females and juveniles with thin cuticle bearing fine round annules oesophagus with isthmus not amalgamated with basal bulb.....

.....*Tylenchuloidea*

Super family CRICONEMATOIDEA
Taylor, 1936

Family CRICONEMATIDAE
Taylor, 1936

Key to the subfamilies of CRICONEMATIDAE

1. Female with a cuticular body seath, juveniles with scales or spines usually arranged in alternating rows or irregularly.....

.....*Hemicriconemoidinae*

Female without a cuticular body seath; scales or spines is present in longitudinal rows ...

.....2

2. Juveniles and females with scale or spines (except females of criconema).....

.....*Criconematinae*

Juveniles and females without scales or spines

.....*Macroposthoniinae*

Sub-order CRICONEMATINA
Siddiqi 1980

Super family TYLENCHULOIDEA
Skarbilovich 1947

Family TYLENCHULIDAE
Skarbilovich 1947

Tylenchulus semipenetrans Cobb, 1913

1913 *Tylenchulus semipenetrans* Cobb, N. A.

Material : ♀♀ 14 from soil around lemon and orange trees, Teliamura 13.4.91, Coll. by A. Chatterjee.

Diagnosis : Female - (mature) body behind neck swollen irregularly 65-100 μm at its widest, ventrally arcuate; neck region distorted, body behind vulva digitate 34 μm long diameter at vulva 22 (20-27) μm . Body cuticle 4 μm (2.5-5.5) thick near middle, not annulated, ovary coiled; Spermatheca with sperms, Intestine syncytial, lacking a lumen, rectum and anus absent. Excretory pore 16(12-19) in front of vulva.

Measurements : ♀ : L = 0.37 mm; a = 4.5; b = 2.9 excretory pore 81%; spear = 13.0 μm .

Distribution : North District, Tripura.

Remarks : This has been observed as a dominant pest of Citrus in Darjeeling and Sikkim by Baqri *et. al.*, (1984).

Key to the species of *Criconemella*

—Stylet 50-60 μm long, tail terminus with folded annules, directed upward.....

.....*C. rustica*

—Stylet 40-45 μm long; tail terminus with cupshaped end.....*C. onoensis*

Super family CRICONEMATOIDEA
Taylor, 1936

Family CRICOMEMATIDAE
Taylor, 1936

Criconemella rustica (Micoletzky 1915)
Luc & Ruski 1981

1915 *Criconema rusticum* Micoletzky

1936 *Criconemoides rusticum* Taylor

1965 *Macroposthonia rustica* De Grisse & Loof

Material : ♀ ♀ 3 from rhizosphere of Guava, Amarapur, 11.4.91, West District, Tripura. Coll. by A. Chatterjee.

Diagnosis : Female - Body cylindrical. Lip region continuous.

Sub-median lobes projecting separately. Stylet 50-60 μm long. Oesophagus typical criconematid type.

Reproductive system prodelphic. Vulva with open lips. Tail terminus consisting of small folded annules.

Male - not found.

Measurements : ♀ : L = 0.34-0.51 mm; a = 10-14; b = 3.8-4.8; c = 19-51; V = 92-95; R = 81-107; Rst. = 15-18; Roes = 25-30; Rex = 26-31; RV = 7-10; Ran = 4-9.

Distribution : West District, Tripura, also reported from Bangladesh.

Criconemella onoensis (Luc, 1959)
Luc & Ruski 1981

1965 *Macroposthonia onoensis* (Luc, 1959) de Grisse & Loof.

Material : ♀ ♀ 2 from rhizosphere of tea plantation beside Agartala-Udaipur Road, 24.4.91, Collected by A. Chatterjee.

Diagnosis : ♀ : Body cylindrical, cuticle with 120 annules total. Lateral field and phasmid absent. Lip region continuous; pseudolips reduced. Sub-medium lobes present, projecting separately. Stylet 42-45 μm long, with very long conus and well developed basal knobs. Female reproductive system prodelphic. Oesophagus with procorpus, amalgamated with postcorpus. Isthmus short and terminal bulb small. Vulva with open lips. Tail with cup-shaped end.

Male - not known.

Measurements : ♀ : L = 0.4-0.42, a = 13, b = 3.8-3.9; c = 17, V = 92-93, R = 130-131; Rst = 16, RV = 8, stylet = 42-45 μm .

Distribution : Rhizosphere of tea plantation, West District, Tripura. Also reported from tea gardens of Darjeeling.

Genus ***Hemicriconemoides*** Chitwood and Birch
field 1957

Hemicriconemoides mangiferae

1961 *Hemicriconemoides mangiferae* Siddiqi

Material : ♀ ♀ 4 collected from rhizosphere of tea plants on the way to Agartala to Udaipur 24.4.91, Coll. A. Chatterjee.

Diagnosis : Cuticular sheet attached to body at anterior end, vulva and tail. Lip region slightly set-off; with 2 annules; 1st angular and directed outward. Body annules 3-4 μm wide at mid body. Stylet knobs 5-6.5 μm across. Vulvar seath lacking. Tail convex, conoid or rounded; the last 3-4 annules narrow abruptly.

Measurements : ♀ : L = 0.5-0.55 mm; a = 15-17, b = 4.6-4.7; C = 14, V = 92-95, R = 132-135; Rst 20-22, Rv = 14; Stylet = 69 μm .

Distribution : Rhizosphere of tea plantation. West District, Tripura.

This has been reported from Coochbihar, W. B. also.

Genus ***Criconema*** Hofmanner and Menzel 1914

Criconema degrissei (Baqri)

1978 *Nothocriconema degrissei* Baqri

Material : ♀ ♀ 2 from soil of rubber and tea gardens on Agartala Udaipur Road. Coll. on 24.4.91 by A. Chatterjee.

Diagnosis : ♀ : Body slightly curved ventrally. Lip region low, with lips. First labial annule not very prominent; 10-12 µm wide; 2nd labial annule 14-17 µm; 3rd annule 18-22 µm. Body annules 60-65 in number. Posterior margin serrated, only except at tail. Stylet slender 64-67 µm long (15-17% of body length); basal knobs 8-9 µm. wide, orifice of dorsal oesophageal gland 9-10 annules from terminus; its anterior margin is larger and over hanging. Spermatheca non-functional. Tail conspicuously conoid.

Male - not known.

Measurements : ♀ : L = 0.93-0.94; a = 12-13; b = 4.1, c = ?; V = 87-89

Distribution : West District, Tripura. Also reported from Darjeeling District, W. B.

Sub-order HEXATYLINA Siddiqi 1980

Super family ANGUINOIDEA Nicoll 1935

Family ANGUINIDAE Nicoll 1935

Genus *Ditylenchus* Filipjev 1936

Ditylenchus angustus (Butler 1913) Filipjev 1934

1913 *Ditylenchus angustus* Butler

1932 *Anguillulina angustus* (Butler 1913) Goodey

Material : ♀ ♀ 4 ♀ ♀ 5 from soil of rice field, Kailasahar and from rice field, Bilonia. Collected by A. Chatterjee. 23.4.91

Diagnosis : Female - Body almost straight, cuticle transversely annulated 1 µm apart at mid body. Lip region slightly sclerotized. Lateral field with four incisures. Stylet 9-11 µm long. Conus less than half of stylet length, basal knob posteriorly sloping. Median oesophageal bulb oval with a valvular apparatus; posterior oesophageal bulb with three distinct gland nuclei; slightly overlapping the intestine ventrally. Prodelphic reproductive system. Spermatheca elongated filled with sperm. Tail 5.2-5.4 anal body width long, tapering to a pointed terminus. Phasmids in the posterior half of tail; very small pore like.

Male : Similar in size and shape to female in general morphology except reproductive system and tail shape. Bursa almost terminal. Spicules curved ventrally 16-20 µm long. Gubernaculum 6-9 µm long.

Measurements : ♀ L = 0.8-1.2 mm; a = 50-60; b = 6-9; c = 19-24; V = 78-80;

♂ L = 0.7-1.1 mm; a = 40-55; b = 6-8; c = 19-25; T = 60

Distribution : Kailasahar, North District Tripura, & Bilonia, South District Tripura, Assam, Bangladesh.

Remarks : This is a serious pest of rice, cause 'Ufra' disease.

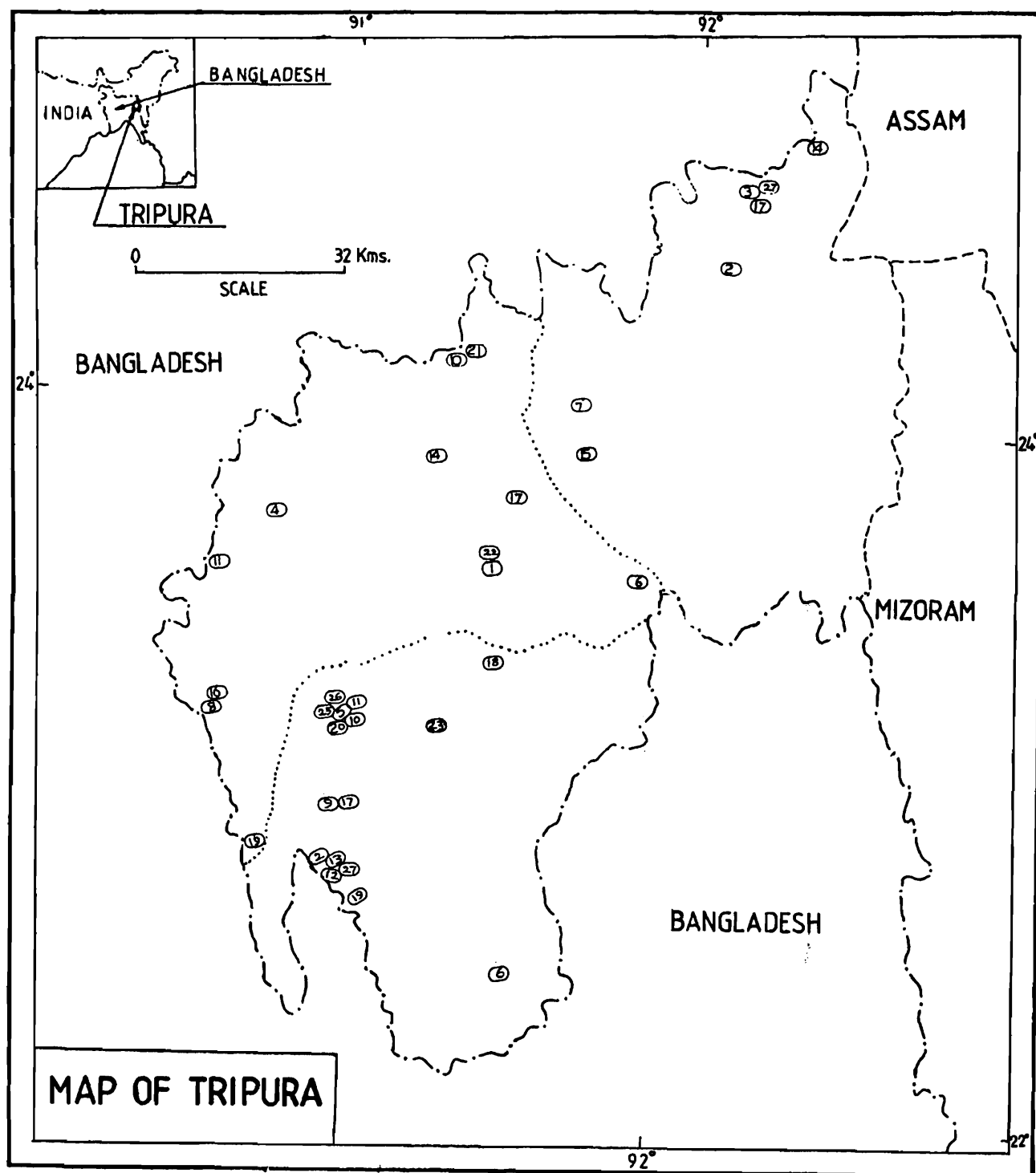
Host and Distribution List

Family	Index No.	Name of the Species	Host Plant	Distribution
TYLENCHIDAE	1	<i>Chitinotylenchus paragracilis</i>	Brinjal	North District
DOLICHODORIDAE	2	<i>Tylenchorhynchus mashoodi</i>	Maize & Gourd	North District
	3	<i>Tylenchorhynchus annulatus</i>	Mango	North District

Family	Index No.	Name of the Species	Host Plant	Distribution
HOPLOLAIMIDAE	4	<i>Hoplolaimus indicus</i>	Jack fruit	West District
	5	<i>Hoplolaimus columbus</i>	Ribbed gourd	West District
	6	<i>Scutellonema sheri</i>	Pumpkin	South District
	7	<i>Scutellonema siamense</i>	Pineapple	North District
	8	<i>Rotylenchus helicus</i>	Pumpkin	South District
	9	<i>Rotylenchus orientalis</i>	Mango	South District
	10	<i>Helicotylenchus crenacauda</i>	Vindi & Tea	West & South District.
	11	<i>Helicotylenchus dishystera</i>	Rubber	West District
	12	<i>Hirschmanniella mucronata</i>	Rice	South District
	13	<i>H. oryzae</i>	Rice	South District
ROTYLENCHULIDAE	14	<i>Rotylenchulus reniformis</i>	Lemon & Pineapple	North & West District.
PRATYLENCHIDAE	15	<i>Pratylenchus penetrans</i>	Jack fruit	North District
	16	<i>Pratylenchus coffeae</i>	Gama grass	South District
	17	<i>Radopholus similis</i>	Banana & Areca nut	North and South District
MELOIDOGYNIDAE	18	<i>Meloidogyne incognita</i>	Vindi and Binjal	
	19	<i>Meloidogyne javanica</i>	Bitter gourd and pineapple.	West and South District.
	20	<i>Heterodera rostochiensis</i>	Vindi and Binjal.	West District.
	21	<i>H. avenae</i>	Pineapple	West District
TYLENCHULIDAE	22	<i>Tylenchulus semipenetrans</i>	Lemon and Orange.	North District
CRICONEMATIDAE	23	<i>Criconemella rustica</i>	Guava	West District.
	24	<i>C. onoensis</i>	Tea	West District
	25	<i>Criconema degrissei</i>	Rubber and Tea.	West District.
	26	<i>Hemicriconemoides mangiferae</i>	Tea and pineapple.	West District.
ANGUINIDAE	27	<i>Ditylenchus angustus</i>	Rice	North and South District

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The Distribution of the species are shown in the following map according to their index numbers.

NEMATODE PARASITES OF VERTEBRATES

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INTRODUCTION

Tripura is the second smallest state of India, situated between latitudes 23°-24°5'N and longitudes 91°10' 92°50'E, covering an area of 10,486 Sq. Km. It is bordered on the north, west and south by Bangladesh and on the east by Mizoram. For administrative point of view, it is divided into three districts, namely, North Tripura, South Tripura and West Tripura, with headquarters at Kumarghat, Udaipur and Agartala respectively.

Topographically the state is within the hill areas of North-East region. Approximately 54.5% of the total land area of this state is under forest cover. As such flora as well as fauna is very rich. Tripura has warm tropical climate. Temperatures are high in the valleys and cooler in the mountains. The monsoon results in an annual rainfall of over 200 Cm., mostly between June and September. Hot and humid climate is an ideal situation for survival propogation of helminth parasites in general.

Helminth parasites of vertebrate hosts of the state have not so far been studied proportionate to their importance to livestock, poultry, fishery and wild life. During 1969-73, and 1991, Tripura was surveyed on four occasions by the departmental Survey parties to explore its mammalian and avifauna. The present author was one of the party member of those surveys. As a result a collection of nematode parasites was obtained from the collected hosts. The collection though small, has produced a number of properly authenticated records of nematodes from the state of Tripura.

The present work was undertaken as a part of the Programme initiated by the Zoological Survey of India to assess the faunal richness of the State.

The study is mainly based on the aforesaid collected specimens.

This comprises 60 species, contained in 47 genera, 26 families and 5 orders of which 14 species and one genus are new to Science. Most of the remaining species are fairly known in India. Keys for the subfamilies, genera, subgenera and species are provided. The classification followed for higher taxa is more or less based on CIH keys. It also includes a host parasite list.

All measurements are in millimeters.

MATERIAL AND METHOD

Nematodes from vertebrate hosts were collected for the present study during Survey work from 1969-1973, on three occasions and once in 1991, undertaken for this work. Hosts were either purchased from the market or animal collectors or collected in the field by shooting, trapping, netting etc. Standard methods were followed in fixing and processing the parasites for examination. During study the specimens were cleared either in Creosote (Beech wood) or Lactophenol. Before restoring them into 70% glycerinealcohol, they were washed a few minutes in 70% acid alcohol, to prevent their darkening. In the case of delicate and small specimens glycerine was used as clearing agent.

LIST OF PARASITIC NEMATODE OF VERTEBRATE HOSTS RECORDED FROM TRIPURA

Class	NEMATODA
Subclass I	ADENOPHOREA
I. Order	ENOPLIDA

Superfamily	TRICHINELLOIDEA	Genus 6	<i>Contracaecum</i> Railliet & Henry, 1912
1. Family	TRICHURIDAE (Ransom, 1911) Railliet, 1915		<i>C. tricuspe</i> (Gedoelst, 1916) Baylis, 1920
Subfamily	CAPILLARIINAE Railliet, 1915	Superfamily (2)	COSMOCERCOIDEA
Genus 1	<i>Capillaria</i> Zeder, 1800	4. Family	COSMOCERCIDAE (Railliet, 1916 Subfam.) Travassos, 1925
	<i>C. columbae</i> (Rudolphi, 1819) Travassos, 1915	Subfamily	COSMOCERCINAE Railliet, 1916
Subfamily	TRICHURINAE Ransom, 1911	Genus 7	<i>Oxysomatium</i> Railliet & Henry, 1916
Genus 2	<i>Trichuris</i> Roederer, 1761		<i>O. macintoshii</i> (Stewart, 1914) Karve, 1927
	<i>T. trichiura</i> (Linnaeus, 1771) Stiles, 1901	Genus 8	<i>Aplectana</i> Railliet & Henry, 1916 <i>Aplectana</i> sp.
	<i>T. ovis</i> (Abildgaard, 1795) Smith, 1908	5. Family	ATRACTIDAE (Railliet, 1917 subfam.) Travassos, 1919
	<i>T. globulosa</i> (V. Linstow, 1901) Ransom, 1911	Genus 9	<i>Monhysterides</i> Baylis & Daubney, 1922
Subclass II	SECERNENTEA		<i>Monhysterides</i> sp.
II. Order	ASCARIDIDA	Superfamily (3)	HETERAKOIDEA
Superfamily (1)	ASCARIDOIDEA	6. Family	ASCARIDIIDAE Travassos, 1919.
2. Family	ASCARIDIDAE Baird, 1853	Genus 10.	<i>Ascaridia</i> Dujardin, 1845
Subfamily	ASCARIDINAE (Baird, 1853) Hartwich, 1974		<i>A. galli</i> (Schrank, 1788) Freeborn, 1923
Genus 3	<i>Ascaris</i> Linnaeus, 1758		<i>A. columbae</i> (Gmelin, 1970) Travassos, 1913
	<i>A. lumbricoides</i> Linnaeus, 1758		<i>A. circularis</i> (V. Linstow, 1903) Railliet & Henry 1914
Subfamily	TOXOCARINAE (Hartwich, 1954) Osche, 1958	7. Family	HETERAKIDAE Railliet & Henry 1912
Genus 4	<i>Toxocara</i> Stiles, 1905	Subfamily	HETERAKINAE Railliet & Henry 1912
	<i>T. canis</i> (Werner, 1782) Stiles, 1905	Genus 11.	<i>Heterakis</i> Dujardin, 1845
Genus 5	<i>Porrocaecum</i> Railliet & Henry, 1912		<i>H. gallinae</i> (Gmelin, 1790) Freeborn, 1923
	<i>P. ardeae</i> (Frolich, 1802) Baylis, 1936	Subfamily	METETERAKINAE Inglis, 1967
3. Family	ANISAKIDAE (Railliet & Henry, 1912 Subfam.) Skrjabin & Karokhin, 1945	Genus 12.	<i>Meteterakis</i> Karva, 1930
Subfamily	ANISAKINAE Railliet & Henry, 1912		<i>M. tripurae</i> n. sp.
			<i>M. govindi</i> Karve, 1930

- Superfamily (4) SUBULUROIDEA
8. Family SUBULURIDAE
(Travassos, 1914) Yorke & Maplestone, 1926
- Subfamily SUBULURINAE
Travassos, 1914
- Genus 13. *Subulura* Molin, 1860
- Subgenus *Subulura* Molin, 1860
S. (S.) glloperdicis Baylis & Daubney, 1922
- III. Order OXYURIDA
- Superfamily (1) OXYUROIDEA
9. Family PHARYNGODONIDAE
Travassos, 1919
- Genus 14. *Pharyngodon* Diesing, 1861
P. tripurensis n. sp.
- Genus 15. *Thelandros* Wedl, 1861
Thelandros sp.
10. Family OXYURIDAE Cobbold, 1864
- Genus 16. *Enterobius* Leach, 1853
E. vermicularis (Linnaeus 1758) Leach, 1853
- IV. Order SPIRURIDA
- Superfamily (1) CAMALLANOIDEA
11. Family CAMALLANIDAE
Railliet & Henry, 1915
- Subfamily CAMALLANINAE Yeh, 1960
- Genus 17. *Camallanus* Railliet & Henry 1915
C. anabantis Pearse, 1933
- Genus 18. *Camallanides* Baylis & Daubney, 1922
C. prashadi Baylis & Daubney, 1922
- Genus 19. *Paracamallanus* Yorke & Maplestone, 1926
P. singhi (Ali, 1957)
Campana Rouget, 1961.
- Genus 20. *Spirocamallanus* Olsen, 1952
S. gubernaculus (Khera, 1956) Soota, 1983
- Superfamily (2) GNATHOSTOMATOIDEA
12. Family GNATHOSTOMATIDAE
Railliet, 1895
- Subfamily GNATHOSTOMATINAE
(Railliet, 1895 fam.) Baylis & Lane, 1920
- Genus 21. *Tanqua* Blanchard, 1904
T. anomala (V. Linstow, 1904) Baylis, 1916
- Superfamily (3) PHYSALOPTEROIDEA
13. Family PHYSALOPTERIDAE
(Railliet, 1895 subfam.) Leiper, 1908.
- Subfamily THUBUNAEINAE
(Sobolev, 1949 tribe) Chabaud, 1975
- Genus 22. *Thubunaea* Seurat, 1914
T. tulshidasi n. sp.
- Subfamily PHYSALOPTERINAE
Railliet, 1893
- Genus 23. *Physaloptera* Rudolphi, 1819
Physaloptera sp.
- Superfamily (4) SPIRUROIDEA
14. Family SPIROCERCIDAE
(Chitwood & Wehr, 1932, Subfam.) Chabaud, 1975
- Subfamily ASCAROPSINAE Alicata & McIntosh, 1933
- Genus 24. *Streptopharagus* Balanc, 1912
S. pigmentus (V. Linstow, 1897) Railliet & Henry, 1918
- Subfamily SPIROCERCINAE
Chitwood & Wehr, 1932.
- Genus 25. *Cylicospirura* Vevers, 1922

- Subgenus *Gastronodus* (Singh, 1934 gen.) Chabaud, 1975.
C. (G.) strassenii (Singh, 1934) Chabaud, 1975
- Superfamily (5) HABRONEMATOIDEA
15. Family HABRONEMATIDAE (Chitwood & Wehr, 1932) Invaschkin, 1961.
- Subfamily HABRONEMATINAE Chitwood & Wehr, 1932
- Genus 26. *Harbronema* Diesing, 1861
H. otusi n. sp.
H. tripurensis n. sp.
- Subfamily HISTOCEPHALINAE Gendre, 1922
- Genus 27. *Viguiera* Seurat, 1913
V. bossicauda n. sp.
- Superfamily (6) ACUARIOIDEA
16. Family ACUARIIDAE (Railliet, Henry & Sisoff, 1912 Subfam.) Chabaud, 1975
- Subfamily ACUARIINAE Railliet, Henry & Sisoff, 1912
- Genus 28 *Synhimantus* Railliet, Henry & Sisoff, 1912
- Subgenus *Synhimantus* Railliet, Henry & Sisoff, 1912
S. (S.) owleti n. sp.
- Genus 29 *Acuaria* Bremser, 1811
Acuaria sp.
- Genus 30 *Echinuria* Soloviev, 1912
Echinuria sp.
- Subfamily SCHISTOROPHINAE Travassos, 1918
- Genus 31 *Scistorophus* Railliet, 1916
Scistorophus sp.
- Subfamily SEURATIINAE Chitwood & Wehr, 1932
- Genus 32 *Rusguniella* Seurat, 1919
Rusguniella sp.
- Superfamily (7) DIPLOTRIAENOIDEA
17. Family DIPLOTRIAENIDAE (Skrjabin, 1916 Subfam.) Anderson, 1958
- Subfamily DIPLOTRIAENINAE Skrjabin, 1916
- Genus 33. *Diplotriaena* Railliet & Henry, 1909
D. tricuspis (Fedchenko, 1874) Seurat, 1915
D. nagpurensis Karve, 1934
- Subfamily DICHEILONEMATINAE Wehr, 1935
- Genus 34 *Hamatospiculum* Skrjabin, 1916
Hamatospiculum sp.
- Superfamily (8) APROCTOIDEA
18. Family APROCTIDAE (Yorke & Maplestone, 1926 Subfam.) Skrjabin & Schikhobalova, 1945
- Subfamily APROCTINAE Yorke & Maplestone, 1926
- Genus 35 *Squamofilaria* Schmerling, 1925
S. glaucidiumae n.sp.
Squamofilaria sp.
Squamofilaria sp.
- Genus 36 *Pseudaprocta* Schikhobalova, 1930
P. indica n. sp.
- Superfamily (9) FILARIOIDEA
19. Family FILARIIDAE (Weinland, 1858) Cobbold, 1879
- Subfamily FILARIINAE Weinland, 1858

Genus 37	<i>Filaria</i> Muller, 1787	Subfamily	OESOPHAGOSTOMINAE
	<i>F. martis</i> Gemlin, 1790		Railliet, 1916
20. Family	ONCHOCERCIDAE	Genus 44	<i>Oesophagostomum</i> Molin, 1861
Subfamily	ONCHOCERCINAE Leiper, 1911	Subgenus	<i>Hysteracrum</i> Railliet & Henry, 1913
Genus 38	<i>Callosciurofilaria</i> n.g.		<i>O. (H.) asperum</i> Railliet & Henry, 1913
	<i>C. agarwali</i> n. sp.	Subgenus	<i>Proteracrum</i> Railliet & Henry, 1913
Subfamily	SPLENDIDOFILARIINAE Chabaud & Choquet, 1953		<i>O. (P.) columbianum</i> (Curtice, 1890) Railliet & Henry, 1913
Genus 39	<i>Chandlerella</i> Yorke and Maplestone, 1926	Subgenus	<i>Conoweberia</i> Ihle, 1922
	<i>C. tripuræ</i> n. sp.		<i>O. (C.) blanchardi</i> Travassos & Vogelsang, 1932
	<i>C. oriolæ</i> n. sp.		<i>O. (C.) tridentatum</i> (Maplestone, 1932)
Genus 40	<i>Paraprocta</i> Maplestone, 1931	Superfamily (3)	TRICHOSTRONGYLOIDEA
	<i>P. passericola</i> n. sp.	24. Family	HELIGMOSOMIDAE (Travassos, 1914 Subfam.) Cram, 1927
Subfamily	Lemdaninae Lopez-Neyra, 1956	Genus 45	<i>Longistriata</i> Schulz, 1926
Genus 41	<i>Lemdana</i> Seurat, 1917		<i>L. tripurensis</i> n. sp.
	<i>Lemdana</i> sp.	25. Family	MOLINEIDAE (Skrjabin & Schulz, 1937 Subfam.) Durette-Desset & Chabaud, 1977
Superfamily (10)	RICTULARIOIDEA	Subfamily	MOLINEINAE Skrjabin & Schulz, 1937
21. Family	RICTULARIIDAE (Hall, 1915 Subfam.) Railliet, 1916	Genus 46	<i>Oswaldocruzia</i> Travassos, 1917
Genus 42	<i>Rictularia</i> Froelich, 1802		<i>O. gaezei</i> Skrjabin & Schulz, 1952
	<i>Rictularia</i> sp.	Superfamily (4)	METASTRONGYLOIDEA
V. Order	STRONGYLIDA	26. Family	ANGIOSTRONGYLIDAE (Boehm & Gebauer 1934 Subfam.) Anderson, 1978
Superfamily (1)	ANCYLOSTOMATOIDEA	Genus 47	<i>Pulmostrongylus</i> Hsu, 1935
22. Family	ANCYLOSTOMATIDAE (Looss, 1905)		<i>P. palustris</i> (Soota and Chaturvedi, 1970)
Genus 43	<i>Ancylostoma</i> (Dubini 1843) Creplin, 1845		
Subgenus	<i>Ancylostoma</i> Lane, 1916		
	<i>A. (A.) caninum</i> (Ercolani, 1859) Lane, 1916		
Superfamily (2)	STRONGYLOIDEA		
23. Family	CHABERTIIDAE (Popova, 1952 Subfam.) Lichtenfels, 1980		

Host Parasite List

Host	Habitat	Parasites
Mammalia		
Family CERCOPITHEIDAE		
1. <i>Macaca m. mulata</i>	Intestine	1. <i>Trichuris trichiura</i> 2. <i>Streptopharagus pigmentus</i> 3. <i>Physaloptera</i> sp. 4. <i>Oesophagostomum</i> (<i>Conoweberia</i>) <i>tridentatum</i>
Family PONGIDAE		
<i>Hylobates hoolock</i>	Intestine, Stomach	1. <i>Trichuris trichiura</i> 2. <i>Oesophagostomum</i> (<i>Conoweberia</i>) <i>blanchardi</i>
Family HOMINIDAE		
Man	Stomach, Intestine	1. <i>Ascaris lumbricoides</i> 2. <i>Enterobius vermicularis</i>
Family SCIURIDAE		
<i>Callosciurus pygerythrus blithi</i>	Stomach. Abdominal cavity	1. <i>Ascaris lumbricoides</i> 2. <i>Callosciurofilaria agarwali</i> ng., n.sp.
<i>Callosciurus erythracus punctatissimus</i>	Intestine	1. <i>Longistriata tripurensis</i> n.sp. 2. <i>Rictularia</i> sp.
Family CANIDAE		
Dog (Domestic)	Intestine	<i>Toxocara canis</i>
<i>Canis aureus</i>	Intestine	<i>Ancylostoma</i> (A.) <i>caninum</i>
Family VIVIRRIDAE		
<i>Herpestes auropunctatus birmanicus</i>	Subcutaneous tissue. Body cavity	1. <i>Filaria martis</i> 2. <i>Pulmostrongylus plustris</i>
Family SORICIDAE		
<i>Suncus murinus</i>	Stomach nodules	<i>Cylicospirura</i> (<i>Gastronodus</i>) <i>strassenii</i>
Family BOVIDAE		
Goat (Domestic)	Intestine	1. <i>Trichuris ovis</i> 2. <i>T. globulosa</i> 3. <i>Oesophagostomum</i> (<i>Hysteracrum</i>) <i>asperum</i> 4. <i>O. (Proteracrum) columbianum</i>

Host	Habitat	Parasites
Aves		
Family ARDEIDAE		
<i>Ardeola grayii</i>	Intestine	<i>Porrocaecum ardae</i>
<i>Bubulcus ibis</i>	Intestine	<i>Contracaecum tricuspe</i>
Family PHASIANIDAE		
Fowl (Domestic)	Intestine	1. <i>Ascaridia galli</i> 2. <i>Heterakis gallinae</i>
Family COLUMBIDAE		
Pigeon (Domestic)	Intestine	<i>Capillaria columbae</i>
<i>Teron phoenicoptera</i>	Intestine	1. <i>Ascaridia columbae</i>
	Body cavity	2. <i>Lemdana</i> sp.
Family STRIGIDAE		
<i>Otus bakkamoena</i>	Body cavity	1. <i>Squamofilaria</i> sp.
	Intestine	2. <i>Subulura</i> (S.) <i>galloperdicis</i>
	Gizzard	3. <i>Habronema otusi</i> n. sp.
	Oesophagus and ventriculus	4. <i>Synhimantus</i> (S.) <i>owleti</i> n. sp.
<i>Glaucidium cuculoides</i>	Body cavity	1. <i>Squamofilaria glaucidiumae</i> n. sp.
	Gizzard	2. <i>Habronema tripurensis</i> n. sp.
<i>Athena brama</i>	Gizzard	<i>Echinuria</i> sp.
Family POLOCEIDAE		
<i>Passer domesticus</i>	Body cavity	<i>Paraprocta passericola</i> n. sp.
Family ORIOLIDAE		
<i>Oriolus xanthornus</i>	Ovary	<i>Chandlerella oriolae</i> n. sp.
Family DICRURIDAE		
<i>Dicrurus remifer</i>	Body cavity	<i>Pseudaprocta indica</i> n. sp.
<i>Dicrurus paradiseus</i>	Body cavity	<i>Hamatospiculum</i> sp.
<i>Dicrurus hottentotus</i>	Gizzard	1. <i>Viguiera bossicauda</i> n. sp. 2. <i>Acuaria</i> sp.
Family MUCICAPIDAE		
<i>Copsychus saularis</i>	Thorasic cavity	<i>Squamofilaria</i> sp.
Family ALCEDINIDAE		
<i>Alcedo atthis</i>	Gizzard	<i>Schistorophus</i> sp.
<i>Halcyon smyrenensis</i>	Gizzard	<i>Rusguniella</i> sp.

Host	Habitat	Parasites
Family STURNIDAE		
<i>Acridotheres fuscus</i>	Body cavity	<i>Diplotriaena nagpurensis</i>
<i>Sturnus contra</i>	1. Body cavity 2. Heart	1. <i>Diplotriaena tricuspis</i> 2. <i>Chandlerella tripurae</i> n. sp.
Family CAMPEPHAGIDAE		
<i>Coracina novaehollandiae</i>	Body cavity	<i>Diplotriaena tricuspis</i>
Family CUCULIDAE		
<i>Centropus sinensis</i>	Intestine	<i>Ascaridia circularis</i>
Reptilia		
Family GEKKONIDAE		
<i>Gekko gekko</i>	Intestine	1. <i>Thubunae tulshidasi</i> n. sp. 2. <i>Pharyngodon tripurensis</i> n. sp. 3. <i>Aplectna</i> sp. 4. <i>Thalandros</i> sp.
Family COLUBRIDAE		
<i>Xenochrophis piscator</i>	Intestine	<i>Camallanides prashadi</i>
<i>Enhydris</i> sp.	Intestine	<i>Tanqua anomala</i>
Family TESTUDINIDAE		
A turtle	Intestine	<i>Monhysterides</i> sp.
Amphibia		
Family RANIDAE		
<i>Rana cyanophlyctis</i> , <i>Rana</i> sp.	Intestine	<i>Oxysomatium macintoshii</i>
Family BUFONIDAE		
<i>Bufo melanostictus</i>	Intestine and rectum	1. <i>Meteterakis tripurae</i> n. sp. 2. <i>M. govindi</i> 3. <i>Oxysomatium macintoshii</i> 4. <i>Oswaldocruza gozei</i>
Fishes		
Family NOTOPTERIDAE		
<i>Notopterus notopterus</i>	Intestine	<i>Spirocamallanus gubernaculus</i>
Family CHANNIDAE		
<i>Channa striatus</i>	Intestine	<i>Paracamallanus singhi</i>
Family ANABANTIDAE		
<i>Anabus testudineus</i>	Intestine	<i>Camallanus anabntis</i>

- Class NEMATODA
I. Sub Class ADENOPHOREA
1. Order ENOPLIDA
Superfamily TRICHINELLOIDEA
Family TRICHURIDAE (Ransom, 1911) Railliet, 1915

Key to Subfamilies

Cloaca with thin muscular wall anterior and posterior to point of entry of spicule. Body usually filiform, but oesophageal region markedly expanded.

Parasites of skin, spleen, intestine, respiratory and excretory system of vertebrates
.....CAPILLARIINAE

Cloaca with thick muscular wall anterior to point of entry of spicule. Anterior region of body filiform but posterior part markedly thicken.

Parasites of large intestine of mammals.....
.....TRICHURINAE

Subfamily CAPILLARIINAE Railliet, 1915

Genus *Capillaria* Zeder, 1800

Capillaria columbae (Rudolphi, 1819)
Travassos, 1915

1819. *Trichosoma columbae* Rudolphi, *Entozoorum Synopsis*, Berlin : p 15.

1915. *Capillaria columbae* Travassos, *Mem. Inst. Osv. Cr.* 7(2) : p 159.

Material : Host : Pigeon, *Columba livia domestica*; Green Pigeon (*Teron phoenicoptera*); location : intestine; locality : Kanchanpur and Paratia; North and South District, Tripura.

Diagnosis : Male : Body 8.5-12.1 long, 0.025-0.065 wide; caudal end provided with a rounded bursa-like membrane supported by a pair of L-shaped processes, each with a terminal papilla; spicule tip bluntly rounded, 1.2-1.6 long; spicule sheath transversely wrinkled, but without spines.

Female : Body 10.5-19.5 long, 0.03-0.09 wide; tail bluntly rounded; vulva 0.06-0.19 from anterior end; eggs with polar plugs, (0.041-0.056 × 0.022-0.036) in diameter.

Distribution : Tripura : North and South Districts. Elsewhere : Cosmopolitan in distribution.

Subfamily Trichurinae Ransom, 1911

Genus *Trichuris* Roederer, 1761

Key to species

Parasites of Primates and Swine .*T. trichiura*

Parasites of ruminants 1

1. Spicules of male less than 3 mm long.....
.....*T. discolor*

Spicules more than 3 mm long 2

2. Spines on distal expansion of everted spicule sheath shorter than rest. Vagina long, slender and sinuous, its lumen widening gradually ...
.....*T. ovis*

— Spines on distal expansion of everted spicule sheath longer than the rest. Vagina short and stout, its lumen forming angular bends expanding suddenly into an egg chamber..*T. globulosa*

1. *Trichuris trichiura* (Linnaeus, 1771)
Stiles, 1901

1771. *Ascaris trichiura* Linnacus, *Mantissa plantarum altera generum elitiones* VI. p. 543.

1901. *Trichuris trichiura* Stiles, *Texas Med. News* Austin, 10(9). p. 527.

Material : Host : Rhesus Macaque, (*Macaca mulata mulata*); location-intestine; locality-Ampi, South District, Tripura; 18.i.1971; Hoolock Gibbon, (*Hylobates hoolock*); location-intestine; locality-Ambasa, North District, Tripura; 1.ii.1971; Coll. V.C. Agarwal.

Diagnosis : Male : Body 30-48 long, 0.45-0.65; slender oesophageal portion about two thirds to three-fifths of the total body length; spicule tip rounded or pointed, 2.0-3.35 long; spicule-sheath variable in shape when extruded, sometimes

cylindrical, sometimes expanded distally and may be partly or wholly covered with spines.

Female : Body 35-32 long, 0.5-0.85 wide; vulva not prominent; eggs (0.05-0.056 × 0.021-0.025) in diameter, almost colourless when laid dark brown, when seen in faeces.

Distribution : Tripura : North District. Elsewhere: India : Widely distributed; Cosmopolitan.

2. *Trichuris ovis* (Abildgaard, 1795) Smith, 1908

1795. *Trichocephalus ovis* Abildgaard, [n.v.]

1908. *Trichuris ovis* Smith, *Univ. Penn. Med. Bull.* 20(12) : p. 269.

Material : Host-domestic goat; location-intestine; locality-Paratia South District; 8.vii.1991; Pachartal, North District, Tripura; 16.vii.1991; coll. S.R. Dey Sarkar.

Diagnosis : Male : Body about 50-80 long, 0.5 wide; slender oesophageal portion about three quarters of the total length; spicule 4.9-7.2 long; thickened distally before tapering to a point; spicule-sheath when fully everted, globular expansion at its distal end, the whole sheath covered with small spines.

Female : Body 50-80 long, 1.0 wide; vulva prominent; vagina relatively long and slender; the lumen of the distal portion lined with fine spines for some distance and part of this spiny lining frequently everted at the vulva; eggs with polar plugs, and 0.07-0.08 × 0.03-0.042 in diameter with polar plugs.

Distribution : Tripura : North District. Elsewhere: India. Widely distributed; Cosmopolitan.

3. *Trichuris globulosa* (V. Linstow, 1901) Ransom, 1911

1901. *Trichocephalus globulosus* V. Linstow, *Arch. Mikr. Anat.*, 58(1) : p. 182.

1911. *Trichuris globulosa* Ransom, *U. S. Dept. Agric. Bureau Animal Industry, Bull.* (127) : 115-116.

Material : Host-domestic Goat; location-Caecum; locality-Pachartal, North District Tripura; 1.vii.1991; coll : S. R. Dey Sarkar.

Diagnosis : Male : Body 40-65 long, 0.71 wide; slender oesophageal portion about two thirds of the total body length; spicule pointed, 3.8-5.7 long; the spicule sheath when fully everted, globular expansion at the distal end; the sheath covered with spines, longer and more closely set than in *T. ovis*.

Female : Body 40-70 long, 0.87 wide; vulva prominent; vagina short, stout and muscular, the lumen of its distal portion lined with large, coarse spines; eggs with polar plugs, measure (0.068 × 0.036) in diameter with polar plugs.

Distribution : Tripura : North District. Elsewhere: India. Widely distributed; Cosmopolitan.

Subclass SECERNENTEA

2. Order ASCARIDIDA

Superfamily (1) ASCARIDOIDEA

Family ASCARIDIDAE Baird, 1853

Key to subfamilies

Oesophagus with globular to ellipsoidal posterior ventriculus.....TOXOCARINAE

Oesophagus without ventriculus ASCARIDINAE

Subfamily ASCARIDINAE (Baird, 1853) Hartwich 1974

Genus *Ascaris* Linnaeus, 1758

Ascaris lumbricoides Linnaeus 1758

1758. *Ascaris lumbricoides* Linnaeus, *Systema naturae per regnatia naturae Secundum Classes. Ordines. Genera Speces, Cum Characteribus differentilis Synonymis. Locis Edits decina, reformata*, Vol. I. p. 648.

Material : Host : Man; Irrawaddi Squirrel, *Calloscirus pygerythrus blythi*; location : Stomach, small intestine; locality; Teliamura, South District; 27.i.1971; Ambasa, North District; Tripura; 4.i.1973; coll : V. C. Agarwal.

Diagnosis : Head with three semicircular lips; dorsal lip with a pair of large double papillae on its outer surface; ventero lateral lips with one double papillae; interlabia absent.

Male : Body 150-250 longs; 3-5 wide; tail conical curved ventrally; caudal papillae 70-75 pairs, arranged irregularly, of these 5 pairs postanal, two interior most pair of postanal papillae having double terminations, and a large median papilla on the anterior lip of cloaca; spicules non-alate, tubular, short and stout about 2 long.

Female : Body 200-400 or even more long; tail short, straight and conical; vulva about anterior third of the body; egg oval, thick shelled.

Distribution : Tripura : South and North Districts.

Elsewhere : India : Widely distributed; Universal.

Subfamily TOXOCARINAE (Hartwich, 1954, fam.) Osche, 1958,

Key to genera

Interlabia absent. Intestinal caecum absent. Cervicalalae present. Lips without dentigerous ridges. Parasites of mammal (Carnivora and Elephants Toxocara

Interlabia present. Intestinal caecum present. Cervical alae absent. Lips with dentigerous ridges. Parasites of birds Porrocaecum

1. Genus *Toxocara* Stiles, 1905

Toxocara canis (Werner, 1782) Stiles, 1905

1782. *Lumbricus canis* Werner, *Vermium intestinalium brevis expositionis continuatio*, : 11-13 Lipsiae

1905. *Toxocara canis* Stiles, *U. S. Dept. Agric. Bur. Anim. Ind. Bull.* (79) : p. 150.

Material : Host : Domestic dog; location-intestine; locality-Pachartal, North Dist, : Tripura; 14.vii. 1991; coll. S. R. Dey Sarkar.

Diagnosis : Male : Body 50-95 long; anterior lobes of the pulp of the lips digitiform, tapering and convergent; oesophagus with a muscular bulb

posteriorly; cervical alae long and narrow, spicules about 0.75-1.0 long alate; tail with digitiform appendage

Female : Body 50-180 long; vulva towards anterior quarter of body; eggs with thin shells, measure about 0.075-0.08 in diameter

Distribution : Tripura : North District.

Elsewhere : India : Widely distributed; Cosmopolitan.

2. Genus *Porrocaecum* Railliet and Henry, 1912

Porrocaecum ardeae (Frolich, 1802) Baylis, 1936

1802. *Ascaris ardeae* Frolich, *Beitrage Zur Naturgeschichte der Eingewidewürmer Naturf.*, Halle, 29 : 44-45.

1036. *Porrocaecum ardeae* Baylis, *Fauna of British India, Nematoda*, Vol. I : 73-74.

Material : Host : Pond Heron, *Ardeola grayei*; location-intestine; locality-Ampi, West District, Tripura; 21.i.1971; Coll : S.R. Dey Sarkar.

Diagnosis : Male : Body 45 long, 0.9 wide; pulp of the dorsal lip with two bifurcated anterior lobes; interlabia relatively large; a pair of lateral alae extending throughout the length of the body; oesophagus 3.0 long, the ventriculus about 0.4 and the intestinal caecum 3.0 long; tail with digitiform prolongation; 5 pairs of papillae on it; in addition 15 pairs of preanal and one pair of double postanal papillae; spicules equal, alated, about 1.2 long; gubernaculum absent.

Female : Body 150 long, 3.0 wide; vulva pre-equatorial; eggs (0.1 × 0.078) in diameter, the outer surface reticulated.

Distribution : Tripura : West District.

Elsewhere : India : Widely distributed; Europe; South America (Brazil); North America and Africa (Transval).

Family ANISAKIDAE (Railliet & Henry, 1912 Subfam.)
Skrjabin & Karokhin, 1945

Subfamily Anisakinae Railliet & Henry, 1912

Genus *Contracaecum* Railliet & Henry, 1912

Contracaecum tricuspe (Geddoelst, 1916)

Baylis, 1920

1916. *Kathleena tricuspis* Geddoelst, *Rev. Zool. Africana* (Bruxelles), 5(1) : 1-90

1920. *Contracaecum tricuspe* Baylis, *Parasitol*, 12 : 253-264.

Material : One male, one female, Z.S.I. Reg. No. WN743; host-Cattle Egret, *Bubulcus ibis*; location-intestine; locality-Teliamura, West District, Tripura; coll-V.C. Agrawal; 30.i.1971.

Diagnosis : Male : Body 13.8 long, 0.78 wide, interlabia with transverse process; 52 pairs of caudal papillae discernible; spicules equal, 4.5 long.

Female : Body 20.5 long, 0.98 wide; tail with a pair of papillae; vulva at 2/5th of body.

Distribution : Tripura, West District. Elsewhere: India : Bihar, Meghalaya, West Bengal; Africa; Australia.

Superfamily (2) COSMOCERCOIDEA

Family COSMOCERCIDAE
(Railliet, 1916 Subfam.)
Travassos, 1925

Subfamily Cosmocercinae Railliet, 1916

Key to genera

1. Gubernaculum present. Prodelphic. Female tail conical and pointed *Aplectana*
- Gubernaculum present or absent. Amphidelphic. Female tail tapering to a fine point *Oxysomatium*

1. Genus *Oxysomatium* Railliet and Henry, 1916

Oxysomatium macintoshii (Stewart, 1914)
Karve, 1927

1914. *Oxysoma macintoshii* Stewart, *Rec. Indian Mus. Calcutta*, 10 : 165-168.

1927. *Oxysomatium macintoshii* Karve, *Ann. and Mag. Nat. Hist.*, 20(9) : 620-628.

Material : Several examples; Z.S.I. Reg. Nos. WN 744 to WN 747; hosts-Toad, *Bufo melanostictus*; Frog, *Rana cyanoflyctis*; location-intestine and rectum; locality-Partia, South District; Pachartal, and Manu, North District, Tripura, 9.vii.91; 16.vii.91, 18.vii.91 and 20.vii.91; Coll. S. R. Dey Sarkar.

Diagnosis : Male : Body 2-2.5 long; lateral alae extended almost throughout the body; spicules equal, about 0.24 long; gubernaculum 0.022 long; caudal papillae simple, 27 pairs, 18 pairs postanal and 9 pairs preanal.

Female : Body 3-6 long; vulva at about middle of the body; tail narrow 0.35-0.41 long; eggs (0.3-0.338 × 0.186-0.226) in diameter; viviparous.

Distribution : Tripura : North, South and West Districts. Elsewhere : India : widely distributed; China; Myanmar; Africa; Tanganyika, Niger Valley.

2. Genus *Aplectana* Railliet and Henry, 1916
Aplectana sp.

Material : 2 examples females; Z.S.I. Reg. No. WN 748; host-*Gekko gecko*; location-rectum; locality-Pachartal, North District, Tripura; 13.vii.91; coll. S. R. Dey Sarkar.

Diagnosis : Female : Body 9.76-8.8 long; 0.56-0.55 wide; oesophagus including bulb 1.55-1.56 long; bulb (0.25-0.24 × 0.21-0.22) in diameter; excretory pore 0.74-0.8 from anterior end; vulva prominent 3.84-4.16 from anterior end; tail 0.37-0.43 long, pointed; eggs (0.064-0.8 × 0.32) in diameter.

Remarks : In the absence of male specific identification is not possible. It appears that the incidence of infection by this genus is totally insignificant.

2. Family ATRACTIDAE (Railliet, 1917 Subfam.) Travassos, 1919

Genus *Monhysterides* Baylis and Daubney, 1922

Monhysterides sp.

Material : One immature female; Z.S.I. Reg. No. WN 749; host-a turtle; location-intestine; locality-Teliamura, West District, Tripura; 2.i.1991; Coll. R. K. Ghose.

Diagnosis : Female : Body 3.6 long, 0.15 wide; oesophagus divided into two parts, anterior short, muscular; posterior long granular but also muscular; tail tapering, 0.5 long; vulva 0.42 from anus.

Remarks : In the absence of male, specific identification is not possible. It may be noted that the incidence of infection by this genus appears totally insignificant.

Superfamily (3) HETERAKOIDEA

Family ASCARIDIIDAE
Travassos, 1919

Genus *Ascaridia* Dujardin, 1845

Key to species

1. Spicules equal 2
Spicules subequal*A. galli*
2. Male caudal papillae 8 pairs*A. circularis*
Male caudal papillae 14 pairs ...*A. columbae*

1. *Ascaridia galli* (Schränk, 1788) Freeborn, 1923

1788. *Ascaris galli* Schränk, *Verzeichnis der bisher hinlanglich, etc. Munchen*, p. 9.

1923. *Ascaridia galli* Freeborn, *Science*, N. T. [new series] 57 : 692-693.

Material : Several males and females, Z.S.I. Reg. No. WN 750; host-Domestic fowl; location-intestine; locality-Ampi, West District; 23.i.1971; Ambasa, North District; Tripura; 25.vii.1991; Coll. S.R. Dey Sarkar.

Diagnosis : Male Body 30-75 long, 0.45-1.2 wide; tail 0.45-0.85 long; preanal sucker 0.2-0.24 from cloaca; caudal alae narrow; caudal papillae 10 pairs, variable in number and position, spicule subequal 1.0-1.5 long.

Female : Body 50-120 long. 0.8-1.85 wide; tail 1.78 long; vulva at about middle of the body; eggs 0.065-0.088 × 0.04-0.05 in diameter.

Remarks : The incidence of infection in the host is high, is shown by the fact that all the four hosts examined, found infected by these parasites.

Distribution : Tripura; North and West District. Elsewhere : India widely distributed; Cosmopolitan.

2. *Ascaridia columbae* (Gmelin, 1790)

Travassos, 1913

1790. *Ascaris columbae* Gmelin, *Systema naturae & C. Editio decimaterlia* pt. 6. p. 3034.

1913. *Ascaridia columbae* Travassos, *Mem. Inst. Oswaldo Cruz, Rio de Janeiro* Manguinhos, 5 : 291-292.

Material : Eight examples, males and females; Z.S.I. Reg. No. WN 751; host-Green Pigeon, *Teron phoenicoptera*; location-intestine; locality-Kanchanpur, North District; 14.ii.1971; Coll. S.R. Dey Sarkar.

Diagnosis : Male : Body 12.96-30.0 long, 0.9-1.04 wide; numerous rounded or oval vesicular bodies present; cuticular striation prominent; lateral alae present in the cervical region only; sucker 0.16 from the cloaca; caudal alae narrow; caudal papillae 15 pairs, 9 preanal and 6 postanal; spicules equal, 1.3 to 1.6 long; tail 0.48 long, pointed.

Female : Body 30.0-40.8 long, 0.96-1.04 wide; tail conical, with a terminal spike, 1.04-1.1 long; vulva about 21.04 from anterior end; eggs 0.66-0.09 × 0.04-0.05 in diameter.

Distribution : Tripura : North District. Elsewhere: India : Widely distributed; Cosmopolitan.

3. *Ascaridia circularis* (Linstow, 1903)

Railliet and Henry, 1914

1903. *Heterakis circularis* Linstow, *Arch. f. microk Anatomie*, 62, p. 110.

1914. *Ascaridia circularis* Railliet and Henry, 9 *Cong. internat. de Zool.*, Rennes (Monaco, 1913) p. 6782.

Material : One subadult male, two juvenile females; Z.S.I. Reg. No. WN 752; host: Crow Pheasant, *Centropus sinensis*; location-intestine; locality-Rajnagar, South District, Tripura; 27.xii.1969; Coll. V.C. Agarwal.

Diagnosis : Cuticle with deep transverse striations; mouth encircled by three semicircular lips; dorsal lip with two papillae; tail conical pointed in both sexes.

Male : Body 12.8 long, 0.35 wide; oesophagus 1.25 long; preanal sucker round, 0.35 from the cloaca; spicule equal, rounded tip, 0.72 long; caudal papillae 8 pairs, 3 preanal, 5 postanal; caudal alae narrow.

Female : Body 20.0 long, 0.8 wide; vulva anterior to mid body.

Distribution : Tripura : South District. Elsewhere: Thailand.

2. Family HETERAKIDAE Railliet & Henry, 1912

Key to subfamilies

1. Interlabia present. Caudal alae well developed, supported by long, narrow papillae. Few sessile papillae on tail. Parasites mainly of birds, rarely mammals Heterakinae

Interlabia absent. Caudal alae supported by few pairs of large fleshy papillae. Many sessile papillae on tail. Parasites of amphibians, reptiles and mammals Meteterakinae

Subfamily HETERAKINAE Railliet & Henry, 1912

Genus *Heterakis* Dujardin, 1845

Heterakis gallinae (Gmelin, 1790) Freeborn, 1923

1790. *Ascaris gallinae* Gmelin, *Caroli a Linne. System naturae* & C. *Editio decima tertia* pt. 6. p. 3034

1923. *Heterakis gallinae* Freeborn, *Nicotine as a poultry vermifuge*. Science N. Y. new Ser., 57 : 692-693.

Material : Several examples; host-Domestic fowl; location-intestine; locality-Ampi, West District; 23. i. 1971; Ambasa, North District, Tripura; 25. vii. 1991; Coll. S. R. Dey Sarkar.

Diagnosis : Male : Body 7-12 long, 0.24-0.35 wide; caudal alae broad; tail about 0.3-0.5 long; preanal sucker well developed 0.1-0.2 from the cloaca; caudal papillae 12 pairs, 4 pairs,

between the cloaca and tail tip, 4 pairs pedunculated and 2 pairs sessile papillae near the cloaca and 2 pairs pedunculated papillae near the sucker; spicules unequal, dissimilar, right 0.6-1.3 long with narrow alae, and a simple conical tip, left 0.6-1.3 long with broad alae and double curve.

Female : Body 8.0-15.0 long; tail tapering and pointed, 1-12 long, with a pair of minute papillae; vulva 3.7-4.75 from posterior end; eggs 0.063-0.75x0.036-0.48 in diameter.

Distribution : Tripura : West and North District.

Elsewhere : India : widely distributed; Cosmopolitan.

Subfamily METETERAKINAE Inglis 1967

Genus *Meteterakis* Karve, 1930

Key to species

Spicules of male tapering and delicate distally, 0.27 long.....*M. govindi*

Spicule of male alate massive and not delicate distally, 0.4 long*M. tripurae* n.sp.

1. *Meteterakis tripurae* n. sp

Material : Holotype one male, Z. S. I. Reg. No. WN 753; host-Toad, *Bufo melanostictus*; location-intestine; locality-Manu, North District, Tripura, 21.vii. 1991; Coll. S. R. Dey Sarkar.

Paratypes-two males, one female. Z. S. I. Reg. No. WN 754; other particulars as for holotype.

Description : Head without cordons, mouth with three lips; cuticle with narrow lateral alae; oesophagus with a posterior bulb; male tail ended in a sharp point; caudal alae well developed, supported by pedunculated papillae; spicules, equal, massive; gubernaculum mass not traceable; female tail conical, pointed, vulva prominent, preequatorial in position.

Male : Body 4.27-5.47 long, 0.26-0.32 wide; nerve ring 0.08-0.12 and excretory pore 0.51-0.56 from the anterior end; oesophagus with bulb 0.75-0.8 long; bulb (0.112-0.144) × (0.128-0.16) in diameter; preanal sucker 0.064 away from the

cloaca; spicules two, equal, alate and massive, rounded tip 0.35-0.4 long; papillae 18 pairs, presuctorial four pairs, suctorial three pairs, postsuctorial one pair, adanal two pairs and postanal eight pairs clearly discernible. Tail 0.192-0.208 long, tip pointed, caudal alae well developed.

Female : Body 5.6 long, 0.35 wide; excretory pore 0.72 from anterior end; oesophagus with bulb 0.83 long, bulb (0.96 × 0.096) in diameter; vulva prominent, 2.4 away from anterior end; tail conical, pointed, 0.32 long, without papillae; eggs (0.048 × 0.032) in diameter.

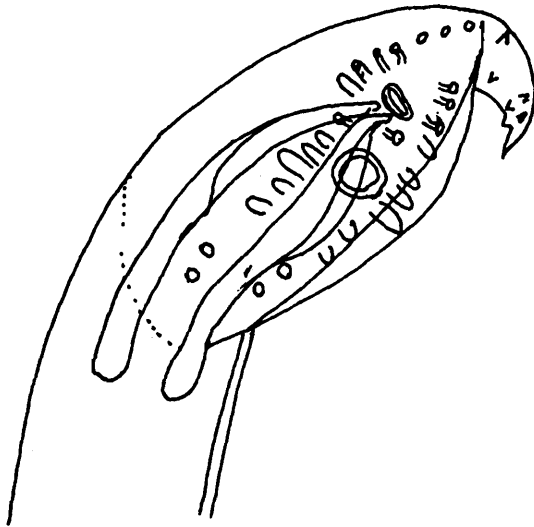


Fig. 1. *Meteterakis tripurae* n. sp. Male posterior end.

Discussion: The present species comes closest to *Meteterakis govindi* Karve, 1930 and *M. japonica* (Wilkie, 1930) Inglis, 1957, but differs from the first species in various body measurements; in having bigger, and massive spicules. It differs from *M. japonica* (Wilkie, 1930) in various body measurements; in possessing smaller spicules and in number and arrangement of caudal papillae.

It also comes close to *M. andamanensis* Soota and Chaturvedi, 1972, in having massive spicules but differs from it in number and arrangement of caudal papillae and also in various body measurements.

2. *Meteterakis govindi* Karve, 1930

1930. *Meteterakis govindi* Karve, *Ann. Trop. Med. & Parasitol.*, Liverpool, 24. : 481-485

Material : One male, one female, Z. S. I. Reg. No. WN.755; host-Toad, *Bufo melanostictus*; location-intestine; locality Manu, North District Tripura; 18. vii. 1991; Coll. S. R. Dey Sarkar; 4 males, 6 females Z. S. I. Reg. No. WN.756; host-*Rana* sp.; 20.vii. 1991; other particulars as above.

Diagnosis : Male : Body 5-5.4 long, 0.23 wide; lateral alae present; tail 0.17-0.2 long; caudal alae well developed; preanal sucker present, 0.07 from cloaca; caudal papillae 17 pairs; spicules equal, similar, tapering and very delicate distally, about 0.27 long.

Female : Body 4.6-6.0 long, 0.25-0.3 wide; tail with a pair of papillae, 0.26-0.34 long, tapering and pointed; vulva 2.2-2.8 from anterior end, eggs 0.075 × 0.043 in diameter.

Distribution : Tripura, North District.

Elsewhere : India : widely distributed; Maynamar, Rangoon; Bangladesh, Dhaka; China.

Superfamily (4) SUBULUROIDEA

Family SUBULURIDAE
(Travassos, 1914) Yorke
and Maplestone, 1926

Subfamily Subulurinae Travassos, 1914

Genus *Subulura* Molin, 1860

Subgenus *Subulura* Molin, 1860

Subulura (Subulura) galloperdicis Baylis
and Daubney, 1922

1922. *Subulura galloperdicis* Baylis and Baubney, *Mem. Indian Museum.*, Calcutta, 7 : 300-302

Material : Two males, one female, Z. S. I. Reg. No. WN 757; host-Owl, *Otus bakkamoena*; location-intestine; locality-Bishalgarh, West District : 20. ii. 1969; coll. Dr. V. C. Agrawal; four males, one female and two fragments of female, Z. S. I. Reg. No. WN 758; host-*Otus bakkamoena*; location- Caecum; locality-Kanchanpur, North. District : Tripura; 17.ii. 1971; Coll. Dr. V. C. Agrawal.

Diagnosis : Male : Body 9.0-10 long, 0.3 wide; cervical alae narrow; tail 0.21 long, with a slender terminal spike; preanal sucker spindle shaped, 0.65 from cloaca; caudal papillae 11 pairs; 4 preanal, 2 adanal and 5 postanal; spicules equal 0.74-0.8 long, 0.02 wide; gubernaculum with a spur, about 0.78 long.

Female : Body 11.0-12.0 long 0.38 wide; tail 1.1 long; vulva in the anterior half; eggs 0.065×0.035 in diameter.

Distribution : Tripura; West and North Districts.

Elsewhere : India : West Bengal, Madhya Pradesh, Rajasthan; Arizona.

3. Order OXYURIDA

Superfamily (1) OXYUROIDEA

Family PHARYNGODONIDAE Travassos, 1919

Key to genera

1. Mouth with three simple lips. Pharynx short or absent. Vulva equatorial or preequatorial *Pharyngodon*
- Mouth with three bilobed lips. Pharynx present. Vulva postequatorial *Thelandros*

1. Genus *Pharyngodon* Diesing, 1861

Pharyngodon tripurensis n. sp.

Material : Holotype one male Z.S.I. Reg. No. WN 759; host-*Gekko gekko*; location-intestine; locality-Pachartal, North District, Tripura; 13. vii. 1991; Coll. S. R. Dey Sarkar; Paratypes eleven females, Z.S.I. Reg. No. WN 760; other particulars as for the holotype. Paratypes thirty females; Z.S.I. Reg. No. WN 761, host-*Gekko gekko*; location-rectum; locality-Ambasa North District, Tripura; 25. vii. 1991; Coll. S. R. Dey Sarkar.

Description : The specimens are small and the body taper to each extremity in both sexes. Mouth is bounded by three distinct lips with no buccal cavity. Cuticle rather thick and transversely striated. Oesophagus with a posterior bulb. Excretory pore post-oesophageal. Lateral alae absent in both sexes. Tail filamentous in both sexes, that of the female having conspicuous spines.

Male : Body 1.82 long, 0.064 wide; nerve ring 0.064 from the head; oesophagus including bulb

0.27 long, bulb about (0.48×0.056) in diameter; excretory pore postoesophageal, 0.35 from anterior end; tail abruptly constricted at level of cloaca and continued as a long filamentous process, 0.128 long; caudal alae short and broad; caudal papillae 4 pairs, 2 pairs preanal and 2 pairs post anal, spicule and gubernaculum absent; genital cone well developed, 0.032 long.

Female : Body 4.64-5.05 long, 0.34-0.37 wide; nerve ring 0.064-0.08 from head end; oesophagus including bulb, 0.56 long; bulb $(0.096-0.11 \times 0.112)$ in diameter; excretory pore 0.65-0.77 from anterior end; vulva post oesophageal, 0.88 from head end; tail constricted behind the anus and continued as a long filamentous process, 0.88-1.09 long having 15-18 posteriorly directed cuticular spines; eggs oval, (0.112×0.032) in diameter, having opercula at each pole.

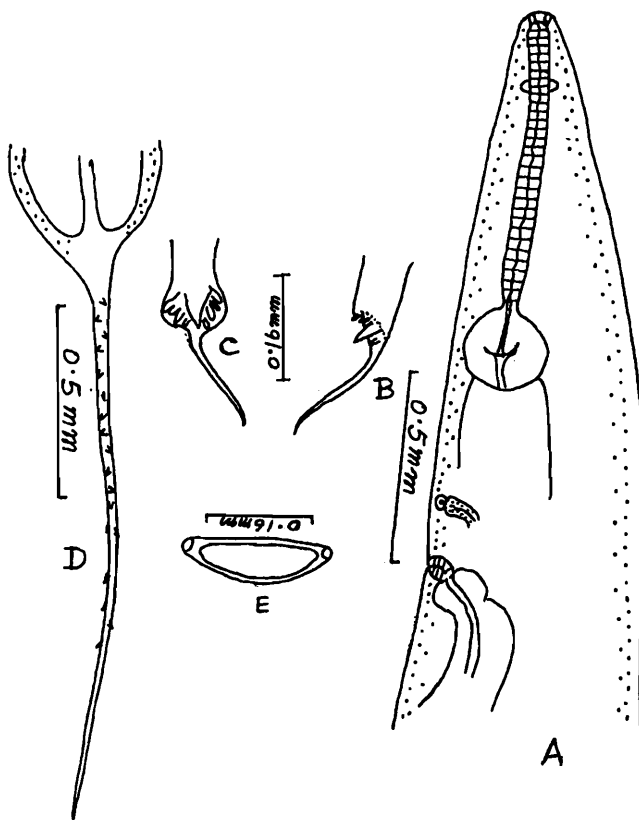


Fig. 2. *Pharyngodon tripurensis* n. sp.

A. female anterior end, showing vulva. B. Male posterior end, lateral view. C. Male posterior end, ventral view. D. Female posterior end, lateral view. E. Egg.

Discussion : The present parasites belong to the genus *Pharyngodon* Diesing, 1867. The

following species *P. megalocerca* (Skrjabin, 1916) Seurat, 1917 (= *Oxyuris megalocerea* Skrjabin, 1916) *P. geckinis* Liu and We, 1941, *P. gekko* (Chakraborty and Vaduri, 1948) Petter and Quentin, 1976 (= *Neopharyngodon gekko* Chakraborty and Vaduri, 1948) and *P. kuntzi* Gupta, 1959, are known from *Gekko gekko*.

The present species comes close to *Pharyngodon gekko* from West Bengal (India) and *P. kuntzi* from Bangladesh (= East Pakistan) but differs from the first species in various body measurements, in number and arrangement of caudal papillae, and in the absence of a spicule and a gubernaculum. It differs from *P. kuntzi* in absence of lateral alae, number and arrangement of caudal papillae (3 pairs in *P. kuntzi*) and also in various body measurements.

It differs from *P. megalocerca*, an African species in the shape of body and in the presence of caudal alae.

The present species differs from *P. geckinis*, a Chinese species in having spines in female tail, in the absence of a spicule and in number and arrangement of caudal papillae. Hence, a new specific name, *Pharyngodon tripurensis* n. sp. is proposed to accommodate them.

2. Genus *Thelandros* Wedl, 1861

Thelandros sp.

Material : One female; host-*Gekko gekko*; Z.S.I. Reg. No. WN 762; location-intestine; locality-Pachartal, North district, Tripura; 13, vii. 1991.

Female : Body 4.5 long, 0.35 wide; curved dorsally; vulva with slight prominent lips, post equatorial in position.

Remarks : In the absence of a male specific identification is not possible. Incidence of infection by this genus appears to be very low.

2. Family OXYURIDAE Cobbold, 1864

Genus *Enterobius* Leach, 1853

Enterobius vermicularis (Linnaeus, 1758) Leach, 1853

1758. *Ascaris vermicularis* Linnaeus, *Systema naturae* Vol. 1. p. 648. Holmaao.

1853. *Enterobius vermicularis* Leach, *Cat. Entozoa. Brit Mus.* p. 108.

Material : Several examples; host-a boy of about 3 years; the specimens extrected from stool; locality-Manu North districtl Tripura; 20 vii. 1991; Coll S. R. Dey Sarkar.

Diagnosis : Male : Body 2.0-4.5 long, 0.1-0.2 wide; narrow lateral alae present near the head and extended up to posterior end; cephalic cuticular swelling about 0.1-0.15 long 0.1-0.11 wide; posterior end curved ventrally; spicule single; gubernaculum absent; caudal papillae 5 pairs.

Female : Body 2.5-13.0 long, 0.3-0.6 wide; tail long and tapering vulva pre-equatorial, prominent.

Distribution : Tripura : North district.

Elsewhere : Cosmopolitan.

4. Order SPIRURIDA

Superfamily (i) CAMALLANOIDEA

Family CAMALLANIDAE Railliet & Henry, 1915

Subfamily CAMALLANINAE Yeh, 1960

Key to genera

1. Buccal capsule not divided into two valves*Spirocamallanus*
Buccal capsule divided into two lateral valves 2
2. Buccal cavity large behind valves
.....*Paracamallanus*
Buccal cavity reduced or absent behind valves.....*Camallanides*
3. Longitudinal band supporting buccal valves not seperated into ventral and dorsal groups*Camallanus*

1. Genus *Camallanus* Railliet and Henry, 1915*Camallanus anabantis* Pearse, 1933

1933. *Camallanus anabantis* Pearse, *J. Siam. Soc. Nat. Hist. Supplement*, 9(2) p. 179.

Material : Two males and three females; host: *Anabas testudineus*; location-intestine; locality-Paratia, South district, Tripura; 10. vii. 1991; Coll. S. R. Dey Sarkar.

Diagnosis : Male : Body 3.5-12.7 long, 0.15-0.35 wide; buccal capusle of two valves, each with nine longitudinal rows of teeth; tail with two spines and a short precaudal alae; spicules two, unequal, similar, smaller 0.12-0.25 long, longer 0.25-0.5; caudal papillae 10-12 pairs, varies in position.

Female : Body 7.2-15.5 long, 0.15-0.48 wide; tridents 0.022 long; cephalic papillae present; tail tip bifid; vulva preequatorial.

Distribution : Tripura : South district.

Elsewhere : India : Bihar, West Bengal, Maharastra, Punjab; Thailand; North Borneo; Malaysia; Sri Lanka.

2. Genus *Camallanides* Baylis and Daubney, 1922*Camallanides prashadi* Baylis and Daubney, 1922

1922. *Camallanides prashadi* Baylis and Daubney, *Mem. Indian Mus., Calcutta*, 7 : 325-328

Material : One male and four females; host Checkered Keelback, *Xenochrophis piscator*; location : intestine; locality : Paratia, South district, Tripura; 10.vii. 1991; Coll. S. R. Dey Sarkar.

Diagnosis : Male : Body 4.5 long, 0.9 wide; cuticular striations very fine; sclerotized rods irregular shape and of yellow colour; tail pointed, small, with caudal alae; caudal papillae 12pairs, 7 preanal, 5 postanal in position; spicules unequal and dissimilar, right broad, alate, 0.18 long, left slender 0.12 long, gubernaculum triangular.

Female : Body 5.0-18.3 long, 0.19-0.5 wide; tail tapering 0.3-0.6 long; vulva 2.3-7 from anterior

end, very prominent modified into a tubular appendage.

Distribution : Tripura : South district.

Elsewhere : India : Widely distributed.

3. Genus *Paracamallanus* Yorke and Maplestone, 1926*Paracamallanus singhi* (Ali, 1957) Campana-Rouget, 1961

1957. *Neocamallanus singhi* Ali, *Indian J. Helminth*, 8 (1956) : P. 19.

1961. *Paracamallanus singhi* Publ. Inst. r. Sci. nat. Belgique, 3(4) p. 27.

Material : One male, two females; host-*Channa striatus*; location-intestine; locality-Fish market, Ambasa, North district, Tripura; 29. vii. 1991; Coll S. R. Dey Sarkar.

Diagnosis : Male : Body 4.5 long, 0.14 wide; oesophagus divided into two parts, anterior muscular, posterior glandular; tail 0.077 long, with caudal alae; spicules unequal, right longer, 0.12 long, left smaller, 0.055 long; caudal papillae pedunculate 10 pairs, 5 preanal, 2 adanal, 3 postanal.

Female : Body 6-14.0 long, 0.14-0.26 wide; tail 0.12-0.45 long; vulva with prominent lips, equatorial or pre-equatorial in position.

Distribution : Tripura : North district.

Elsewhere : India : Widely distributed.

4. Genus *Spirocamallanus* Olsen, 1952*Spirocamallanus gubernaculus* (Khera, 1955) Soota, 1983.

1955. *Procamallanus gubernaculus* Khera, *An. Esc. nac. Ciene. biol. Mex.* 8 : p. 245

1983. *Spirocamallanus gubernaculus* Soota, *Rec. Zool. Surv. India Occasional Paper No. 54*, p. 182.

Material : One male and two females; host; *Notopterus notopterus*; location-intestine; locality-Fish market, Agartala, Tripura; 31. vii. 1991; Coll. S. R. Dey Sarkar.

Diagnosis : Mouth supported by four submedian and two lateral papillae; buccal capsule elongated, barrel-shaped with 16-18 spiral thickenings and pair of lateral finger-shaped thickenings parallel to longitudinal axis; oesophagus divided into two parts, cervical papillae present.

Male : Body 6.4 long, 0.12 wide; spicules unequal dissimilar, right 0.18 long, left 0.06 long; caudal papillae, 11 pairs, 5 preanal 6 postanal; tail tapering blunt, with caudal alae, 0.04 long.

Female : Body 7.5-12.6 long, 0.09-0.1 wide; tail 0.07-0.09 long, with a pair of papillae at tip, vulva 1.4-6.2 from anterior end.

Distribution : Tripura : Agartala

Elsewhere : India : Bihar, West Bengal, Lucknow.

Superfamily (2) GNATHOSTOMATOIDEA

Family GNATHOSTOMATIDAE
Railliet, 1895.

Subfamily GNATHOSTOMATINAE
(Railliet, 1895 fam.) Baylis
and Lane, 1920

Genus *Tanqua* Blanchard, 1904

Tanqua anomala (V. Linstow, 1904)
Baylis, 1930

1904. *Heterakis anomala* V. Linstow, *Spolia Zeylan*, 1(4) : p. 97.

1916. *Tanqua anomala* Baylis, *Ann. Mag. Nat. Hist.*, Ser 8, 17 : 229-230.

Material : Several examples; host-a snake, *Ehydria* sp.; location-intestine; locality-Pachartal, North district, Tripura; 14. vii. 1991; Coll. S. R. Dey Sarkar.

Diagnosis : Head-bulb with two swellings without spine; a cuticular collar present behind the head-bulb; male tail with well developed alae.

Male : Body 20.5.39 long, 0.045-1.1 wide; cuticular striation present; head bulb 0.3-0.52 in

diameter; spicules 0.78-1.72 long; caudal alae well developed; caudal papillae 8 pairs, 3 preanal, 5 postanal.

Female : Body 20-44 long; 0.88-1.4 wide; tail conical; vulva 4.5-7.8 from posterior end; uterus with two branches; eggs measure upto 0.065×0.05 .

Distribution : Tripura; North district.

Elsewhere : India widely distributed; China; Sri Lanka; Saim.

Superfamily (3) PHYSALOPTEROIDEA

Family PHYSALOPTERIDAE
(Railliet, 1895 Subfam.)
Leiper, 1908.

Key to subfamilies

Cuticular collar slight. Cuticular projection beyond cephalic extremity absent. Caudal papillae often many, very difficult to differentiate from cuticular ornamentation surrounding them. Parasites mainly of reptiles, rarely amphibians THUBUNAEINAE

Cuticular collar well developed. Cuticular projection beyond cephalic extremity present. Caudal papillae few, clearly distinct from cuticular ornamentation. Parasites of various vertebrates except fishes
.....PHYSALOPTERINAE

Subfamily THUBUNAEINAE
(Sobolev, 1949, tribe)
Chabaud, 1975

Genus *Thubunaea* Seurat, 1914

Thubunaea tulshidasi n.sp.

Material : Holotype one male, Z.S.I. Reg. No. WN 763; host-Gekko-geeko; location-intestine; locality-Ambasa, North District, Tripura; 25. vii. 1991; Coll. S. R. Dey Sarkar. Paratypes-3 males and 12 females, Z.S.I. Reg. No. WN 764 other particulars as for the holotype.

Description : The specimens are soft, delicate and slender, white in colour when alive. There

are four papillae on the outer margin of the head. The lips are unequal, the left being smaller than the right. The left lip bears three forwardly

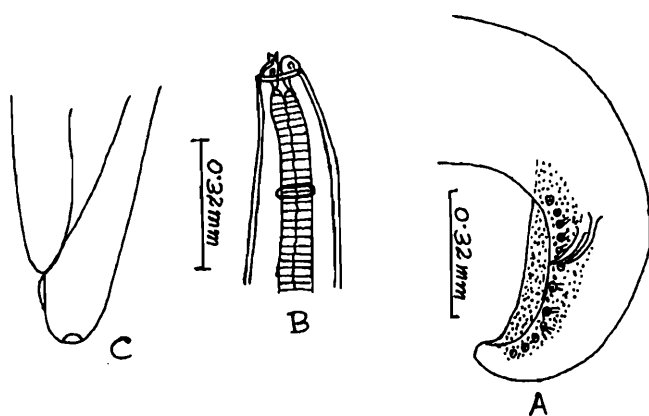


Fig. 3. *Thubunaea tulsidasi* n.sp.
A. Male posterior end. B. Anterior end. C. Female posterior end.

directed teeth, the middle tooth being larger than the laterals. At the base of the lips there is a slight cuticular collar. A pharynx is present. The oesophagus as usual divided into two parts—an anterior muscular and a posterior glandular.

Male : Body 10.16-10.8 long, 0.26-0.3 wide; pharynx 0.048 long; nerve ring 0.19-0.22 from anterior end; cervical papillae and excretory pore behind the nerve ring; oesophagus divided into two parts an anterior muscular and a posterior glandular, total length 1.9-2.04; excretory pore indistinct; caudal alae well developed; tail tip blunt, 0.19-0.22 long; the caudal end curved ventrally; the ventral surface of the tail tuberculated; spicules similar, unequal and small, the right shorter 0.08 long and the left longer 0.128 long; caudal papillae 12 pairs, 5 pairs preanal, one pair adanal and 6 pairs postanal in position; three of the 5 preanal papillae and two of the six postanal papillae pedunculated; gubernaculum absent.

Female : Body 14.24-15.84 long, 0.35-0.38 wide; pharynx 0.048 long; nerve ring 0.22-0.24 from anterior end; cervical papillae and excretory pore behind the nerve ring; entire oesophagus 2.24-2.4 long; tail 0.13-0.16 long, tip rounded without a pair of papillae; vulva post oesophageal, 2.4-2.66 from anterior end;

muscular vagina posteriorly directed; uterine branches two; egg rounded 0.032×0.032 in diameter.

Discussion : The present species comes closer to *Thubunaea asymmetrica* Baylis, 1930, *T. dactyluris* Karvey 1938, *T. quadridentata* Khera, 1951, in having teeth on the left smaller lip only. But differs from all these in various body measurements, number and arrangement of caudal papillae and in the length of the spicules. Further, *T. asymmetrica* has three equal teeth on the left smaller lip only, but the same in the present worm are unequal. It also differs from *T. dactyluris* in the absence of a girdle papillae behind the cuticular collar and a pair of papillae in the female tail.

However, the worm under discussion differs from *T. quadridentata* in number and shape of teeth on the left lip (*T. quadridentata* left lip bears four teeth).

Hence, the present worm is regarded as different from all the known forms and a new specific name is proposed to accommodate them.

Subfamily PYRALOTERINAE Railliet, 1893

Genus *Physaloptera* Rudolphi, 1819

Physaloptera sp.

Material : 2 females; Z.S.I. Reg. No. WN 798; host-Monkey, *Macaca mulata mulata*; location-intestine; locality-Charilam, West District, Tripura; 16. ix. 1969; Coll. Dr. V. C. Agrwal.

Female : Body about 37.00 long 2.5 wide; cuticle reflected over the lips to form a large cephalic collarette.

Remarks : In the absence of a male, specific identification is not possible. As the specimens are poorly preserved a detailed study is not possible.

Superfamily (4) SPIRUROIDEA

Family SPIROCERCIDAE
(Chitwood and Wehr, 1932,
Subfam) Chabaud, 1975

Key to Subfamilies

1. Pharynx without rugous or annular thickenings
.....SPIROCERCINAE

Pharynx with rugous or annular thickenings
.....ASCAROPSINAE

Subfamily ASCAROPSINAE, Alicata and
McIntosh, 1933

Genus *Streptopharagus* Blanc, 1912

Streptopharagus pigmentus (V. Linstow, 1897)
Railliet and Henry, 1918

1897. *Spiroptera pigmenta* V. Linstow, *Arch. Mikr. Anat*
40 (3) : 608-610

1918. *Streptopharagus pigmentus* Railliet and Henry, *Bull.*
Soc. Path. Exot. 11(2) : 82-86

Material : 2 examples; Z.S.I. Reg. No. WN
765; Host-Monkey, *Macaca mulata mulata*;
location-intestine; locality-Charilam, West
District, Tripura; 16. ix. 1969; Coll. Dr. V. C.
Agrawal.

Diagnosis : Male : Body 28-55 long; 0.6-1
wide; lateral alae present on the left side only;
caudal alae transversely striated; 4 pairs preanal
and one pair postanal pedunculated papillae and
a group of 5 pairs of small sessile papillae near
the tail tip; cloacal aperture partly surrounded by
claw-like cuticular processes; spicules unequal,
dissimilar, alate, left slender 4-6.7 long; right
stouter 0.5-0.76 long; gubernaculum small,
asymmetrical.

Female : Body 46-95 long; 0.85-1.5 wide; tail
conical; vulva 9.5-20.0 from the anterior end.

Distribution : Tripura; West District.

Elsewhere : India, West Bengal; Africa;
Eupore; Japan; Indochina.

Subfamily SPROCERCINAE Chitwood
and Wehr, 1932

Genus *Cylocospirura* Ververs, 1992

Subgenus *Gastronodus* (Singh, 1934, Gen)
Chabaud, 1975

Cylocospirura (Gastronodus) strassenii
(Singh, 1934) Chabaud, 1975.

1934. *Gastronodus strassenii* Singh, *Curr. Sci. Bangalore*,
2 (8) : p. 287.

1975. *Cylocospirura (Gastronodus) strassenii*, *CIH Keys*
to Nematode Parasite No. 3. p.33

Material : Four examples; Z.S.I. Reg. No.
WN 766; host House Shrew, *Suncus murinus*,
location-nodules in the stomach wall; locality-
Ambasa, North district, Tripura, 26. vii. 1991;
Coll. S. R. Dey Sarkar.

Diagnosis : Male : Body 14-16 long, 0.3-0.56
wide; cervical papillae present; tail short spiral,
rounded tip, 0.24 long, with one pair of spines;
caudal alae well developed; caudal papillae 12
pairs, 6 preanal, 6 postanal and single preanal
median papilla, of the postanal papillae 2 pairs
sessile; spicules unequal, dissimilar, longer
narrow, 1.92-2.7 long, pointed, shorter 0.45-0.6
long, enclosed by a broad and rounded alae,
gubernaculum 'V' shaped, 0.064 long.

Female : Body 25.0-40.0 long; anus
subterminal, tail rounded, with a pair of lateral
papillae; vulva 0.82-1.5 from anterior end; eggs
thick shelled.

Distribution : Tripura : North District.

Elsewhere : India : Andhra Pradesh, West
Bengal; Bangladesh.

Superfamily (5) HABRONEMATOIDEA

Family HABRONEMATIDAE
(Chitwood and Wehr,
1932) Invaschkin, 1961.

Key to subfamilies

1. Posterior border of lips and pseudolabia without
ornamentation HABRONEMATINAE

Posterior border of lips and pseudolabia with
ornamentations HISTOCEPHALINAE

Subfamily HARBONEMATINAE
Chitwood and Wehr. 1932

Genus *Habronema* Diesing, 1861

Key to species

Lateral alae present
 *Habronema tripurensis* n.sp

Lateral alae absent *Habronema otusi* n.sp.

1. *Habronema otusi* n. sp.

Material : Holotype one male, Z.S.I. Reg. No. WN 767; host-collared Scops owl, *Otus bakkamoena*; location-Gizzard; locality-Paratia, South District Tripura; 8. vii. 1991; Coll. S. R. Dey Sarkar; Paratypes one male, two females; Z.S.I. Reg. No. WN 768; other particulars as for the holotype.

Description : Yellowish-white worms of

pharynx 0.06-0.08 long; nerve ring 0.27-0.32 from anterior end; oesophagus muscular portion narrow, 0.48-0.56 long, glandular portion wider than muscular portion, 3.04 long; excretory pore obscured; tail spirally coiled, 0.16-0.19 long, caudal alae wide, tip ended in a spike; spicules similar, unequal, the left being longer 1.2-1.32 long, with a spear at the tip; right smaller, 0.37-0.48 long, pointed; gubernaculum 0.04-0.048 long; caudal papillae, 4 pairs pedunculated preanal, one unpaired sessile papilla on the anterior margin of the cloaca, 2 pairs pedunculated postanal papillae at about the middle of the tail and 2 pairs sessile near the tip discernible.

Female : Body 12. 16 long, 0.32 wide; pharynx

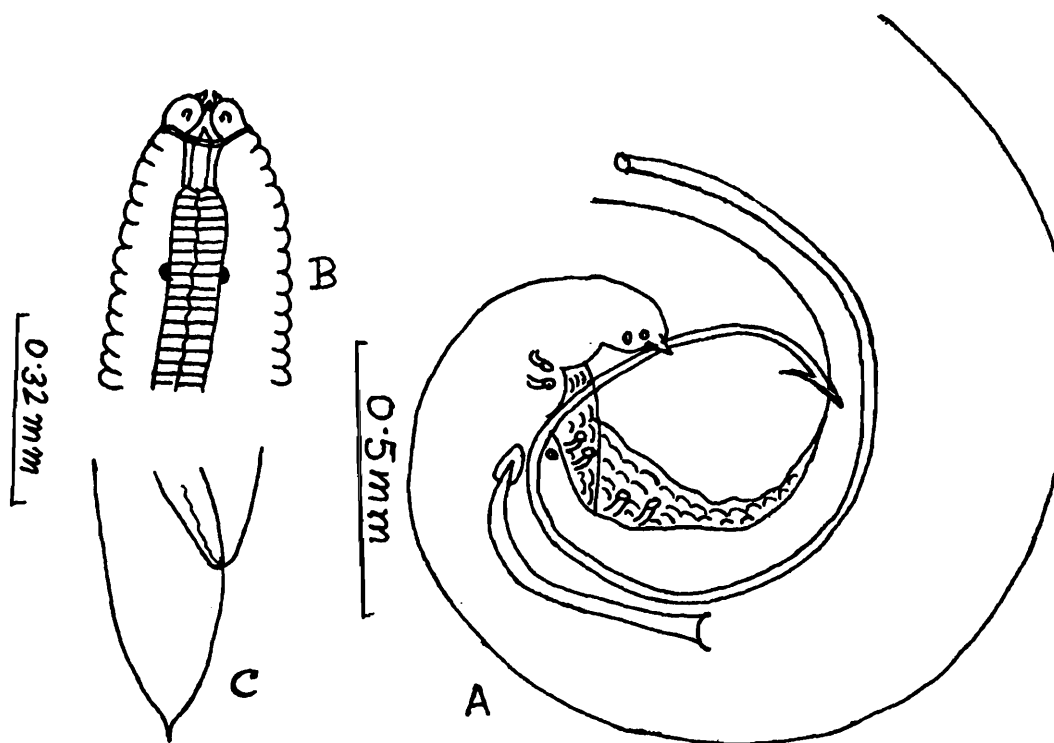


Fig. 4. *Habronema otusi* n. sp.

A. Male posterior end. B. Anterior end. C. Female posterior end.

medium thickness and size. Head with two small lateral lips. Cuticle heavily striated transversely. Lateral alae absent. Cervical papillae not located. Pharynx well cuticularised. Oesophagus distinctly divided into two parts, anterior muscular portion shorter and narrower than posterior glandular portion. Caudal alae symmetrical.

Male : Body 11.2-12.0 long, 0.32-0.35 wide;

0.06; nerve ring 0.3 from anterior end; oesophagus, muscular 0.48 long, narrow, glandular 3.12 long, wide; tail conical, ended in a sharp point, 0.16 long; vulva equatorial, 6.08 from anterior end.

Discussion : The present species being devoid of lateral alae comes close to *Habronema fischeuri* Seurat, 1916, *Habronema murrayi* Ortlepp, 1934, *Habronema aegotheles* Johnston and Mawson,

1941 and *Habronema ameerae* Ali, 1961. The first two resemble it in possessing a median preanal sessile papilla in front of the cloaca, in having longer spicule with spear-shaped ends. However, it differs from them in body measurements number and arrangement of caudal papillae and in the position of vulva.

The worm under discussion differs markedly from *H. aegotheles* in body size (male = 2.5, female 8.1-8.9 in *H. aegotheles*), size and shape of spicules and in number and arrangements of caudal papillae (Preanal papillae 4-6 pairs in *H. aegotheles*).

The present worm comes closer to *H. ameerae* in having symmetrical caudal alae, in the number of preanal papillae but differs from it in body size (males = 11.2-12.0, female = 12.16 in the present worm and in *H. ameerae* male = 4.5-5.3, female = 8.0-8.9 long), shape and size of spicule and in the position of vulva. Hence, the present worm is regarded as different from all the known forms and named as *Habronema otusi* n. sp.

2. *Habronema tripurensis* n. sp.

Material : Holotype one male, Z.S.I. Reg. No. WN 769; host-Barred owlet, *Glaucidium cuculoides ruficens*; location-under horny layer of gizzard; locality-Paratia, South District, Tripura; 6.vii. 1991; Coll. S. R. Dey Sarkar; Paratypes 2 females; Z.S.I. Reg. No. WN 770; other particular as for the holotype.

Description : Body elongate, coarsely striated. Mouth with two large lateral lips with four small teeth; dorsal and ventral lips prolonged in middle by a sharp point. Lateral alae two, wide and symmetrical, started from the head. Cervical papillae at the junction of the Pharynx and oesophagus. Pharynx well cuticularised; esophagus distinctly divided into two parts, anterior muscular portion shorter and narrower than posterior glandular portion.

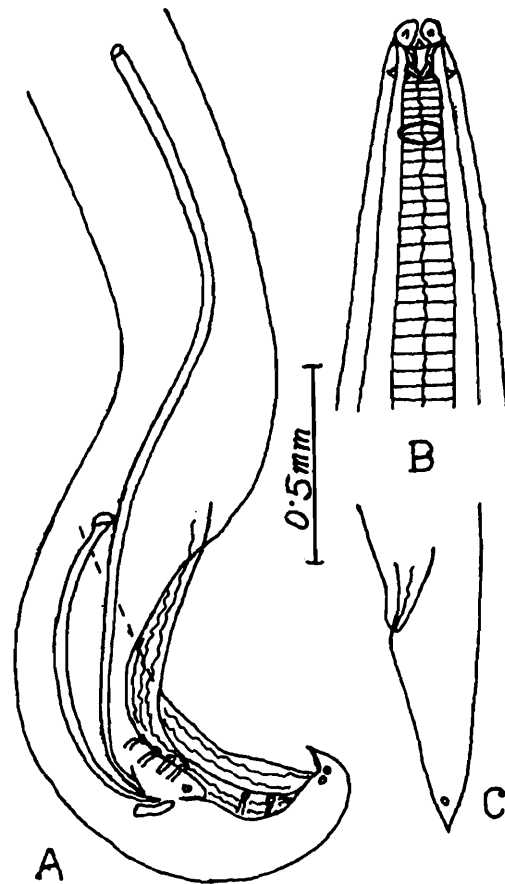


Fig. 5. *Habronema tripurensis* n. sp.
A. Male posterior end. B. Anterior end. C. Female posterior end.

Male : Body 10.64 long, 0.32 wide; pharynx 0.064 long; nerve ring 0.24 from the head; cervical papillae 0.064 from anterior end; lateral alae wide, symmetrical starting near the head and extending upto 1.36; oesophagus muscular portion narrow, 0.64 long, glandular portion wider than muscular portion, 1.92 long, total 2.56 long; caudal end strongly curved ventrally; tail 0.24 long; caudal alae symmetrical, meet in a point beyond the tip of the tail; spicules similar, unequal, the left being longer 1.2 long, with a spear at the tip, right smaller 0.56 long, blunt; gubernaculum 0.048 long; caudal papillae 9 pairs, 4 pairs pedunculated, one pair sessile preanal, the rest postanal; of the postanal papillae 2 pairs pedunculated and 2 pairs near the tail tip discernible.

Female : Body 11.2-13.28 long, 0.24-0.35 wide; Pharynx 0.064 long; nerve ring 0.26 from

the head; cervical papillae 0.064 from anterior end; lateral alae starting near the head and extended upto 1.12-1.76 of the body, 0.048 wide; oesophagus 2.16-2.24 long; tail conical, pointed, 0.24-0.26 long; vulva slightly postequatorial, 6.4-7.36 from anterior end; eggs 0.032 $\times$ 0.016 in diameter.

Discussion : The present species comes close to *Habromena leptoptera* (Rudolphi, 1819) Seurat, 1914, *H. mansioni* Seurat, 1914, *H. hyderabadensis*, Ali, 1961, *H. waheedae* Ali, 1961, *H. magnipapillatum* Ali, 1961 and *H. avicedae* Soota and Dey Sarkar, 1981, in the presence of cervical papillae and lateral alae in both side of the body, but differs from them in various body measurements, size and shape of spicules, position of vulva and in

number of sessile papillae. Hence, the present species is regarded as different from all the known forms and named as *Habronema triprensis* n. sp.

Subfamily HISTOCEPHALINAE

Gendre, 1922

Genus *Viguiera* Seurat, 1913

Viguiera bossicauda n. sp.

Material : Holotype one male, Z.S.I. Reg. No. WN 771; host-Crested Black Drongo, *Dicrurus h. hottentotus*; location-under horny layer of gizzard; locality-Paratia, South District, Tripura; 7. vii. 1991; Coll. S. R. Dey Sarkar; Paratypes-one male, three females; Z.S.I. Reg. No. WN 772; other particulars as for the holotype.

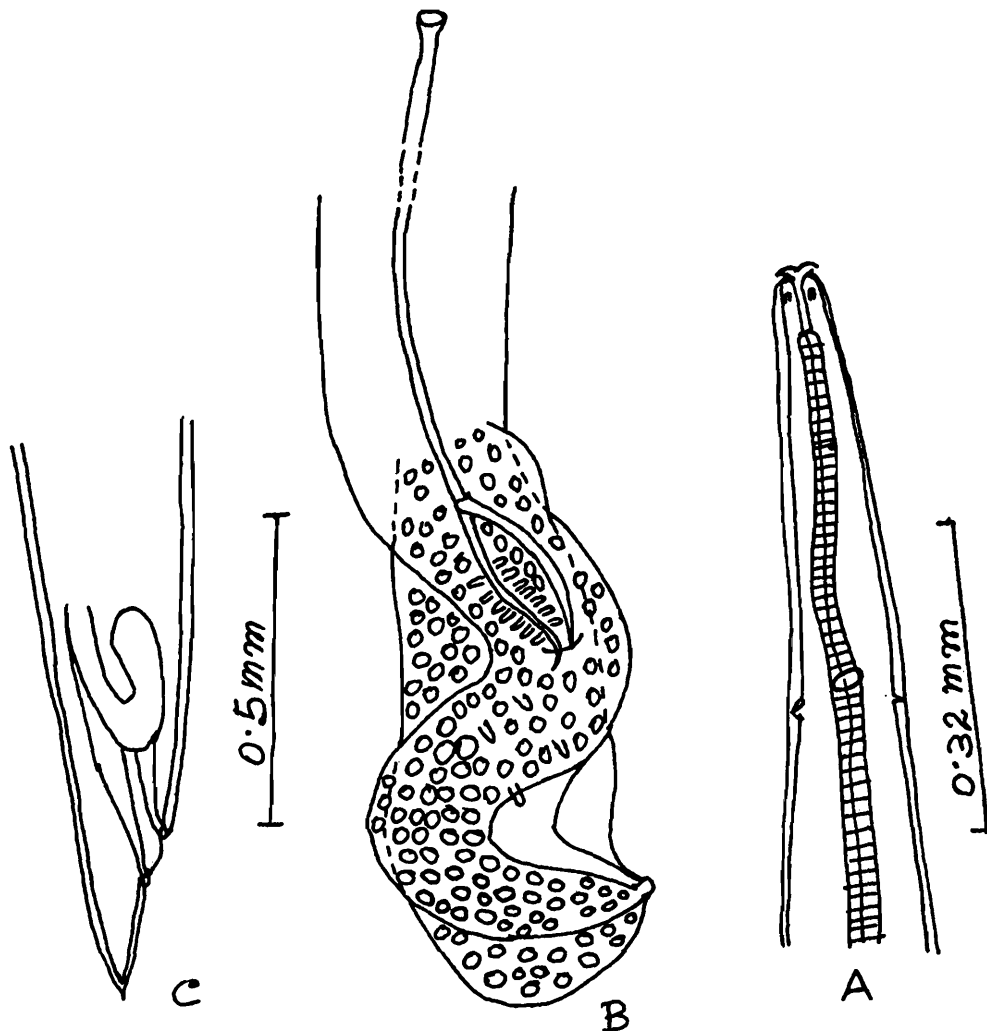


Fig. 6. *Viguiera bossicauda* n. sp.

A. Anterior end. B. Male posterior end. C. Female posterior end.

Description : Body thin, filiform, sharply attenuated at anterior end. Head rounded, provided with appendages, cuticle thin, transversely striated throughout the body, cervical papillae present at level of nerve ring. Two pairs of submedian cephalic papillae present. Pharynx short, cylindrical and thick walled. Oesophagus very long, divided into two parts, anterior muscular and posterior glandular. Posterior extremity of male spirally coiled, well developed caudal alae with numerous cuticular bosses.

Male : Body 6.4 long, 0.18-0.19 wide; pharynx 0.032 long; nerve ring at 0.24-0.25 and excretory pore at 0.27 from anterior end; cervical papillae at 0.24 from the head; entire oesophagus 3 long, of its anterior muscular part 0.43 long; tail tapering, spirally coiled, tip bluntly pointed, 0.4 long. Caudal alae well developed, symmetrical provided with numerous cuticular bosses; nine pairs of pedunculated caudal papillae of which seven pairs preanal and two pairs postanal; spicules very unequal, similar, left longer, slender 1.28, long tip pointed, right spicule 0.19 long, tip pointed; spicule ratio 1:6.7; gubernaculum absent.

Female : Body 8.96-9.44 long, 0.24 wide; pharynx 0.32-0.4 long; nerve ring 0.29 from anterior end; cervical papillae 0.27 from the head; entire oesophagus 3.52-3.56 long, of its anterior muscular part 0.45-0.48 long; tail conical, 0.112-0.128 long; vulva very close to anus, 0.14-0.16 from posterior end; vagina directed anteriorly; eggs oval, thick shelled, (0.32 × 0.016) in diameter.

Remarks : *Viguiera bossicauda*, n. sp. comes closer to *V. euryoptera* (Rudolphi, 1879) Seurat, 1913 and *V. majumdari* De, 1979 but differs from both of them markedly in various body measurements, shape and size of spicules, in number and arrangement of caudal papillae and in the presence of caudal alae with cuticular bosses.

Superfamily (6) ACUARIOIDEA

Family ACUARIIDAE (Railliet, Henry & Sisoff, 1912 subfam.) Chabaud, 1975

Key to subfamilies

1. Cephalic ornamentation with cordons on cuticle which often form cuticular collarate 2

Cephalic ornamentation with cylindrical horns, blades, shield or a hood, apex of these structures always clearly detached from the cuticle Schistorophinae

2. Cordons extending longitudinally and extending largely on the cervical region
..... Acuariinae

Cordons extending transversely from near point of origine and expand only on the cephalic region to form a callarette Seuratiinae

Subfamily ACUARIIDAE Railliet, Henry & Sisoff, 1912

Key to genera

Cordons not recurrent and not anastomosing
..... *Acuaria*

Cordons recurrent and anastomosing or not anastomosing. Body spines on lateral field absent *Synhimantus*

Cordons not recurrent but anastomosing. Body spines on lateral field present *Echinuria*

1. Genus *Synhimantus* Railliet, Henry & Sisoff, 1912

Subgenus *Synhimantus* Railliet, Henry & Sisoff, 1912

Synhimantus (Synhimantus) owleti n.sp.

Material : Holotype one male, ZSI. Reg. No. WN 773; host-Barred Owlet, *Glaucidium cuculoides ruficenes*; location-oesophagus and proventriculus; locality-Partia, South District, Tripura, 8. vii. 1991; Coll. S. R. Dey Sarkar; Paratypes-3 males, 4 females, ZSI. Reg. No. WN 774; other particulars as for the holotype.

Description : Mouth with two small lateral lips; the body coarsely striated; cephalic region with four long cordons; cordons recurrent and anastomosing in pairs on each lateral surface; cervical papillae tricuspid; pharynx long and narrow; oesophagus distinctly divided into two

parts anterior muscular and posterior glandular; male tail spirally coiled; caudal alae present; spicules very unequal and dis-similar; vulva postequatorial.

Male : Body 6.27-6.75 long, 0.22-0.24 wide; pharynx 0.14-0.19 long; nerve ring 0.32 from the head; cordons extend 0.26-0.28 posteriorly from head, then turning forward to anastomose at about the middle of the pharynx; cervical papillae tricuspid, 0.49-0.72 from anterior end; oesophagus divided into two parts, an anterior narrow muscular portion 0.51-0.56 long and a posterior wide glandular 1.66-1.88 long; posterior extremity spirally coiled; caudal alae well developed; tail tip round, 0.17-0.27 long; ten pairs of pedunculated caudal papillae, of which five pairs preanal and five pairs postanal in position; spicules very unequal and dissimilar, right spicule longer, tubular, pointed tip, 0.56-0.64 long; left spicule smaller, short, boat shaped, tip round, 0.12-0.14 long; a thin small process projects from the base of the left spicule; spicule ratio 1: 4.5; gubernaculum absent.

Female : Body 10.64-14.32 long, 0.43-0.48 wide; pharynx 0.24-0.32 long, nerve ring 0.32 - 0.4 from the head; cordons as in male, extend 0.44-0.64 from anterior end; tricuspid cervical papillae 0.64-0.73 from anterior end; oesophagus,

muscular 0.7-0.73 long and glandular 2.16-2.4 long; tail conical with rounded tip; vulva prominent, 4.56-6.88 from posterior end; eggs oval, thin shelled (0.016×0.032) in diameter.

Discussion : The present worm differs from all the known species of the genus *Synhimantus* (*Synhimantus*) Railliet, Henry and Sisoff, 1912, in various body measurements, shape and size of spicules and in number and arrangement of caudal papillae. However, it is nearer to *Synhimantus* (*Synhimantus*) *recta* (Molin, 1890) Gendre, 1920, *S. (S.) subrecta* (Gendre, 1921) Cram, 1927, *S. (S.) elliptica* (Molin 1858) Skrjabin, 1924 and *S. (S.) hamata* (Linstow, 1877), Skrjabin, 1924, in having post equatorial vulva of the female. Hence, it is regarded that a new species is being dealt with and it is proposed to name it *Synhimantus* (*Synhimantus*) *owleti* n. sp.

2. Genus *Acuaria* Bremser, 1811

Acuaria sp.

Material : 3 females, ZSI Reg. No. WN 775; host-Crested Black Drongo, *Dicrurus h. hottentotus*; location-under horny layer of gizzard; locality-Paratia, South District, Tripura; 8. vii. 1991; Coll. S. R. Dey Sarkar.

Diagnosis : Mouth with two lateral lips from which the cordons originate; cordons rectilinear and extending longitudinally. Body slender. Pharynx long and narrow. Oesophagus distinctly divided into two parts anterior muscular and posterior glandular.

Male : Unknown.

Female : Body 24.8-26.8 long, 0.176 wide; pharynx 0.208-0.224 long, thin walled; nerve ring 0.35 from anterior end; cordons extend 0.4 posteriorly from head; anterior muscular oesophagus 0.62-0.67 long, posterior glandular 1.57-1.68 long; tail 0.22 long, tapering to a blunt point; vulva very prominent 13.9-14.2 from posterior end; eggs (0.032×0.016) in diameter.

Remarks : In the absence of a male, specific identification is not possible.

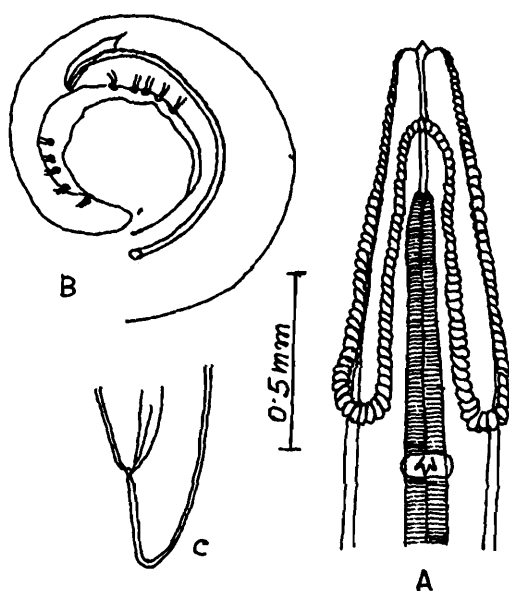


Fig. 7. *Synhimantus* (*synhimantus*) *owleti* n. sp.
A. Anterior end, lateral view. B. Male posterior end.
C. Female posterior end.

3. Genus *Echinuria* Soloviev, 1912

Echinuria sp.

Material : One female; Z.S.I. Reg. No. WN 776; host-spotted owlet, *Athene brama*; location-gizzard; locality-Manu, North District Tripura; 19.vii. 1991; Coll; S. R. Dey Sarkar.

Diagnosis : Cordons not recurrent but anastomosing posteriorly; cuticle finely striated. Cuticular spines not observed. Cervical papillae prominent.

Female : Body : 14.5 long, 0.38 wide; pharynx 0.31 long; oesophagus divided into two parts, anterior muscular 0.85 long, posterior glandular 1.6 long; nerve ring 0.35 from anterior end; tail bluntly conical, 0.02 long; vulva postequatorial, 0.2 from posterior end.

Remarks : In the absence of a male, specific identification is not possible.

Subfamily SCHISTOROPHINAE Travossos, 1918

Genus *Schistorophus* Railliet, 1916

Schistorophus sp.

Material : One female; Z.S.I. Reg. No. WN 777; host-small Blue King fisher, *Alcedo atthis*; location-gizzard; locality-Pachartal, North District, Tripura; 13. vii. 1991; Coll. S. R. Dey Sarkar.

Diagnosis : Body slender, finely striated; mouth with two small lips; Pharynx elongated; oesophagus divided into two parts, an anterior muscular and posterior glandular.

Female : Body 14.6 long, 0.08 wide; pharynx 0.14 long; total oesophagus 1.25 long; tail bluntly conical 0.9 long; vulva at about the middle of the body, 7.3 from anterior end; Eggs 0.032×0.016 in diameter.

Remarks : In the absence of a male, specific identification is not possible.

3. Subfamily SEURATIINAE Chitwood and Wehr, 1932

Genus *Rusguniella* Seurat, 1919

Rusguniella sp.

Material : One female; Z.S.I. Reg. No. WN 778; host-King fisher, *Halcyon smyrnensis*; location-gizzard; locality-Paratia, South Dist. Tripura. 7.vii. 1991; Coll. S. R. Dey Sarkar.

Diagnosis : Body tapering anteriorly; lips conical and pointed; cordons in form of a triangle; narrow cephalic alae present.

Female : Body 7.0 long, 0.14 wide; pharynx 0.18 long; cordons extended 0.15 from the head; oesophagus divided into two parts, total length 1.3; tail 0.11 long, straight, ending in a blunt point; vulva 0.16 from posterior end.

Remarks : In the absence of a male, specific identification is not possible.

Superfamily (7) DIPLOTRIAENOIDEA

Family DIPLOTRIAENIDAE
(Skrjabin, 1916 Subfam.)
Anderson, 1958

Key to Subfamilies

Mouth simple, with trident-like structures on each side of anterior end of oesophagus. Anus subterminal, Vulva in oesophageal region. Parasites of cavities of birds.

.....Diplotriaeninae

Trident like structures absent. Oral opening bordered by cuticularized elevations. Tail moderately long with lateral alae and pedunculate papillae, less commonly subterminal without alae and with sessile papillae. Parasites of cavities of reptiles and birds. Dicheilonematinae

Subfamily DIPLOTRIAENINAE
Skrjabin, 1916

Genus *Diplotriaena* Railliet and Henry, 1909

Key to species

Caudal papillae in male absent

.....*D. nagpurensis*

Caudal papillae in male present .*D. tricuspis*

1. *Diplotriaena tricuspis* (Fedchenko, 1874)
Seurat, 1915

1874. *Filaria tricusps* Fedchenko, *Izv. Imp. Obsh. Lyub. Estesty, Antrop. & C.*, Moscow, 10 : 60-61

1915. *Diplotriaena tricusps* Seurat, *Bull. Soc. Hist. Nat. Afr. Nord.*, 7(2) : 17-21.

Material : Four examples, ZSI Reg. No. WN 779; host-Pied Myna, *Sturnus contra*; location-Body cavity; locality-Manu, North District, Tripura; 20. vii. 1991; Coll. S. R. Dey Sarkar; One example, Z.S.I. Reg. No. WN 799; host-Large Cuckoo Shrike (*Coracina novae-hollandiae*) : location-Body cavity; locality-Ampi, West District, Tripura, 17.i. 1971; Coll. V. C. Agrawal.

Diagnosis : Male : Body 36-75 long; triadents equal 0.09-0.24 long; oesophagus divided into two parts, anterior narrow muscular, posterior wide, glandular, tail truncate, 0.13 long; caudal papillae 9-11 pairs, spicules unequal, dissimilar, left straight, 1-2.56 long, right spirally twisted about $1\frac{1}{2}$ turns, 0.55-0.92 long.

Female : Body 40-200 long; vulva in oesophageal region, 0.43-0.8 from anterior end; tail subterminal.

Distribution : Widely distributed in India.

Elsewhere : Africa, Asia, Europe, U.S.A.

2. *Diplotriaena nagpurensis* Karve, 1934

1934. *Diplotriaena nagpurensis* Karve, *J. Univ. Bombay*, 2 : 75-81.

Material : Three examples, ZSI. Reg. No. WN 780; host; Jungle Myna, *Acridotheres fuscus*; location-Body cavity; locality-Manu, North District, Tripura; 20.vii. 1991; Coll. S. R. Dey Sarkar.

Diagnosis : Male : Body 33.95-56.0 long; tridents equal, 0.14-0.16 long; oesophagus as in *D. Tricusps*; tail end rounded, about 0.7 long and devoid of caudal papillae; spicules unequal dissimilar, left straight. 2.1-2.48 long, right spirally twisted about one turn, 0.56-0.71 long.

Female : Body 159.0 long; vulva at about 0.7 from anterior end; tail subterminal.

Distribution : India : Maharashtra, Madhya Pradesh; Uttar Pradesh and Tripura.

Subfamily DICHEILONEMATINAE
Wehr. 1935

Genus *Hamatospiculum* Skrjabin, 1916

Hamatospiculum sp.

Material : Two fragments, Z.S.I. Reg. No. WN 781; host-Greater Racket-tailed Drongo, *Dicrurus paradiseus*; location-Body cavity; locality-Telianura, West District, Tripura; 2.ii. 1971; Coll. Dr. V. C. Agrawal.

Diagnosis : Mouth with two small projecting lateral lips; anterior extremity provided with four pairs of submedian head papillae and a pair of lateral papillae; lateral alae absent; oesophagus divided into two parts, an anterior narrow portion and a posterior wider part. Vulva in the wider oesophageal region.

Superfamily (8) APROCTOIDEA

Family APROCTIDAE (Yorke and Maplestone, 1926 subfam.) Skrjabin and Schikhobalova, 1945.

Subfamily APROCTINAE Yorke & Maplestone, 1926

Key to genera

Delicate head cordons between cephalic papillae present. Buccal cavity minute. Oesophagus short and undivided

.....*Pseudaprocta*

Head cordons absent. Buccal cavity short, broad and funnel shaped. Oesophagus undivided

.....*Squamofilaria*

1. Genus *Squamofilaria* Schmerling, 1925

Squamofilaria *glaucidiumae* n. sp.

Material : Holotype one male, Z.S.I. Reg. No. WN 782; host-Barred owlet, *Glaucidium cuculoides ruficens*; location-Body cavity; locality-Paratia, South District, Tripura; 8.vii.1991; Coll.

S. R. Dey Sarkar; Paratypes 2males, 3 females, Z.S.I. Reg. No. WN 783; other particulars as for the holotype.

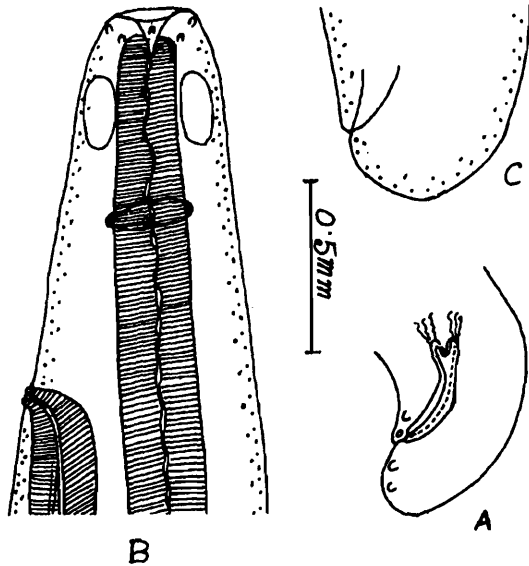


Fig. 8. *Squamofilaria glaucidiumae* n. sp.
A. Male posterior end. B. Female anterior end, showing vulva. C. Female posterior end.

Description : Mouth without lips. Buccal cavity funnel shaped. Cephalic papillae five pairs. Cuticle thick, with fine transverse striations and some bosses, scattered irregularly at about the middle of the body in both sexes. Oesophagus cylindrical and undivided. Tail short and round in both sexes. Spicules short and equal. Gubernaculum absent. Vulva in female in the anterior end, prominent.

Body 14.4-15.6 long, 0.4 wide; buccal cavity short, broad and funnel shaped, 0.032 deep; nerve ring 0.192 from anterior end; oesophagus cylindrical, undivided, 1.09-1.28 long, 0.064-0.08 wide; tail 0.112 long, tip rounded; spicules equal, rounded distally and massive in the proximal end, 0.176 long; caudal papillae three pairs, one pair preanal, two pairs, postanal and single median preanal papilla present.

Female : Body 31.68-33.84 long, 0.064-0.8 wide; buccal cavity 0.048 deep; nerve ring 0.224 from the anterior end; oesophagus as in male, 1.55-1.58 long, 0.096-0.128 wide; tail short, rounded, 0.096-0.112 long; Vulva in the oesophageal region, at about the middle of the oesophagus, 0.65-0.67 from the head; eggs (0.064 × 0.031) in diameter.

Discussion : The present specimens differs from all the known species of the genus *Squamofilaria* Schmerling, 1925, in various body measurements, shape and size of spicules and in number and arrangement of caudal papillae and therefore, a new specific name is proposed to accomodate them.

2. *Squamofilaria* sp.

Material : Three females, Z.S.I. Reg. No. WN 786; host-collared Scops owl, *Otus bakkamoena*; location-Body cavity; locality-Paratia, South District, Tripura; 8.vii. 1991; Coll. S. R. Dey Sarkar.

Description : Male : Unknown.

Female : Body 27.2-28.64 long, 0.53-0.56 wide; buccal cavity short, broad and funnel shaped; cuticle unstriated with a few scattered bosses; nerve ring 0.028-0.224 from the head; oesophagus undivided, 1.04-1.17 long; tail short, round, 0.096-0.08 long; vulva in the oesophageal region, 0.64-0.72 from the anterior end; eggs (0.016-0.024 × 0.032-0.04) in diameter.

Remarks : In the absence of a male specific identification is not possible.

3. *Squamofilaria* sp.

Material : Seven females, Z.S.I. Reg. No. WN 784; host-Magpie Robin, *Copsychus saularis*; location-thorasic cavity; locality-Pachartal, North District, Tripura; 13.vii. 1991; Coll. S. R. Dey Sarkar; 2 femals, Z.S.I. Reg. No. WN 785; host Magpie Robin, *Copsychus saularis*; location- body cavity; locality-Ambasa, North District, Tripura; 29.vii. 1991; Coll. S. R. Dey Sarkar.

Description : Male : Unknown.

Female : Body 17.2-29.6 long, 0.32-0.78 wide; buccal cavity short, broad and funnel shaped; cuticle without bosses; nerve ring 0.064-0.16 from anterior end; oesophagus undivided, short, 0.59-0.78 long, 0.08-0.128 wide; tail tip round, 0.192-0.128 long; vulva in the oesophageal region, distinct, 0.0192-0.384 from anterior end; eggs (0.048 × 0.032) in diameter.

Remarks : In the absence of a male specific identification is not possible.

2. Genus *Pseudaprocta* Schikhobalova, 1930

Pseudaprocta indica n. sp.

Material : Holotype one male, Z.S.I. Reg. No. WN 786; host-Lesser Racket tailed drongo, *Dicrurus remifer*; location; Body cavity; locality -Ambasa, North District, Tripura; 4.ii. 1971; Coll. Dr. V. C. Agrawal. Paratypes : 4 males, 8 females, Z.S.I. Reg. No. WN 787; other particulars as for the holotype.

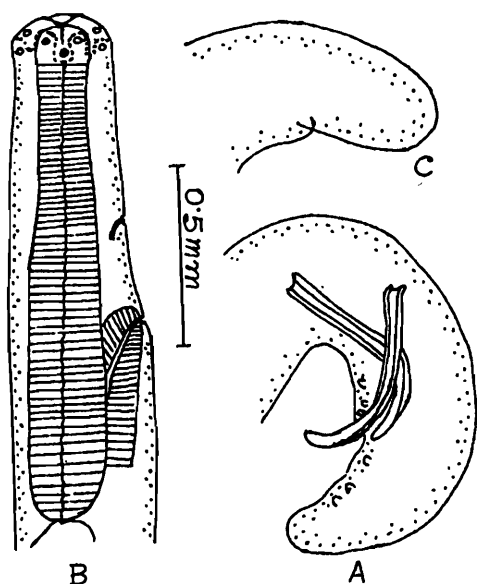


Fig. 9. *Pseudaprocta indica* n. sp.

A. Male posterior end. B. Female anterior end, showing vulva. C. Female posterior end.

Description : Body stout, slightly tapering towards extremities. Mouth without lips. Five pairs cephalic papillae easily distinguishable. Head with delicate lobed cordons between cephalic papillae. Buccal cavity minute. Cuticle finely striated, without bosses. Oesophagus short and undivided. Male : Tail spirally coiled and bluntly rounded, caudal alae absent. Spicules similar and equal. Gubernaculum present. Female : Vulva in oesophageal region. Eggs with coiled embryos. Tail rounded, bent ventrally cuticle with a few scattered bosses.

Male : Body 12.48-13.6 long, 0.45-0.48 wide, nerve ring 0.05-0.19 from anterior end; excretory pore 0.24 from the head; oesophagus undivided,

0.64-0.67 long, 0.08 wide; tail, spirally coiled, 0.19-0.2 long; spicules similar, equal, broad and rounded tips, measure 0.288-0.336 in length; gubernaculum 0.048 long; caudal papillae 6 pairs, 2 pairs preanal, one pair adanal and 3 pairs postanal in position.

Female : Body 27.2-29.9 long, 0.77-0.89 wide; nerve ring 0.16-0.19 from anterior end; excretory pore 0.032-0.37 from the head; oesophagus 0.82-0.96 long, 0.08 wide; vulva prominent, 0.45-0.48 from anterior end; cuticle with a few scattered bosses, especially in the middle of the body; tail tip rounded, 0.22-0.24 long, without any papillae; eggs (0.016 × 0.032) in diameter.

Discussion : The present species comes nearer to *Pseudaprocta gubernacularia* Schikhobalova, 1930, in the presence of a gubernaculum in the male. But differs from it in various body measurements, size of spicules, number and arrangements of caudal papillae, and in the absence of subterminal caudal papilla and much longer tail in the female. The spicules are subequal in *P. gubernacularia* but the same are equal in the present species.

Hence, the present species is regarded as different from all the known forms under the genus *Pseudaprocta* Schikhobalova, 1930 and is named *Pseudaprocta indica* n. sp.

Superfamily (9) FILARIOIDEA

Family FILARIIDAE (Weinland, 1858) Cobbold, 1879

Subfamily FILARIINAE Weinland, 1858

Genus *Filaria* Muelier, 1787

Filaria martis Gmelin, 1790

1790. *Filaria martis* Gmelin, *Systema naturae* etc. (6), Vermis, p. 3040.

Material : Two males, three females, Z.S.I. Reg. No. WN 788; host-Mongoose, *Herpestes auropunctatus birmanicus*; location- subcutaneous tissue; locality-Chailingta, North District, Tripura; 22.xii. 1972 Coll. Dr. V. C. Agrawal.

Diagnosis : Mouth with four small lips. Buccal cavity reduced. Cuticle smooth with lateral alae along entire length. Oesophagus long and indistinctly divided. Caudal alae in male long, wide, transversely striated, continuous behind tip of tail. Spicules very unequal, dissimilar, right small and left long. Gubernaculum absent. Vulva beside oral opening.

Description : Male : Body 54.5-57.5 long, 0.32 wide; nerve ring 0.24 from anterior end; oesophagus 5.2 long; spicules unequal, dissimilar, right smaller 0.112 long, left longer, complex, 0.64 long; tail spirally coiled; 0.128 long, provided with long, wide and transversely striated caudal alae; caudal papillae pedunculated, 10 pairs discernible, 3 pairs preanal and 7 pairs postanal.

Female : Body 114.0-122.5 long, 0.48 wide; nerve ring 0.32 from anterior end; oesophagus 8.8 long; vulva beside oral opening; tail round, anus terminal.

Remarks : This species has been recorded from several carnivores and rodents, now it forms new host and locality record.

Distribution : India : Tripura, North District.

Elsewhere : Africa; Europe; Brazil; Argentina; Mexico, and North America.

Family ONCHOCERCIDAE (Leiper, 1911)

Key to subfamilies

1. Buccal capsule usually present 2
Buccal capsule usually absent.....3
2. Spicules markedly different in size and shape. Oesophagus well developed. Caudal alae rarely present.....Onchocercinae
3. Oesophagus short or variable. Caudal papillae reduced in size and number. Tail long. Caudal alae rarely present. Spicules little different in size and shape. Splendidofilariinae
Oesophagus long. Caudal papillae few in number. Anus subterminal in both sexes. Spicules similar in size and form or markedly different.....Lemdaninae

Subfamily ONCHOCERCINAE Leiper 1911

Callosciurofilaria n.g.

Callosciurofilaria agarwali n.g., n. sp.

Material : Holotype one male, Z.S.I. Reg. No. WN 789; host-Irrawaddy Squirrel, *Callosciurus pygerythrus*; location-abdominal cavity; locality-Kanchanpur, North District, Tripura; 16.ii. 1972;

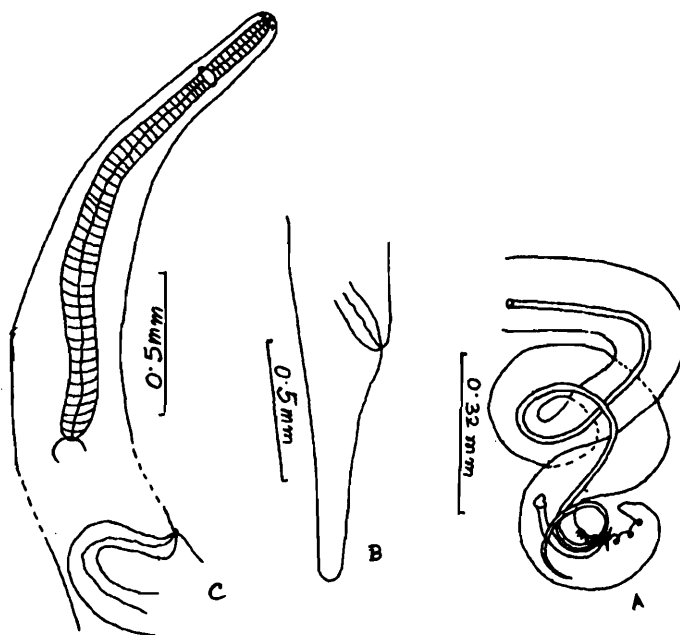


Fig. 10. *Callosciurofilaria agarwali* n.g., n.sp.

A. Male posterior end. B. Female posterior end. C. Female anterior end, showing vulva.

Coll. Dr. V. C. Agrawal. Paratypes one female and three fragments of female, Z.S.I. Reg. No. WN 790; other particulars as for the holotype.

Diagnosis : Body slenderized to ends. Mouth without lips. Buccal cavity inconspicuous. Head round with four papillae. Body smooth, unstriated. Oesophagus undivided narrow and of moderate length. Male tail spirally coiled, without alae, tip conical. Spicules dissimilar, markedly unequal; shorter spicule thick, curved, proximal end wide, distal end with a dorsal hook like appendages directed anteriorly. Left spicule longer, tapering to a fine point. Caudal papillae 7 pairs, 4 pairs, preanal and 3 pairs postanal. Gubernaculum absent. Female tail long, tip simple, rounded. Vulva post oesophageal.

Description : Male : Body 32.16 long, 0.16 wide; nerve ring 0.064 from the anterior end; oesophagus simple, undivided, 0.4 long; spicules very unequal, dissimilar, the right shorter and the left longer; the left spicule slender and finely pointed, 1.2 long; the right spicule stouter, 0.16 long, its proximal end wide and distal end with a dorsal hook like appendage directed anteriorly; tail spirally coiled, without alae, tip conical; 0.096 long; caudal papillae 7 pairs, 4 pairs preanal and 3 pairs postanal in position; gubernaculum absent.

Female : Body 80.8 long, 0.29 wide, (a fragment measure 105.5 long, 0.32 wide); nerve ring 0.096 from the head; oesophagus as in male, 0.96 long; tail 0.48-0.56 long, tip simple, rounded; vulva prominent, post oesophageal, 1.92 from the anterior end; viviparus, microfilariae very small.

Discussion : The present form differs from all the known genera of Onchocercidae. It has a close resemblance to *Pseudolitomosa* Yamaguti, 1941, in having smooth cuticle, undivided oesophagus, unequal and dissimilar spicules, absence of caudal alae, but differs from it in the structure of buccal cavity, in the shape of tail in

both sexes, in the presence of caudal papillae and in the shape of spicules and position of vulva in female. In view of the above differences it is considered desirable to give a new generic name to the parasites described above and the name *Callosciurofilaria agarwali* n. g. n. sp. is proposed to accommodate them.

Subfamily **SPLENDIDOFILARIINAE** Chabaud and Choquet, 1953

Key to genera

Oesophagus divided or undivided. Cuticle with or without bosses. Spicules equal or subequal, similar. Vulva pre or post oesophageal.

..... *Chandlerella*

Oesophagus undivided. Cuticle without bosses. Spicules unequal, similar; vulva well behind posterior end of oesophagus

..... *Paraprocta*

Genus ***Chandlerella*** Yorke and Maplestone, 1926

Key to species

Oesophagus undivided. Spicules equal, 0.08 mm long *Chandlerella tripurae* n. sp.

Oesophagus divided. Spicules subequal 0.08 and 0.11 mm long *Chandlerella oriolae* n.sp.

1. *Chandlerella tripurae* n. sp.

Material : Holotype one male, Z.S.I. Reg. No. WN 791; host = Pied Myna, (*Sturnus contra*); location-heart; locality-Kanchanpur, North District, Tripura; 13.ii. 1971; Coll. V. C. Agrawal; Paratype one female, Z.S.I. Reg. No. WN 792; other particulars as for the holotype.

Description : Mouth without lip. Cephalic papillae 4 pairs. Cuticle smooth, thin and unstriated. Oesophagus simple, club-shaped and undivided. Tail short and rounded in both sexes. Tail of male coiled, without alae. Spicules equal,

short and stout. Vulva in female just behind the oesophagus. Viviparus.

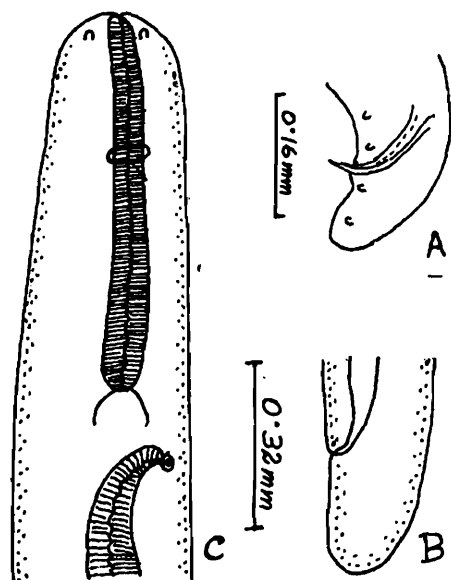


Fig. 11. *Chandlerella tripurae* n. sp.
A. Male posterior end. B. Female posterior end.
C. Female anterior end, showing vulva.

Male : Body 8.8 long; 0.16 wide; nerve ring 0.16 from the anterior end; oesophagus undivided, 0.35 long; tail coiled, short, 0.064 long, tip rounded; spicules similar equal, short, tips pointed, 0.08 long; caudal papillae 4 pairs conspicuous, 2 pairs preanal and 2 pairs postanal.

Female : Body 17.28 long; 0.192 wide; nerve ring 0.192 from the anterior end; oesophagus as in male, 0.48 long; 0.048 wide; vulva post oesophageal, 0.56 from the anterior end; tail round, 0.16 long, eggs (0.024 × 0.016) in diameter.

Discussion : The present specimen comes close to *Chandlerella bosei* (Chandler, 1924) Yorke and Maplestone, 1926 in the body length, undivided oesophagus and in the presence of equal spicules. But differs from it in the shape of spicules, number and arrangement of caudal papillae and in the position of vulva in the female.

2. *Chandlerella oriolae* n. sp.

Material : Holotype one male, Z.S.I. Reg. No. WN 793; host-Black headed Oriole, *Oriolus xanthornus*; location-Overy; locality-Teliamura; West District, Tripura; 1. xii. 1971; Coll. Dr. V. C. Agrawal.

Description : Mouth without lip-like structures. Cephalic papillae 4 pairs. Cuticle smooth and

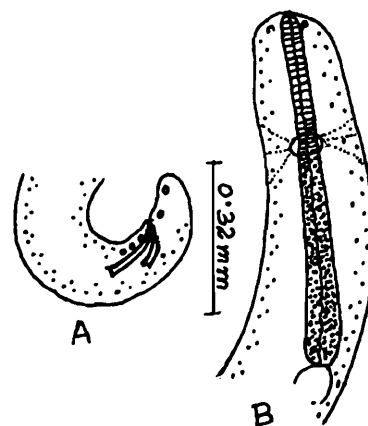


Fig. 12. *Chandlerella oriolae* n. sp.
A. Male posterior end. B. Anterior end.

thin. Oesophagus Club-shaped and divided. Caudal end coiled without alae. Spicules similar, subequal and short. Caudal papillae 5 pairs.

Male : Body 10.9 long; 0.24 wide; nerve ring 0.19 from the head; oesophagus divided into two parts, anterior part muscular; 0.19 long, posterior part glandular 0.29 long; entire oesophagus 0.48 long, 0.048 wide; tail coiled 0.08 long, tip rounded; spicules subequal 0.08 and 0.11 long, similar; caudal papillae 5 pairs, minute, 3 pairs preanal and 2 pairs postanal in position.

Female : Unknown.

Discussion : *Chandlerella oriolae* n. sp. differs from all the known species of the genus *Chandlerella* Yorke and Maplestone, 1926 in various body measurements, size and shape of spicules, number and arrangement of caudal papillae. In having subequal spicules it is closer to *Chandlerella lerouxi* (Sing, 1949) but differs from it in having divided oesophagus and in number and arrangement of caudal papillae (*C. lerouxi* has 9 pairs caudal papillae and undivided oesophagus).

2. Genus *Paraprocta* Maplestone, 1931

Paraprocta passericola n. sp.

Material : Holotype one male, Z.S.I. Reg. No. WN 794; host-House Sparrow, *Passer*

domesticus; location-Body cavity; locality-Manu North District, Tripura; 19.vii. 1991; Coll. S. R. Dey Sarkar. Paratypes 5 males, 6 females; Z.S.I. Reg. No. WN 795; other particulars as for the holotype. Paratypes 2 males, 2 sub-adult males and 7 females; Z.S.I. Reg. No. WN 796; host-yellow legged Green Pigeon, *Teron phoenicoptera*; location-Body cavity; locality-Kanchanpur, North District, Tripura; 18.ii. 1971; Coll. Dr. V. C. Agrawal.

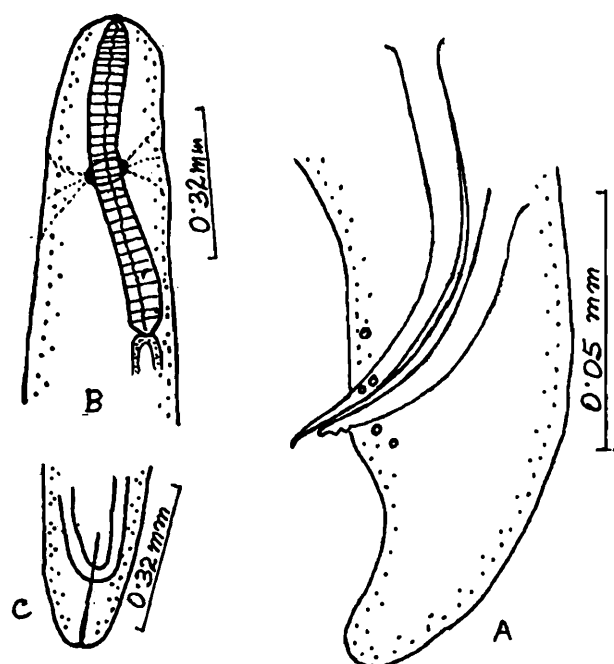


Fig. 13. *Paraprocta passericola* n. sp.
A. Male posterior end. B. Female posterior end.
C. Female anterior end.

Diagnosis : Mouth without lips, Buccal cavity minute. Head round, with four submedian cephalic papillae. Cuticle smooth, unstriated. Oesophagus short, stout and undivided. Caudal end of male spirally coiled, tail tip rounded. Spicules unequal, similar both broad and traugh like. Caudal papillae 5 pairs, minute. Anus in female atrophied, vulva well behind posterior end of oesophagus. Viviparous.

Male : Body 8.72-13.2 long, 0.13-0.21 wide; nerve ring 0.16-0.19 from the head; oesophagus 0.35-0.48 long, 0.048 wide; tail short, rounded, without alae 0.03-0.08 long; caudal papillae minute, 3 pairs preanal and 2 pairs postanal clearly discernible; spicules unequal, similar and

broad, longer flaght distally, 0.08-0.096 long, with pointed tip, and the smaller 0.048-0.064 long, rounded tip.

Female : Body 14.72-25.36 long, 0.27-0.35 wide; nerve ring 0.16-0.24 from the head; oesophagus 0.44-0.53 long; 0.032-0.056 wide; anus atrophied, caudal end rounded; vulva 1.15-1.52 from the anterior end very difficult to locate due to presence of numerous larvae in the uterus.

Discussion : The present parasite belongs to the genus *Paraprocta* Maplestone, 1931. This genus was proposed by Maplestone in 1931 and its type species is *Paraprocta bravicanata*. Since then no additional species or redescription of the species has been made. The present specimens do not agree with it in various body measurements, shape and size of spicules and in presence of cephalic and caudal papillae. Therefore, a new specific name *Paraprocta passericola* n. sp. is proposed to accomodate them.

Subfamily LEMDANINAE Lopez-Neyra, 1956

Genus *Lemdana* Seurat, 1917

Lemdana sp.

Material : One posterior fragment of a male, 3 females, Z.S.I. Reg. No. WN 797; host-Yellow legged Green Pigen, *Teron phoenicoptera*; location-Body cavity; locality-Ampi, West District, Tripura; 22.i.1971; Coll. Dr. V. C Agrawal.

Description : Male : Spicules very unequal, longer 2.4 long, smaller 0.25 long; anus subterminal, tail tip round.

Female : 55.0-66.5 long; tail as in male; vulva in oesophageal region.

Superfamily (10) RICTULARIOIDEA

Family RICTULARIIDAE (Hall, 1915
Subfam.) Railliet, 1916

Genus *Rictularia* Froelich, 1802

Rictularia sp.

Material : Two females, Z.S.I. Reg. No. WN 800; host-*Calloscirus erythracus punctatissimus*;

location-intestine; locality-Ambasa, North District, Tripura; 4.ii. 1971; Coll. Dr. V. C. Agrawal.

Diagnosis : Oral opening dorsal in position and transverse. Oesophageal tooth single. Prevulvar spines 30 pairs in number.

Order STRONGYLIDA

Superfamily (1) ANCYLOSTOMATOIDEA

Family ANCYLOSTOMATIDAE
(Looss, 1905)

Genus *Ancylostoma* (Dubini, 1843) Creplin,
1845

Ancylostoma (Ancylostoma) caninum
(Ercolani, 1859) Lane, 1916

1859. *Strongylus caninus* Ercolani, *Noewi Elementi Tearicoparactici di Medicina Veterinaria* Bologna, p. 530.

1889. *Ankylostomum caninum* V. Linstow, *Compendium der Helminthologie* etc. p. 15.

1916. *Ancylostoma (Ancylostoma) caninum* Lane, *Ind. J. Med. Res.* Calcutta, 4, p. 74

Material : Twelve examples, Z.S.I. Reg. No. WN 801; host-Jacal, *Canis aureus*; location-intestine; locality-Ambasa, North district, Tripura; 30.vii. 1991; coll. S. R. Dey Sarkar.

Diagnosis : Oral opening with three pairs of ventrolateral teeth; inner most pair of ventral teeth almost as large as the others. Male bursa with short lobe and divergent ray.

Male : Body about 10.0 long; spicules upto 0.9 long; gubernaculum 0.16 long.

Female : Female body upto 14.0 long; tail 0.2 long; vulva at about posterior third of the body.

Distribution : Tripura : North district.

Elsewhere : India : Widely distributed; Cosmopolitan.

Superfamily (2) STRONGYLOIDEA

Family CHABERTIIDAE
(Popova, 1952 Subfam.)
Lichtenfels, 1980

Subfamily OESOPHAGOSTOMINAE
Railliet, 1916

Genus *Oesophagostomum* Milon, 1861

Key to subgenera

Cervical papillae anterior to Oesophageal expansion.....1

Cervical papillae posterior to Oesophageal expansion *Oesophagostomum (Hysteracrum)*

1. Spicules short less than 1 mm. long, vagina short *Oesophagostomum (Proteracrum)*

Spicule long more than 1 mm. long. Vagina long. *Oesophagostomum (Conoweberia)*

1. Subgenus *Hysteracrum* Railliet and Henry,
1913

Oesophagostomum (Hysteracrum) asperum
Railliet and Henry, 1913

1913. *Oesophagostomum (Hysteracrum) asperum* Railliet and Henry, *Bull. Soc. Path. exot.*, Paris, 6 (7) : 507-509.

Material : Several examples; host-goat (domestic); location-intestine; locality-Paratia, South District; 8.vii. 1991; Pachartal, North District; Tripura; 16.vii. 1991; coll. S. R. Dey Sarkar.

Diagnosis : External leaf crown contains 12 elements and internal leaf crown contains 24 small elements; the mouth-collar in the form of a truncate cone and marked off by a well defined groove posteriorly; cephalic inflation of the cuticle well developed.

Male : Body upto 13 long; 0.48 wide; oesophagus club shaped, 0.74-0.88 long; spicules 1.35-1.7 long; gubernaculum shovel-shaped, about 0.1 long.

Female : Body upto 17.0 long, 0.5-0.6 wide; tail 0.14-0.17 long, with a pair of papillae at 0.055-0.066 from the tip; vulva prominent, about 0.32-0.39 from posterior end.

Distribution : Tripura : North and South Districts.

Elsewhere : India : Widely distributed; China; Indo-China; Malaya; Pakistan; Kaghan Valley; Panama Canal Zone.

2. Subgenus ***Proteracrum*** Railliet and Henry, 1913

Oesophagostomum (Proteracrum) Columbianum (Curtice, 1890) Railliet and Henry, 1913

1890. *Oesophagostoma columbianum* Curtice, U. S. Dept. Agric. Washington, 220 : p. 16.

1913. *Oesophagostomum (Proteracrum) columbianum* Railliet and Henry, Bull. Soc. Path. exot., Paris, 7 : p. 507.

Material : Two males, 4 females; Z.S.I. Reg. No. WN 802; host-goat, location-intestine; locality-Agartala, Tripura (Sadar); 31.vii. 1991; coll. S. R. Dey Sarkar.

Diagnosis : The external leaf Crown contains 20-24 elements, the internal 40-48; the mouth collar in the form of a truncate cone, its posterior end prominent; cephalic inflation absent; lateral alae present.

Male : Body 12-16 long, 0.23-0.4 wide; oesophagus about 1.0 long; spicules 0.75-0.85 long; gubernaculum about 0.1 long.

Female : Body 14-18 long, 0.3-0.5 wide; tail tapering, 0.3-0.6 long; vulva less prominent, at about 1-1.4 from posterior end.

Distribution : Tripura : Agartala.

Elsewhere : Cosmopolitan in distribution.

3. Subgenus ***Conoweberia*** Ihle, 1922

Key to species

Teeth in oesophageal funnel large and arising near its base *O. (C) tridentatum*

Teeth in oesophageal funnel small and arising from its anterior end *O. (C). blanchardi*

1. ***Oesophagostomum (Conoweberia) blanchardi*** (Railliet and Henry, 1912) Travassos and Vogelsang, 1932.

1912. *Oesophagostomum blanchardi* Railliet and Henry, Arch. Parasit., 14 (4) : p. 572.

1932. *Oesophagostomum (conoweberia) blanchardi* Travassos and Vogelsang, Mem. Inst. Oswaldo Cruz, 26 (3) : 251-328.

Material : Four males, ten females, Z.S.I. Reg. No. WN 803; host-Hoolock Gibbon, *Hylobates hoolock*; location-Stomach; locality-Ambasa, North district, Tripura; 4.ii. 1971; coll. V. C. Agrawal.

Diagnosis : The external leaf crown contains 10 elements; the internal numerous small elements; cephalic inflation well developed; oesophageal funnel wide, its walls slightly incurved and bear three teeth anteriorly.

Male : Body 14.7-17.0 long, 0.4-0.48 wide; oesophagus about 0.7-0.78 long; spicules 1.6 long, alate, tip blunt; gubernaculum 0.11-0.16 long; cervical groove 0.28-0.33 from anterior end.

Female : Body 17.1-22.0 long, 0.67 wide; tail conically pointed, 0.19-0.22 long; vulva 0.27-0.28 from the anus, prominent.

Distribution : Tripura : Ambasa.

Elsewhere : India : West Bengal (Calcutta Zoo); Borneo; Indochina; Java; London Zoo.

2. ***Oesophagostomum (conoweberia) tridentatum*** (Maplestone, 1932)

1932. *Oesophagostomum tridentatum* Maplestone, Rec. Indian Mus., Calcutta, 34(3) : 257-259.

Material : One male, and 3 females; Z.S.I. Reg. No. WN 332; host-Rhesus monkey, (*Macaca m. mulata*); location-intestine; locality-Charilam, South district, Tripura; 16.ix. 1969 : coll. V. C. Agrawal.

Diagnosis : The external leaf-crown contains 20 broad, pointed elements, which project beyond the mouth collar; mouth collar conical; internal leaf crown absent; Oesophageal funnel wide and cupshaped, three large, anteriorly directed teeth with broad bases and sharp points arising near the base of the oesophageal funnel.

Male : Body 13.5 long; 0.5 wide; oesophagus about 1.0 long; spicules 1.6 long; gubernaculum 0.17 long; prebursal papillae present.

Female : Body 14-17 long; tail about 0.16-0.2 long; vulva at about 0.16-0.2 from the anus.

Distribution : Tripura : Charilam.

Elsewhere : India : West Bengal (Calcutta Zoo); Borneo.

Superfamily (3) TRICHOSTRONGYLOIDEA

Family HELIGMOSOMIDAE
(Travassos, 1914 Subfam.
Cram, 1927)

Genus *Longistriata* Schulz, 1926

Longistriata tripurensis n. sp.

Material : Holotype one male, Z.S.I. Reg. No. WN 804; host-*Callosciurus erythraeus punctatissimus*; location-intestine; locality-Ambasa, North District, Tripura; 9.ii. 1971; Coll. Dr. V. C. Agrawal; Paratypes 4 males, 6 females, Z.S.I. Reg. No. WN 805; other particulars as for the holotype.

Diagnosis : The specimens are filiform, blood red while alive. Body spirally coiled in both sexes. Head simple with four papillae. Cuticle finely striated transversely with eight longitudinal ridges. Cephalic vesicle annulated.

Male : Body 5.76-6.4 long, 0.08-0.096 wide; the cephalic inflation 0.048 long, 0.032 wide and well marked off from the rest of the body by an annular constriction; cuticle of the body finely striated transversely with eight longitudinal ridges; starting from a little posterior to the annular constriction of cephalic inflation the longitudinal ridges extended upto a little anterior to the bursa; oesophagus narrow 0.24-0.29 long, nerve ring 0.048 from the head; the excretory pore inconspicuous.

Bursa with two symmetrical lateral lobe, the dorsal lobe not differentiated; prebursal papillae absent. Ventral rays with common trunk, divergent distally, reaching the bursal margin; laterals with common trunk; externolateral and medialateral close together proximally and divergent distally; the postero lateral ray divergent from the mediolateral ray; externodorsal arising from common trunk with dorsal, reaching the bursal margin; the dorsal ray bifurcated distally and each branch simple and not bifurcated at the tip;

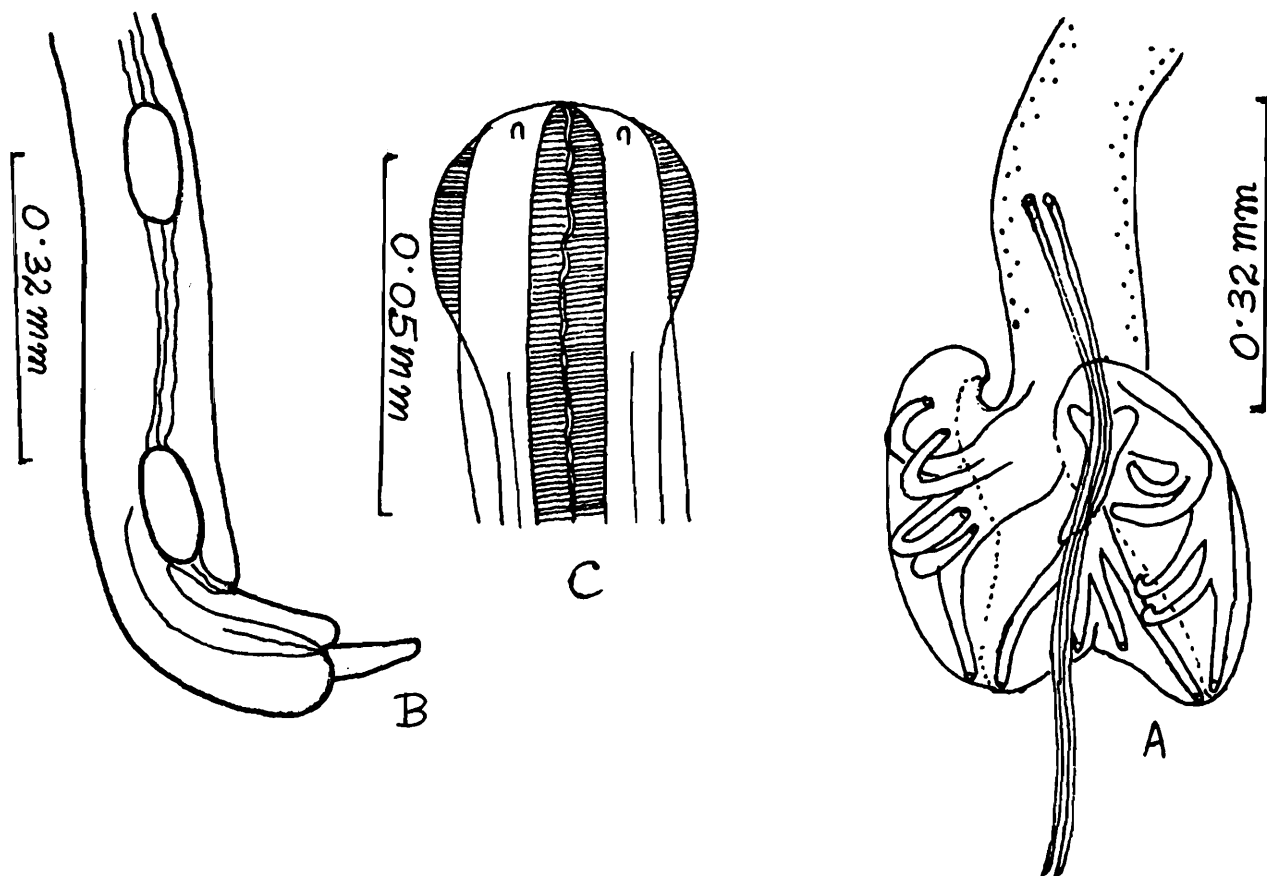


Fig. 14. *Longistriata tripurensis* n. sp.
A. Male posterior end. B. Anterior end. C. Female posterior end.

spicules equal, brown in colour, simple and filiform, 0.48-0.51 long; genital cone well developed, elongated 0.112-0.128 long; gubernaculum absent.

Female : Body 9.6-11.52 long, 0.096-0.144 wide; longitudinal ridges and transverse striations as in male; nerve ring 0.064 from the head; oesophagus 0.4-0.48 long; the posterior end of the female retracted into a prepuce-like sheath of cuticle; tail digitiform; 0.064 long; vulva 0.128 from the posterior end; monodelphic; eggs (0.048-0.064 × 0.024-0.32) in diameter.

Discussion : The present form differs from all the known species of the genus *Longistriata* Schulz, 1926, in various body measurements shape and size of the spicules. In having 8 longitudinal ridges, each division of dorsal ray simple and undivided, absence of gubernaculum, it comes close to *Longistriata longispicularis* Singh 1962, the only Indian species of the genus. But it differs from the present species in various body measurements, in shape of female tail and having longer spicules (In *L. longispicularis* male 12.21-16.28 long, spicule 1.44-1.69 long; female 13.66-16.93 long). Therefore, a new specific name *Longistriata tripurensis* n. sp. is proposed to accommodate them.

Family MOLINEIDAE (Skrjabin & Schulz, 1937, Subfam.) Durette-Desset and Chabaud, 1977.

Subfamily MOLINEINAE Skrjabin & Schulz, 1937

Genus *Oswaldocruzia* Travassos, 1917

Oswaldocruzia goezei Skr-jabin & Schulz, 1952

Material : One male, 9 females, Z.S.I. Reg. No. WN 806; host-*Rana* sp.; location-intestine; locality-Gandachera, North District, Tripura; 12.i 1991; Coll. R. K. Ghosh.

Diagnosis : Male : Body filiform 7.5 long, 0.13 wide; head including vesicle 0.035 wide; oesophagus club shaped 0.38 long; spicules

complex, equal 0.23 long, split into 5 separate branches; gubernaculum absent; bursa wide and trilobed; posterior lobe small; prebursal papillae absent; ventral rays almost equal, close together and reaching the edge of the bursa; anterolateral ray divergent from and of about the same length as, the other lateral rays; externodorsal rays originate from the base of the dorsal ray; dorsal ray long stout, cleft distally, with two pairs of small accessory branches and several short terminal digitations.

Female : Body 10.0-16.5 long, 0.16-0.25 wide; tail conical, 0.22-0.32 long; vulva prominent 4.5-5.1 from the posterior end, amphidelphic.

Distribution : Widely distributed in India.

Elsewhere : Euproe, Asia.

Superfamily (4) METASTRONGYLOIDEA

Family ANGIOSTRONGYLIDAE
(Boehm and Gebauer, 1934
Subfam.) Anderson, 1978

Genus *Pulmostrongylus* HSU, 1935

Pulmostrongylus palustris (Soota and Chaturvedi, 1970)

1970. *Herpestostrongylus palustris* Soota and Chaturvedi, *Proc. Indian Acad. Sci. Bangalore. B.* 71 (3) : 105-107

1978. *Pulmostrongylus palustris* Anderson, *CIH Keys to the nematode Parasites of Vertebrates*, No. 5 p. 20.

Material : 16 males, 26 females, Z.S.I. Reg. No. WN 807; and one male, 42 females, Z.S.I. Reg. No. WN 808; host-Mongoose, *Herpestes auropunctatus birmanicus*; location-Body cavity, liver and surrounding the outer wall of heart; locality-Ambasa, North district, Tripura; 7.ii. 1971; coll. Dr. V. C. Agrawal.

Description : Male : Body 18.88-21.28 long, filiform, without cuticular striations, 0.25-0.27 wide; nerve ring 0.06-0.08 from the head; oesophagus club shaped 0.32-0.33 long; spicules equal, short, stout and ridged; 0.09-0.11 long; gubernaculum minute, inverted 'Y' shaped, 0.032 long; bursa short, dorsal lobe absent; ventero-

ventral and lateroventral rays fused together except for a very short distance near the distal end; anterolateral separated from the rest of the lateral system, mediolateral and posterolateral also fused together excepting for a short distance near the terminal end and appear very stout, externodorsal separated with a blunt ray tip and a nodular swelling little above the tip, dorsal ray divided, each division with bidigitate termination, the inner digit of each division slightly longer than the outer digit; two unequal chitinous rings surrounding by a larger third ring or sheath near cloaca.

Female : Body 20.24-22.8. long, 0.29-0.35 wide; oesophagus 0.4-0.43 long; tail 0.48-0.56 long, tapering and ending in a blunt tip; vulva prominent, 1.12-1.18 from the posterior end; eggs granular.

Remarks : The female of this species is described here, for the first time.

Distribution : India : West Bengal, Tripura (North District).

SUMMARY

This paper deals with parasitic nematodes collected from vertebrate hosts in Tripura. This comprises 60 species contained in 47 genera, 26 families and 5 orders of which 14 species and one genus are new to science. Most of the remaining species are fairly well known in India, but forms new host or locality records.

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ACANTHOCEPHALA

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INTRODUCTION

Acanthocephala, the endoparasitic thorny-headed worm is found inhabiting the intestine of fishes, amphibians, reptiles, birds and mammals. Larval forms are found in crustaceans, beetles and in some other insects.

Thapar (1927, 1930); Dutta (1927) recorded some Acanthocephala from India. That was the beginning of the study of Acanthocephala in the country. During fifties Das (1950; 1952; 1957); Sarkar (1953; 1954; 1956) Soota (1953; 1956); Tripathi (1959); Agarwal (1958); Farooqi (1958) paid attention to this group and recorded a good number of Acanthocephala from the country. Later, Gupta & Lata (1967); Fotadar (1968); Gupta and Jain (1980); Gupta and Fatma (1983); Farooqi (1981); George and Nadakal (1978; 1984) added their notable contributions to the knowledge of Indian Acanthocephala. But our knowledge of Indian species of Acanthocephala still deserves more. In view of the fact, a little effort has been taken to work out the collections made by the Zoological Survey of India from the state of Tripura.

The paper deals with 17 species under 9 genera and 7 families. 4 species are found new to science. The description of all species with morphological diagnostic features have been appended. The measurements are in millimetres unless otherwise stated.

MORPHOLOGY AND TERMINOLOGY

The worm lacks digestive tract in all stages of development. Nutrition takes place through body wall. The parasite is characterised by a specialised structure called proboscis which consists of hooks and spines arranged on it in definite orders, either

in longitudinal or circular order. Proboscis is the hold fast. Hooks and spines help the worm adhere to the tissue of the hosts. This organ is highly retractile and recoils inside the proboscis sheath under adverse condition. Paired lemnisci that grow from the base of the neck hang inside the body cavity as strips of bands along the sides of proboscis sheath. They help retraction and eversion of the proboscis (Hamann, 1891; Kostylev, 1912). Suspensory ligament extending through the whole body cavity envelops gonads. Adjoining two testes, the cement glands lie with various number and size. Sticky secretion of these glands plugs the female gonopore after copulation. Final organ of the male reproductive system is the bell shaped compulsory bursa located at the posterior end of the body cavity usually remains retracted inside the body. Before copulation, with the contraction of the muscular sac, fluid from it squeezes out to the wall of the bursa. As a result, the organ pushes out and envelops the end of the female.

Female forms are generally larger than males. General morphology of the female is same as male. The reproductive system consists of ovaries and oviducal system. Ovaries float as ovarian balls in the ligament sac. The oviducal system consists of uterine bell, oviducts, uterus and vagina. They are held in body cavity by suspensory ligament. The posterior end of ligament sac is attached to the muscular uterine bell. The bell sorts out the immature eggs and allows the mature eggs to pass on to the uterus, vagina and gonopore. Mature eggs contain embryonic larva surrounded by several egg membranes.

Dimension of the worm, number of proboscis hooks and their pattern of arrangements, number and extent of body spines, position of gonads, nature and number of cement glands, size and

nature of eggs etc. are considered for taxonomic study of the worm.

COLLECTION, FIXATION AND PRESERVATION

The adult living worms are collected from the mucosa of the intestine carefully. The worm is then put into water of a watch glass for cleaning in order to remove the foreign bodies attached to it. This process is done with the help of fine brush. In case, where the proboscis is not protruded, it is often necessary to resort to delicate squeezing of the parasite. The worm is placed under a cover glass and gentle pressure is applied with the fine needle on the cover glass so that the proboscis comes out of the proboscis sheath. 70% alcohol is dropped through a pipette under the cover glass from the side of the proboscis. Fully stretched worms with protruded proboscis could easily be obtained if the live specimens are kept in distilled water for some hours under air-tight condition. F. A. A. are used as the fixative for histological studies.

Preservation : The fixed worms are best preserved after at least two washes in 70% alcohol to ensure that the worm is free from fixing fluid.

Staining : Acanthocephala provide poor penetrability of stain due to its cuticular body and chitinized hooks. However, for the smaller Acanthocephala, the staining is possible and is generally done with alcoholic Borax Carmine stains, and mounted in Canada Balsam for permanent whole mount. Glycerine gives best result as clearing agent particularly for hooks and their roots. Specimens are clarified in 25% to 50% glycerine and studied. In some cases chemically pure glycerine also gives good result.

LIST OF SPECIES

1. Family : QUADRIGYRIDAE Van Cleave, 1920.

(1) Genus : *Pallisentis* Van Cleave, 1928
i) *P. ophiocephali* (Thapar, 1930)

ii) *P. colisai* Sarkar, 1954.

(2) Genus : *Acanthosentis* Verma et Dutta, 1929

iii) *Acanthosentis* sp.

2. Family : NEOECHINORHYNCHIDAE Van Cleave, 1919

Subfamily : NEOECHINORHYNCHINAE Travassos, 1926.

(3) Genus : *Neo-echinorhynchus* Hamann, 1892

iv) *N. devdevi* (Dutta, 1936)

3. Family : PSEUDOACANTHOCEPHALIDAE Petrotschenko, 1956

(4) Genus : *Pseudoacanthocephalus* Petrotschenko, 1956.

v) *P. paratiensis* n. sp.

vi) *P. manuensis* n. sp.

4. Family : PLAGIORHYNCHIDAE Golvan, 1960.

Subfamily : PLAGIORHYNCHINAE Meyer, 1931.

(5) Genus : *Plagiorhynchus* Luhe, 1911

Sub-genus : *Plagiorhynchus* - (*Prosthorhynchus*) Schmidt and Kuntz, 1966

vii) *P. (Prosthorhynchus) deysarkari* n. sp.

Subfamily : PORRORCHINAE golvan, 1956.

(6) Genus : *Porrorchis* Fukui, 1929

viii) *P. hylae* (Johnston, 1914), Schmidt and Kuntz, 1967.

5. Family : GIGANTORHYNCHIDAE Hamann, 1992.

(7) Genus : *Mediorhynchus* Van Cleave, 1916.

ix) *M. thrushi* n. sp.

x) *M. garruli yamaguti*, 1939

xi) *M. armenicus* Petrotschenko, 1958

Host : *Colisa fasciatus*.

Diagnosis : Male : Total length 3.50-4.83 x 0.32-0.38, cylindrical. Proboscis globular, 0.21 x 0.17. Proboscis hooks in 4 circles with 8-10 hooks in each. Hooks of 1st and 2nd circles long and thin. While 3rd and 4th circles small. Size ratio between hooks of 2nd and 3rd circles 1 : 2 or more.

Measurement of hooks : —

H_1	0.070
H_2	0.056
H_3	0.027
H_4	- 0.024

Proboscis sheath 0.48 x 0.15-0.17. Nerve ganglion at the base of proboscis sheath, Lemnisci long, tubular.

Number of collar spines 15-17 x 12-15

Number of trunk spines 15-17 x 10-16

Testes 2, elongate, tandem, T_1 -0.43 x 0.14 T_2 -0.42 x 0.15.

Cement gland syncytial with 8-10 nuclei, measured. 22-0.29 in length.

Seminal vesicle 0.22-0.29 in length. Bursa not protruded, genital pore terminal.

Female : Body more or less similar to that of male. Total length 5.30-7.42 x 0.62-0.70. Proboscis 0.42-0.46 x 0.27-0.28. Proboscis sheath 0.67-0.73 x 0.21-0.22. Trunk and Body spines conspicuous. Uterine bell 0.126 x 0.56.

Distribution : South of Tripura.

Discussion : Sarkar (1954) described the species from *Colisa fasciatus* from Delhi. Later, it has been recorded from some other parts of the country. The species is described here as a new locality record.

Genus *Acanthosentis* Verma et Dutta, 1929

Acanthosentis sp.

Material examined : 2 ♂

Host : *Mystus* sp.

Location : Intestine.

Diagnosis : Male : Body small, cylindrical.

Total length 1.65-1.92 x 0.38-0.53. Proboscis short globular with 3 circles of hooks with 6 hooks in each circle. Proboscis 0.14 in length. Body spines appear to be more than 20 rows. Body nuclei not clear. Proboscis sheath short, cylindrical single layered. Testes tandem at the posterior third of the body T_1 -0.20-0.29 x 0.18-0.22 T_2 -0.15-0.27 x 0.20-0.28. Cement gland syncytial, nuclei not clear. Bursa not protruded.

Distribution : South of Tripura.

Discussion : The specimens are too poorly preserved to be studied in details for reaching species level. Therefore, the specimens are described here as *Acanthosentis* sp. with a new locality record.

Family NEOECHINORHYNCHIDAE
Van Cleave, 1919.

Subfamily NEOECHINORHYNCHINAE
Jrassos, 1926.

Genus *Neo-echinorhynchus* Hamann, 1892.

Neoechinorhynchus devdevi (Dutta, 1936)

1936. Dutta, M. N. Scientific results of the Yale North India Expedition Biological Report No. 20. Helminth parasites of fishes from North India, with special reference to acanthocephalans. *Rec. Ind. Mus.* 38 (2), 211-229.

1951. Kaw, B. L. Studies in Helminthology. Helminth parasites of Kashmir *Ind. J. Helm.* 3 (2). pp. 117-132.

Material examined : 2 ♂

Host : *Mystus* sp.

Location : Intestine

Diagnosis : Male : Body small, cylindrical 7.00 x 0.84 Proboscis short, almost globular, 0.17 x 0.10, armed with 6 spiral rows with 3 hooks in each row.

Measurement of hooks

H ₁	-	0.038
H ₂	-	0.024
H ₃	-	0.020

Proboscis sheath 0.30 x 0.13, single layered, short, Nerve ganglion at its base. Lemnisci cylindrical, elongate, unequal L₁ 0.64 x 0.07 L₂ 0.59 x 0.10.

Hypodermic nuclei 7-8 dorsally, 2 ventrally. Testes 2 tandem, contiguous, T₁ 0.48 x 0.36. T₂ 0.66 x 0.36. Cement glands syncytial with 2 or more nuclei, 0.71 x 0.42. Bursa not protruded.

Distribution : Tripura.

Discussion : Kaw, 1951, transferred *Eosentis devdevi* to *Neo-echinorhynchus*. This transfer is justified. The species *Neo-echinorhynchus devdevi* is described here with a new locality and host record.

Family PSEUDOACANTHOCEPHALIDAE
Petrotschenko 1956.

Genus *Pseudoacanthocephalus* Petrotschenko,
1956.

Key to Species

1. 20 longitudinal rows of hooks with 5 hooks in each row *P. paratiaensis* n. sp.
Less than 20 longitudinal rows 2
2. 14 longitudinal rows with 4 hooks in each row *P. shillongensis* Bhattacharya, 1997

Pseudoacanthocephalus paratiaensis n. sp.
(Fig. 1 a, b & c)

Material examined : One female.

Host : *Bufo melanostictus*.

Location : Intestine.

Diagnosis : Female : Body 18. 5 x 2. 25, cylindrical, Proboscis 0.625 long x 0.45 wide, armed with 20 longitudinal rows of 5 hooks in each row. Hooks almost equal in size, roots with anterior bulge.

Measurement of hooks :—

Root	-	0.0664
Point		0.0913

Proboscis sheath 1.125 x 0.5, double walled with nerve ganglion at the base. Lemnisci 2, equal, leaf like, 1.025 x 0.375 longer than proboscis receptacle. Genital opening sub-terminal, Vagina 0.125, uterus 0.625. Uterine bell 0.625. Eggs oval, not fully developed.

Distribution : Paratia, Tripura.

Discussion : The present form is comparable with its allied species *P. bufonis* (Shipley, 1903) nov. comb. and *P. caucasicus* (Petrotschenko, 1953) nov. comb. with regard to the length of proboscis and number of longitudinal rows of hooks but it differs from them in number of hooks per row and breadth of proboscis. Moreover, the length of point of hook is much longer in the present form than that of *P. bufonis*. Further, the roots of hooks in the present form are not "approximately one and a half times thicker than point" as stated in *P. bufonis*.

In *P. caucasicus*, 1st and 2nd hooks of each row consist of roots with anterior and posterior processes which are lacking in the present form. Moreover, the dimension of roots and points of *P. caucasicus* is much larger than that of the present form.

P. rauschi Gupta & Fatma, 1985 differs from the present form by possessing 10-12 hooks per row and in having terminal female genital opening which is sub-terminal in the present form.

The species under description is distinguishable from all the species under the genus by the presence of a bulbous swelling at the root tips of all the hooks as well as number of hooks per row. It is, therefore, designated as a new species, *P. paratiaensis*.

Pseudoacanthocephalus shillongensis,
Bhattacharya, 1997.
(Fig. 2 a, b, c & d)

Ref. Bhattacharya, S. B (1997)—State Fauna Series (4) Fauna of Meghalaya, Z.S.I.

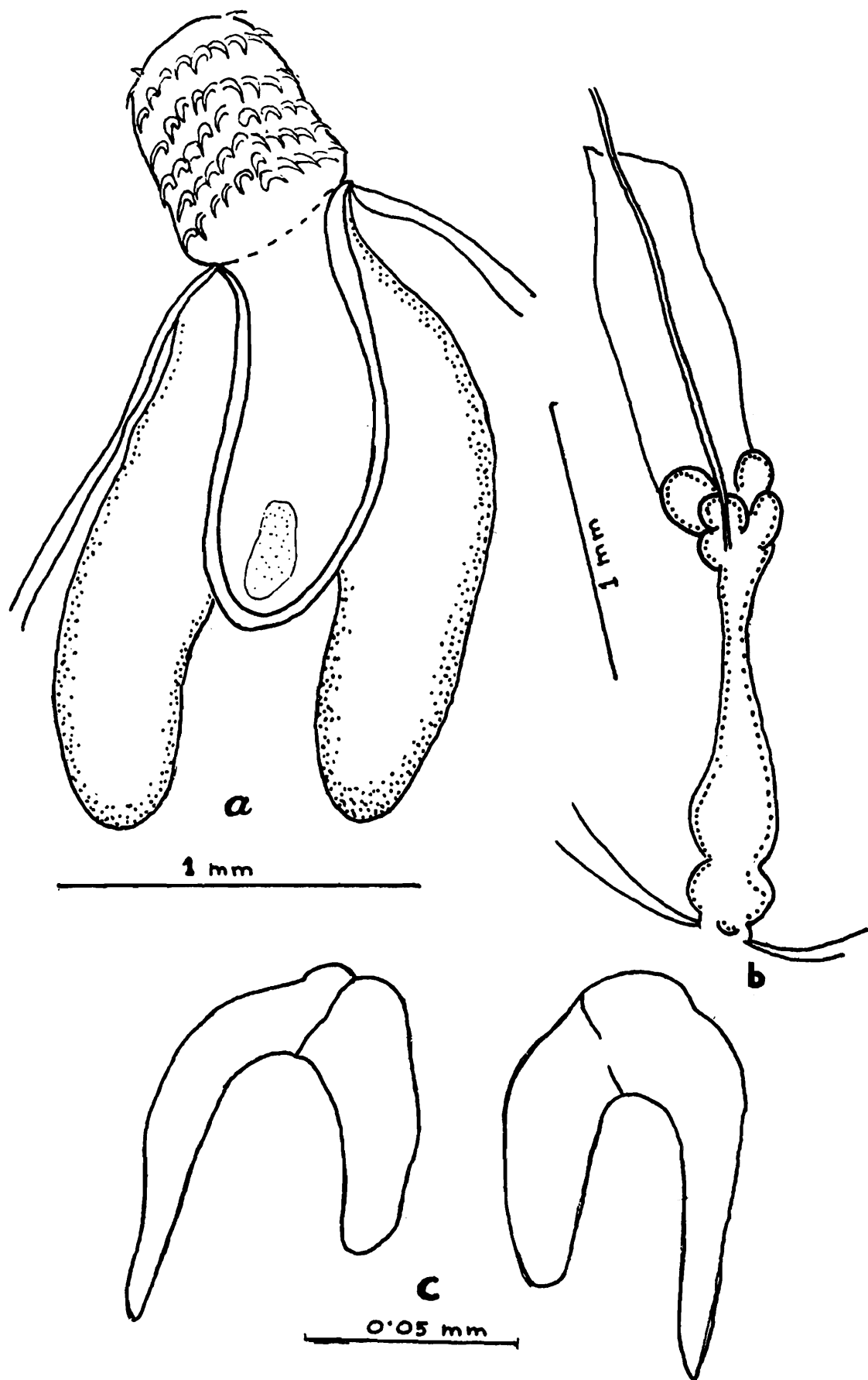


Fig. 1. *Pseudoacanthocephalus paratiaensis* n. sp.
(a) anterior part of female, (b) female genital organ, (c) hooks.

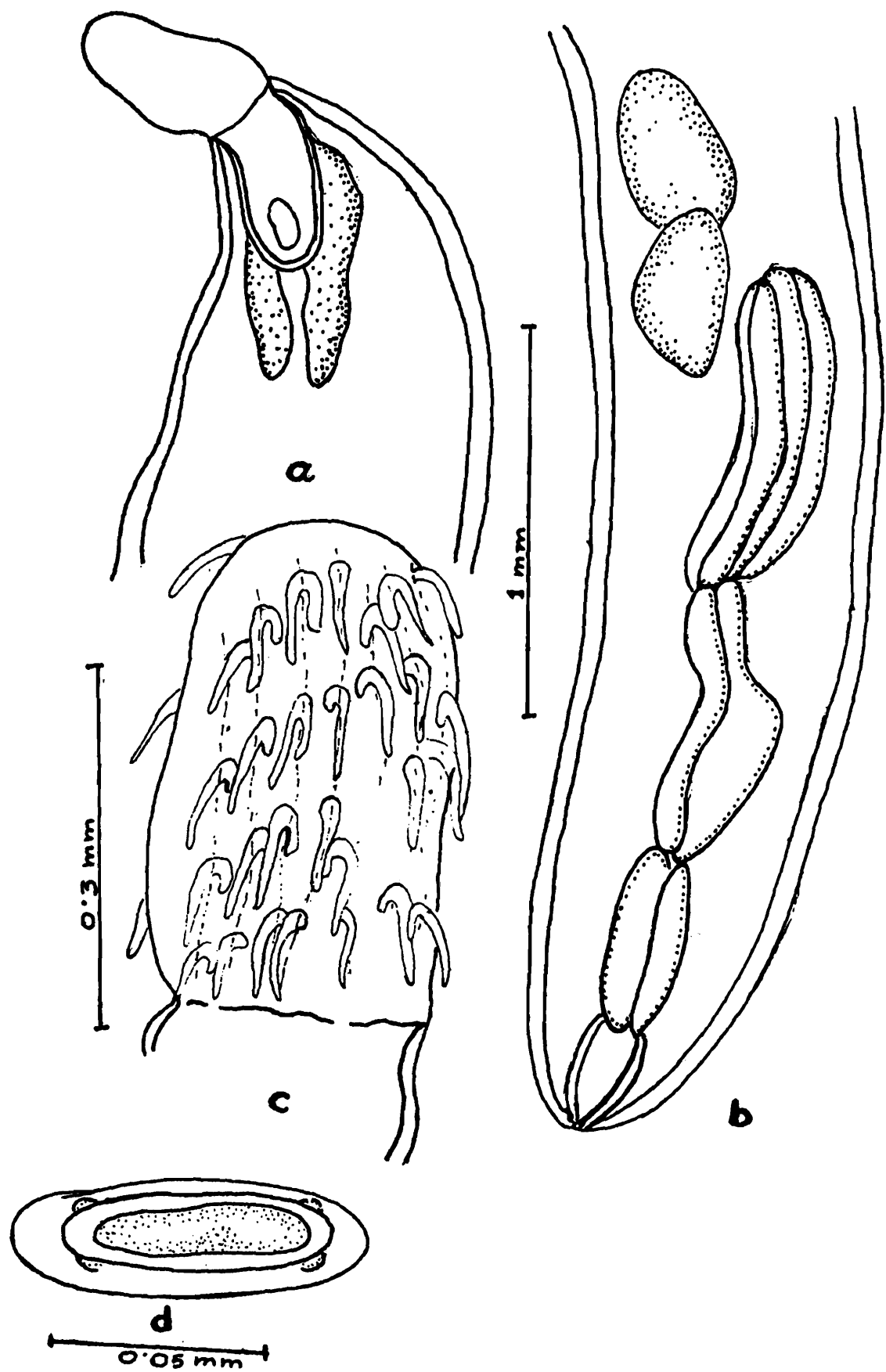


Fig. 2. *Pseudoacanthocephalus manuensis* n. sp.
(a) anterior part of male, (b) posterior part of male, (c) proboscis with hooks, (d) egg.

Material examined : 2 ♂ 1 ♀.

Host : *Bufo melanostictus*

Location : Intestine.

Diagnosis : Male, Body 6.5-9.75 x 1.5 -1.75, spindle shaped, proboscis 0.4 x 0.325 armed with 14 longitudinal rows of hooks with 4 hooks in each row. Hooks equal in size.

Measurement of hooks : —

Root 0. 064

Point 0. 083

Neck very short. Proboscis sheath 0.75 x 0.45, nerve ganglion near its base. Lemnisci leaf like, longer than Pr. sheath. Testes two, post equatorial cement glands 6.

Female : Body 18.625 x 2.125, Proboscis hooks as in male. Genital pore sub-terminal, Uterus 0.712, Uterine bell 0.656. Eggs oval, 0.07 x 0.024, without polar prolongations of the middle shell.

Distribution : Manu, Tripura.

Discussion : The species under report shows close proximity to *P. shillongensis* Bhattacharya, 1997 which bears the lowest number of proboscis hooks as compared to other species described so far under the genus. Hence, *P. shillongensis* Bhattacharya, 1997 is reported for the second time with a new locality record.

Family PLAGIORHYNCHIDAE Golvan, 1960.

Key to the Subfamily

1. Proboscis ovoid and spherical, parasitic as adult in birds and mammals
.....PORRORCHINAE Golvan, 1956.
- Proboscis not ovoid, cylindrical 2
2. Proboscis cylindrical or somewhat bulbous...
.....PLAGIORHYNCHINAE Meyer, 1931.

Subfamily PLAGIORHYNCHINAE, Meyer, 1931.

Genus *Plagiorhynchus* Luhe, 1911.

Subgenus *Plagiorhynchus* (Prosthorhynchus)
Schmidt & Kuntz, 1966.

Plagiorhynchus (*Prosthorhynchus*)
deysarkari n. sp.

(Fig. 3 and 4a, b, & c)

Material examined : One male and one female.

Host : *Sturnus malabaricus*.

Location : Intestine.

Diagnosis : Male, Body 7.625 x 1.625

Medium size, plumpy. Proboscis 0.95 x 0.225, cylindrical, fairly long, directed ventrad, armed with 14 longitudinal rows of 14 hooks in each row, basal hooks smaller than anterior hooks. All hooks rooted except last two of each row.

Measurement of hooks :

	Root	Point
Anterior hooks	0.052-0.054	0.054-0.064
Basal hooks		0.03

Neck 0.1 x 0.229. Proboscis receptacle 1.5 x 0.5, double walled, nerve ganglion at its middle. Lemnisci 2, long, slender, coiled. Testes 2, 1.425 x 0.625, overlapping, cement gland 4, 1.75 long, genital pore terminal.

Female : Body 11.125 x 1.875, medium size, hypodermic nuclei present. Other morphological characters except reproductive organs same as that of male. Genital pore sub-terminal. Egg 0.041-0.074 x 0.024-0.033 without polar prolongations of the middle shell.

Distribution : Ambasa, North district of Tripura.

Discussion : Schmidt & Kuntz, 1966 established the sub-genus *Plagiorhynchus* (*Prosthorhynchus*) with sub-terminal genital pore in female and without polar prolongations of the middle shell of egg as two major differentiating characters from the sub-genus *Plagiorhynchus* (*Plagiorhynchus*). Zafar & Farooqi, 1981 redescribed *Prosthorhynchus nicobarensis* Soota & Kasal, 1972 as *Plagiorhynchus* (*Prosthorhynchus*) *nicobarensis* (Soota & Kausal, 1972) n. comb. from *Turdoides caudatus* from Aligarh (U. P.).

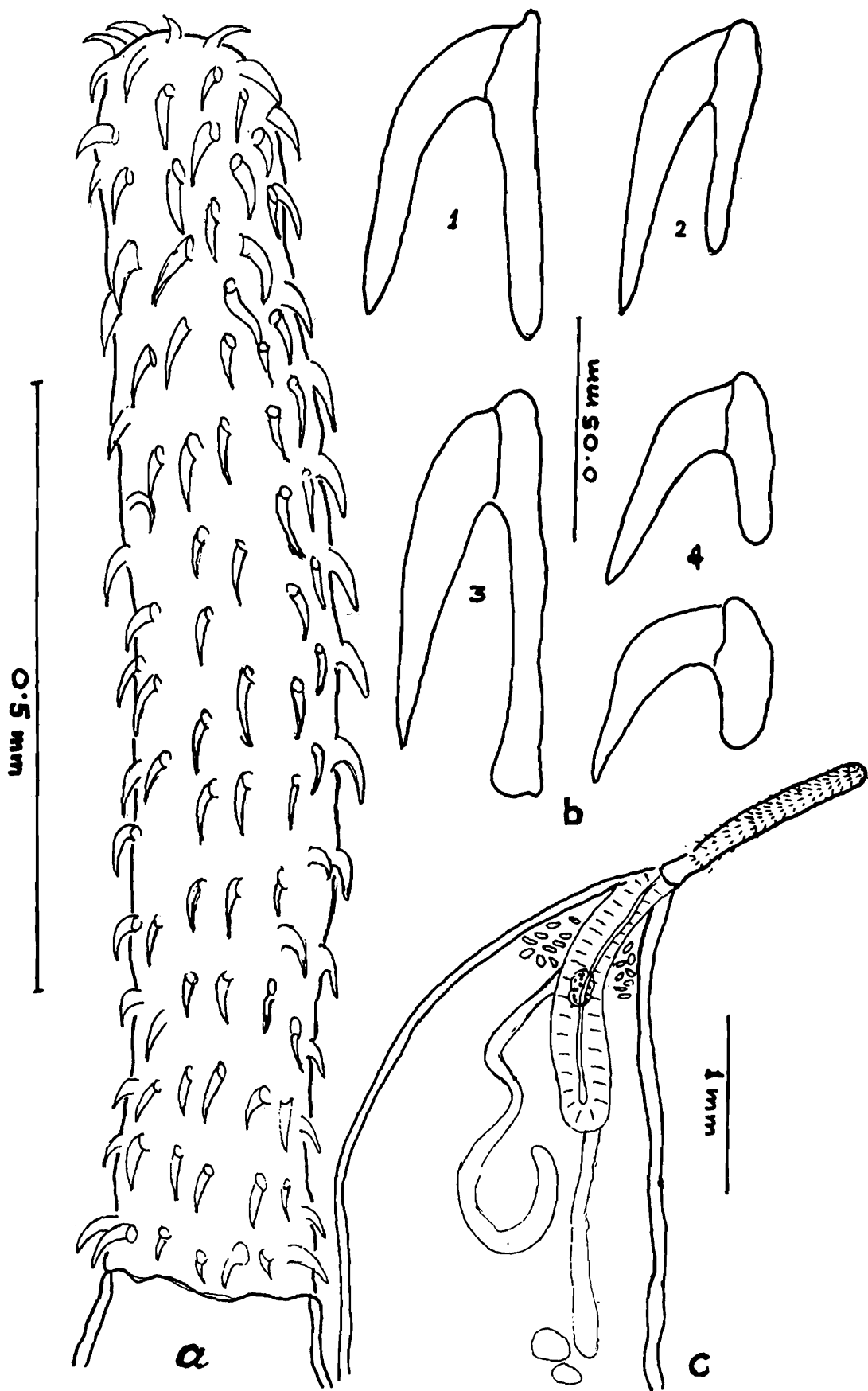


Fig. 3. *Prostherhyncus deysarkari* n. sp.
(a) proboscis, (b) hooks, (c) anterior part of the body.

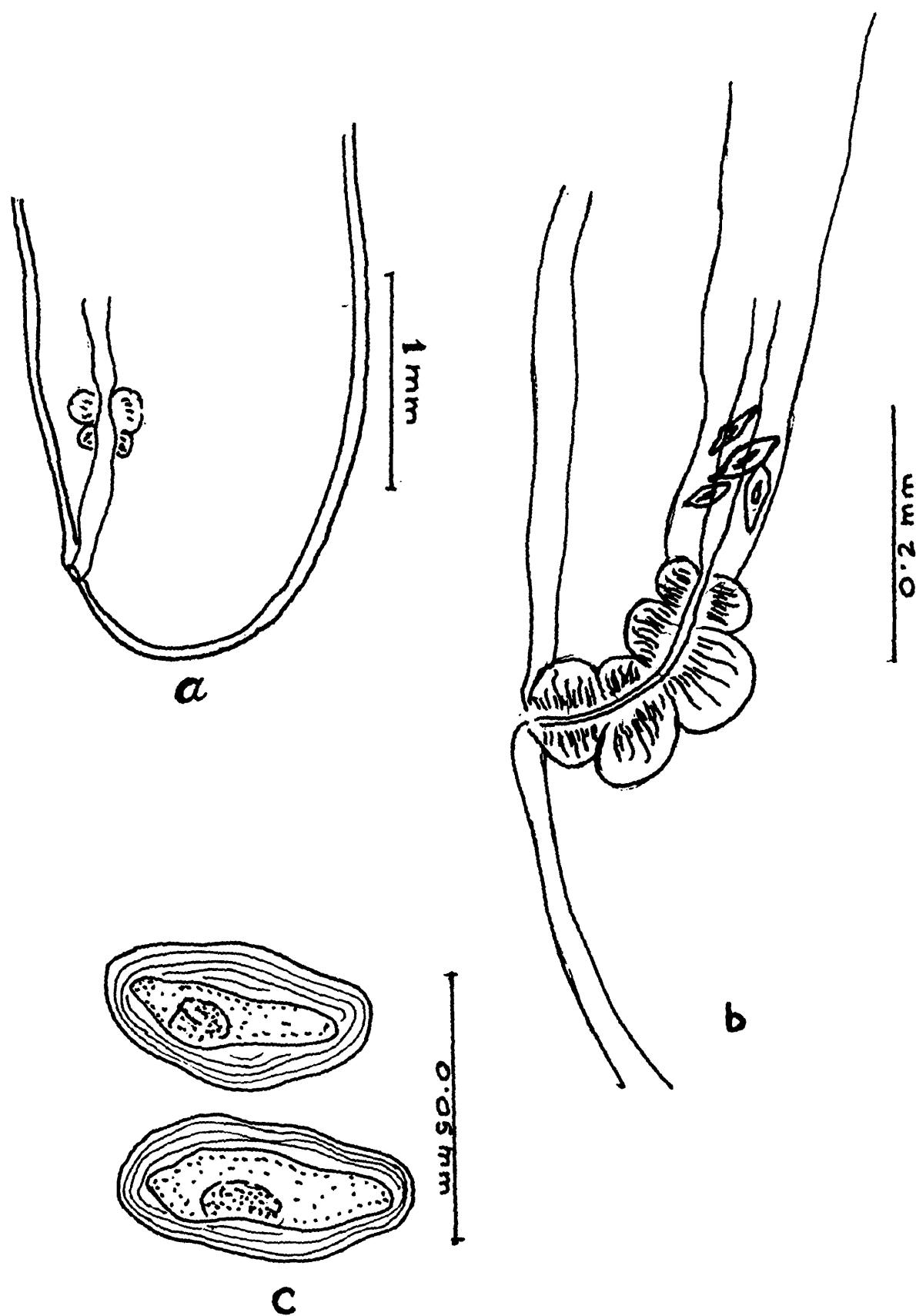


Fig. 4. *Prosthorhyncus deysarkari* n. sp.
 (a) posterior end of female, (b) enlarged posterior end of female, (c) egg.

The present form differs from *P. (Prosth.) nicobarensis* in having lesser number of proboscis hooks. Further, it differs from *Plagiorhynchus kuntzi* Gupta & Fatma, 1988 in having long coiled lemnisci and still lesser number of hooks. The present species conforms with *P. (Prosth.) taiwanensis* Schmidt & Kuntz, 1966 but differs in having smaller size of hooks and lemnisci.

Thus, *P. (Prosth.) deysarkari* is described here as a new species with new host.

Subfamily PORRORCHINAE Golvan, 1956.

Genus *Porrorchis* Fukui, 1929.

Porrorchis hylae (Johnston, 1914) Schmidt and Kuntz, 1967.

1967. Schmidt & Kuntz—Revision of the Porrorchinae with description of two new genera and three new species. *J. Parasit.* Vol. 53 (i).

Material examined : 4 ♂ and 6 ♀.

Host : *Glaucidium cuculoides* (Spotted owl)

Location : Intestine.

Diagnosis : Male : Body 12.75 x 1.5, cylindrical, aspinose, fairly large, anterior body swollen. Proboscis 0.55 x 0.5, globular, armed with 24-30 longitudinal rows of hooks with 9-10 hooks in each row. Anterior 4-5 hooks with roots. Anterior hooks with larger roots than points. 3rd, 4th and 5th hooks of each row stronger and larger. Hooks gradually diminish in size towards base of proboscis, posterior hooks with upwardly directed manubria.

Measurement of hooks :

Root	Point
1. 0.042- 0.049	0.016
2. 0.049	0.033
3. 0.058	0.041
4. 0.066	0.041
5. 0.058	0.033
	0.033
	0.033
	0.033
	0.033

Neck 0.25 x 0.55, short, proboscis sheath 0.95 x 0.525, cylindrical, ganglion near its middle. Lemnisci two 1.75 long, equal, slender, longer than proboscis sheath. Testes 2, 1.125 x 0.5 and 1.25 x 0.875, restricted within swelled anterior region of the body. Cement glands 4.5 x 0.5 long (approx.) Seminal vesicle 1.75.

Female : Longer than male. 30-34 x 2.625-2.75, anterior body swollen. Proboscis armed with 28-30 longitudinal rows of hooks with 10-12 hooks in each row. All hooks with roots. Measurement of hooks same as that of male. Uterine bell 0.37, Uterus 0.75. Eggs 0.033- 0.498. Genital pore terminal.

Distribution : Paratia, Tripura.

Discussion : The present specimens conform with *P. hylae*. Two juvenile specimens of *P. hylae* were recorded for the first time from India by Gupta and Jain, 1975 in the mesentery of a snake, *Boiga trigonata* at Chandigarh. The adult forms of this species have been described here with new host and locality record. The differences in measurement of hooks, size of eggs etc. have been considered as intraspecific variations.

Family GIGANTORHYNCHI DAE Hamann, 1892.

Genus *Mediorhynchus* Van Cleave, 1916.

Key to the species

1. Total number of hooks 100-140 but less than 35 rows of spines *M. garruli*.
Total number of hooks and spines less 2
2. Total number of hooks 70-80 but less than 15 rows of spines *M. armenicus*.
Total number of hooks almost same but more than 15 rows of spines *M. thrushi*.

Mediorhynchus thrushi n. sp.

(Fig. 5(a,b,c) and 6 (a,b))

Material examined : 2 males.

Host : *Garrulax moniligers*.

Location : Intestine.

Diagnosis : Male : Total length 4.84 x 1.72, medium size, plumpy, Lacunar system with 2 lateral longitudinal canals with transverse anastomoses, Proboscis 0.55 long and maximum width 0.425 at base.

Proboscis hooks with 16 longitudinal rows with 5 hooks in each and spines in 18 longitudinal rows with 5 spines in each row.

Measurement of hooks and spines :

Hook	Root	0.033
	Point	0.041
Spines		0.025

Spines almost equal in size. Proboscis sheath 0.70 x 0.28, single layered, saccular, attached at the base of proboscis. Lemnisci 2, moderately long, slender, equal, 4 giant nuclei in each. Testes 2, contiguous. T₁ 0.98 x 0.55, T₂ 0.71 x 0.59. Cement glands 6 in pairs. Seminal vesicle 0.38. Bursa not protruded. Genital pore terminal.

Distribution : Paratia, Tripura.

Discussion : The species agrees with *M. garruli* as both contain equal number of spines in each row. *M. garruli* differs from the present species in having longer body length and greater number of cement gland and in having greater number of rows of hooks and spines. The species has similarity with *M. numidae* with the presence of 4 giant nuclei in each lemniscus. but differs in having more number of rows of hooks and spines on proboscis. Moreover, *M. numidae* bears ramified nuclei scattered in the body wall whereas it is absent in the present species. Having compared with all known Indian species of the genus, it is found to be new. Therefore, the species is described here as new with the name *M. thrushi* n. sp.

***Mediorhynchus garruli* Yamaguti, 1939**

1939. Yamaguti S.—Studies on the helminth fauna of Japan. Pt. 29. Acanthocephala, II. *Jap. J. Zool.* **13** (3) pp. 317-3651.

Material examined : One female.

Host : Wood pecker.

Location : Intestine.

Diagnosis : Female. Body long, 25.75 x 3.37 cylindrical, proboscis conical, 1.375 long and maximum width 0.58 at base.

Hooks on protoboscis 26-28 longitudinal rows with 4-5 in each, roots longer than points. Spines with 30-32 longitudinal rows with 4-5 in each.

Measurement of hooks and spines :

Hook	Root	0.05-0.06
	Point	0.028-0.05
Spines		0.03-0.06

Proboscis sheath 1.125 x 0.25, single layered. Lemnisci two, short, 6-7 nuclei each anteriorly. Genital aperture terminal.

Eggs 0.06 x 0.036.

Distribution : Paratia, Tripura.

Discussion : The present species is close to *M. garruli* Yamaguti, 1939 for both have same number of hooks and spines in each row on proboscis. Size of eggs, body length of both the species are identical. Schmidt & Kuntz, 1977 synonymised *M. garruli* with *M. robustus* Van Cleave, 1916 on the basis of number of hooks and spines on proboscis only. This synonymy is not agreed upon for the former bears 8 cement glands whereas, the latter does not. Moreover, the former bears larger eggs than the latter. Hence, the species is described as *M. garruli* with a new locality record.

***Mediorhynchus armenicus* Petrotschenko, 1958**

1958. Petrotschenko, V. I.—Acanthocephala of domestic and wild animals. Academy of Sciences of the USSR. All -Union Society of Helminthologists. pp. 1-478.

Material examined : 2 ♂, 1 ♀.

Host : *Picus flavinucha*.

Location : Intestine.

Diagnosis : Male : Body medium size. 9-16 x 2.21-2.93. Cylindrical with little pseudometamerism. Proboscis 0.56-0.63 long and

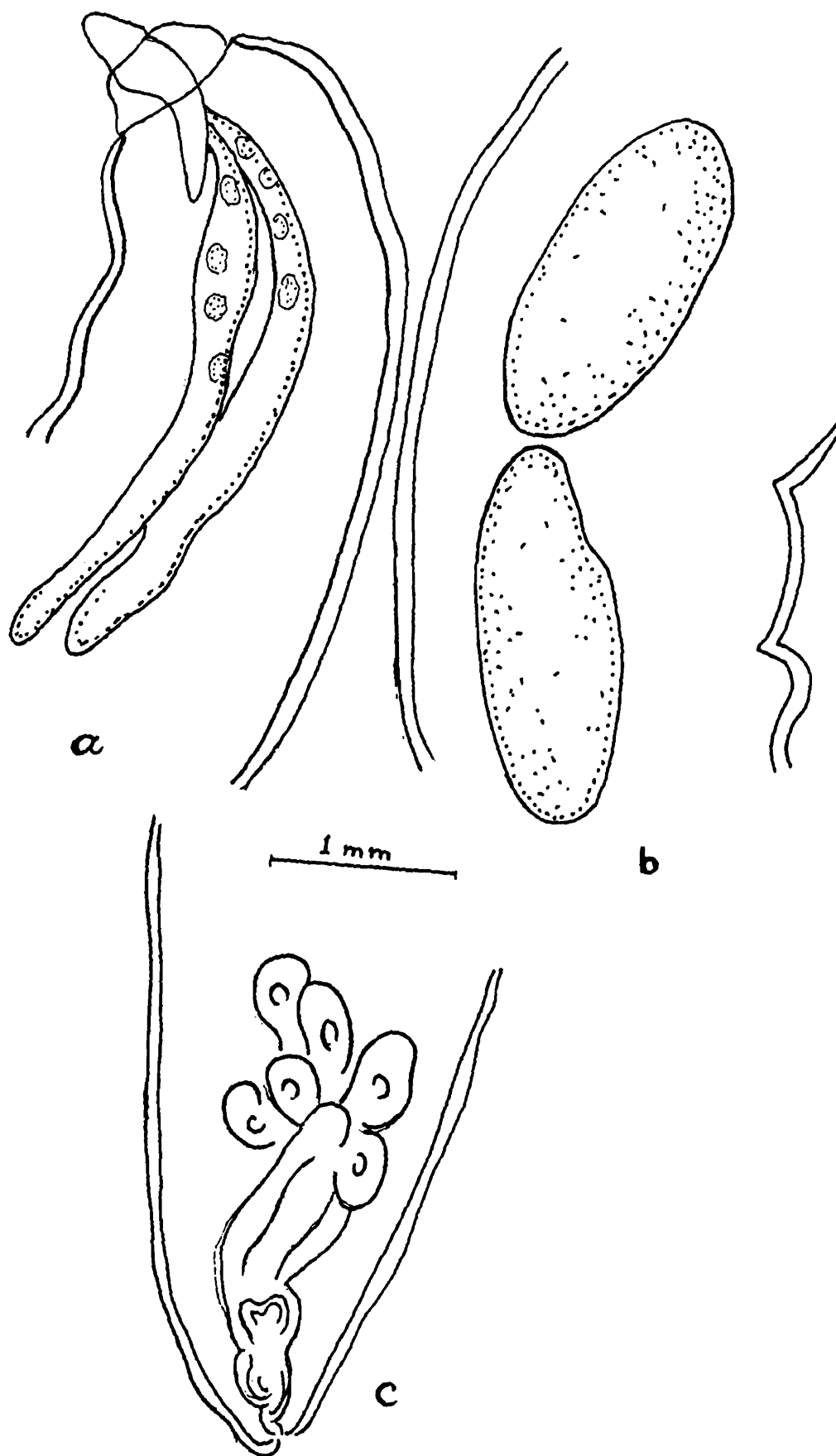


Fig. 5. *Mediorhynchus thrushi* n. sp.
A. anterior part of male, B. testes, C. posterix part of male.

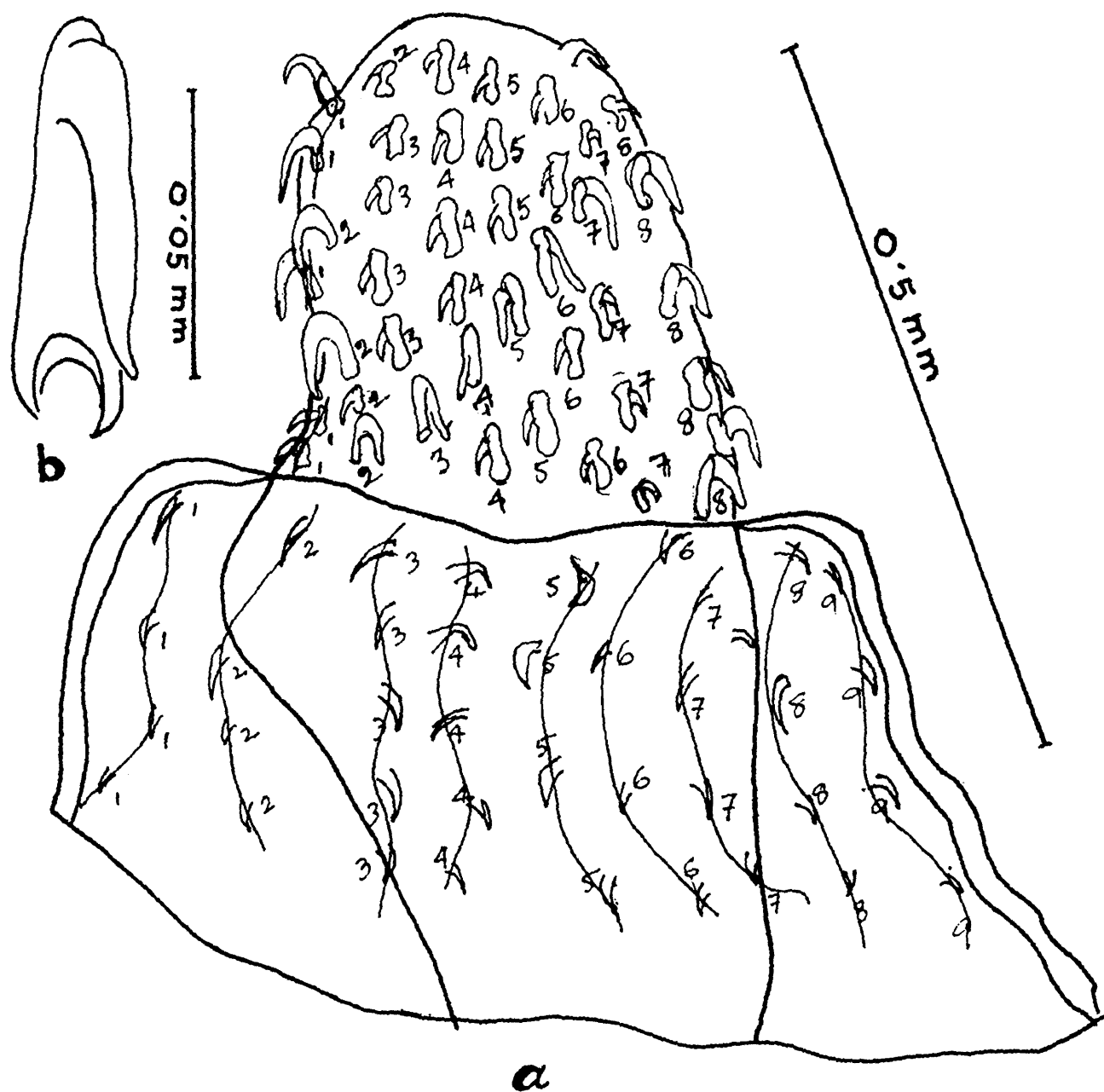


Fig. 6. *Mediorhynchus thrushi* n. sp.
A. hooks and spines on the proboscis. B. hook.

maximum width 0.52-0.59 at base. 10-12 longitudinal rows of hooks with 7 hooks in each row on proboscis, hooks 0.04. 10. 10-12 longitudinal rows of spines with 5-6 in each row on teloboscis, spines 0.03.

Proboscis sheath 0.49-0.77 x 0.24-0.43, single walled. Lemnisci short, unequal. Testes in the posterior half of the body, oval, tandem. T_1 1.30-1.93 x 0.78-0.95, T_2 1.29-2.17 x 0.81-0.94.

Cement glands ovoid 8, Seminal vesicle 0.77-1.05 long. Bursa not protruded, genital pore terminal.

Female : Total length 23-28 x 3.00-4.05 Proscis 0.66 long and maximum width 0.60 at base. Number and arrangement of hooks and spines same as in male. Uterine bell 0.53 x 0.22. Eggs 0.04-0.06 long. Genital pore terminal.

Distribution : Tripura.

Discussion : The present species agrees with *M. armenicus* Petrotschenko, 1958. *M. armenicus* was reported from India by Gupta & Lata. *M. passeris* was described by Das from India. Schmidt & Kuntz, 1977 synonymised both the species with *M. micracanthus*. *M. armenicus* bears 8 orbicular cement glands whereas *M. micracanthus* has 4. Thus the proposed synonymy is probably not justified. Present species also bears 8 orbicular cement glands and same number of rows of hooks and spines as in *M. armenicus*. Hence, the species is described as *M. armenicus* with a new locality record.

Family CENTRORHYNCHIDAE
Van Cleave, 1916.

Subfamily CENTRORHYNCHINAE
Travassos, 1923.

Genus *Centrorhynchus* Luhe, 1911.

Key to the species

1. Proboscis less than 1 mm.(2)
- Proboscis 1 mm. or more than 1 mm. long.
.....(3)

2. Number of proboscis hooks more than 400.
.....*C. horridum*.
Number of proboscis hooks less than 400. ...
.....*C. turdi*.
3. Number of proboscis hooks more than 700
hundred with 10-12 rooted hooks
.....*C. milvus*.
rooted hooks less:(4)
4. 7-8 rooted hooks*C. spilornae*.
2nd, 3rd and 5th hooks of each row long and
stout*C. globocaudatus*.

Centrorhynchus horridum (Linstow, 1897)
Amaguti, 1963

1897. Linstow O. V.-Nemathelminthen, gesammelt von
Herrn Prof. Dahl in Bismarck Archipel. *Arch. Naturg.*
63 Jg., Bd. 1, 281-291.

Material examined : 2 males (1 broken)

Host : King fisher (*Halcyon* sp.)

Location : Intestine.

Diagnosis : Male : Body medium, 6.48 (including Bursa 0.74) x 1.29. Proboscis 0.81 x 0.46, armed with 28-32 longitudinal rows of hooks with 15-17 hooks. 6-7 hooks with roots and rests rootless. Proboscis sheath short saccate, 0.98 x 0.31. Nerve ganglion near its middle. Lemnisci short slender, reaching beyond proboscis sheath.

Testes in anterior and broadest region of body, oval, tandem and almost contiguous. T_1 0.66 x 0.43. T_2 0.74 x 0.46. Cement glands 2, long and slender seminal vesicle 0.42 in length. Bursa protruded, genital pore sub-terminal.

Distribution : Tripura.

Discussion : The specimens resemble most with *C. horridum* (Linstow, 1897). Variations regarding position of testes, body size etc. are observed. *C. horridum* was first recorded by Linstow (1897) from *Halcyon* sp. From Bismark-Archipelago. Meyer (1932) redescribed it. Travassos (1926) transferred it to the genus *Prosthorhynchus*. Golvan (1956) transferred it to

sub-genus *Longirostris* of the genus *Centrorhynchus*. Yamaguti (1963) listed it under *Centrorhynchus*.

This species is reported here with new locality record.

***Centrorhynchus turdi* Yamaguti, 1939.**

1939. Yamaguti, S. Studies on the helminth fauna of Japan Pt. 29. *Acanthocaphala* II. 13 (3), 317-351.

Material examined : 2 ♂.

Host : Tree-pie (*Dendrocita* sp.)

Location : Intestine.

Diagnosis : Male : Body medium, cylindrical 7.21 x 1.67. Proboscis cylindrical, 0.98 x 0.55, armed with 26-28 longitudinal rows of hooks with 11 hooks in each row. 4th and 5th hooks from the anterior with strongest roots. Maximum length of hooks 0.04. Proboscis sheath elongate, double walled 1.27 x 0.41. Nerve ganglion at its middle.

Lemnisci long and almost equal, testes and cement glands badly damaged.

Distribution : Tripura.

Discussion : The specimens conform with *C. turdi*. Yamaguti (1939) described this species from *Turdus C. cardis*. Jain & Gupta (1972) recorded the species in *Centropus* sp. from Chandigarh. The species has been recorded here in *Dendrocita* sp. with a new locality.

***Centrorhynchus milvus* Ward, 1956.**

1956. Ward, H. L. A new species of *Centrorhynchus* (Acanthocephala, from the Kite, *Milvus migrans* in Egypt. *J. Par* 42 (i) : 39-41.

Material examined : One male, one female.

Host : *Milvus migrans govinda* Sykes.

Location : Intestine.

Diagnosis : Male : Body 36.09 x 0.84, long cylindrical slender, wide anterior region. Proboscis 1.1 x 0.5, cylindrical, armed with 32-34 longitudinal rows with 24 hooks in each row. 12 hooks in each row with roots, rest are rootless.

Proboscis sheath elongate, double walled 1.54 x 0.36. Nerve ganglion at its middle. Lemnisci long slender. Testes 2, tandem, located in anterior wider region of body, oval T_1 1.08 x 0.71, T_2 1.34 x 0.66. Cement glands long 2.76 x 0.66. Seminal vesicle 0.66 in length. Bursa protruded, genital pore sub-terminal.

Female : Body similar to that of male. Body length 40.00 x 0.82 Proboscis 1.12. Uterine bell 0.21 x 0.11. Eggs-0.056 x 0.028.

Distribution : Amabasa, Tripura.

Discussion : *Centrorhynchus milvus* was reported from India from *Accipiter badius* from Hoshiarpur, Punjab by Gupta and Lata, 1966. The species has been reported here from *Milvus migrans govinda* with a new locality record. Variation in size of the species is observed.

***Centrorhynchus globocaudatum* (Zeder, 1800).**

1958. Petrotschenko, V. I. [Acanthocephala of domestic and wild animals] T.2. pp. 215-218.

Material examined : 1 ♂, 2 ♀.

Host : *Otus* sp.

Location : Intestine.

Diagnosis : Male : Body long. 15 x 0.76. Cylindrical with broadening near testes at the anterior region. Proboscis 1.12 x 0.27 armed with 30-32 longitudinal rows with 18-20 hooks in each row. 2nd, 3rd and 5th hooks strongest. Maximum length of point 0.42, maximum length of root 0.05, Proboscis sheath double walled, nerve ganglion at its middle. Lemnisci 2, long, Testes 2, orbicular. one after other at the anterior broad region of the body. Cement glands 2 or 3, tubular, long.

Female : Body similar to that of male. Total length 21-30. Eggs 0.042 x 0.021, obliterating genital organs, genitalia sub-terminal, posterior end flat, broad, shoe like.

Distribution : Tripura.

Discussion : The present species comes close to *C. globocaudatum* (Zeder, 1800). Gupta and Gupta (1974) recorded it in *Milvus migrans* from

Chandigarh. Punjab. The species has been recorded here with a new locality record.

Centrorhynchus spilornae Schmidt & Kuntz, 1969.

1969. Schmidt, D & Kuntz, E. *Centrorhynchus spilornae* sp. n. (Acanthocephala) and other centrorhynchidae from the Far east. *J. Parasit.* Vol. 55. No. 2. P. 329-334.

Material examined : 2 ♂, 2 ♀.

Host : Owlet.

Location : Intestine.

Diagnosis : Body 21-30 long x 0.67- 0.75, proboscis 1.2, armed with 32-34 longitudinal rows of hooks with 20-24 hooks in each row. First 7-8 hooks with strong roots remaining rootless.

Measurement of hooks :

1st 4 hooks 0.049-0.058. Remaining rooted hooks 0.024- 0.0415. Rootless hooks-0.035-0.041. Proboscis sheath 0.875 long x 0.175 wide, double walled with ganglion near centre. Lemnisci 2, flat longer than proboscis sheath. Testes 2, at the swollen region of the body. T_1 0.72 x 0.25, T_2 0.825 x 0.25. Cement glands 2, tubular, beginning immediately behind posterior testis, Genital pore terminal.

Female : Body 26-35 long x 0.8- 0.9 (greatest width), swollen at the anterior region and at the terminal end of body with a terminal papilla. Genital pore subterminal. Eggs 0.41- 0.47 without polar prolongations of the middle shell.

Distribution : Tripura.

Discussion : The specimens conform with *C. spilornae* with regard to number of hooks and presence of female terminal papilla. Zafar and Farooqi, 1981 recorded *S. spilornae* Smidt & Kuntz, 1969 in Serpent eagle from Aligarh. They also considered *C. andamanensis* Soota & Kansal obtained from the same host from Andamans as a synonym of *C. spilornae*. The species is redescribed here as *C. spilornae* with a new host and locality record.

Family MONILIFORMIDAE Van Cleave, 1924.

Genus *Moniliformis* Travassos, 1915.

Moniliformis (m) moniliformis (Brems, 1811).

1811. Bremser, J. G. *Nilitia insignis vermium intestinalium* Collections vindo. bonensis. 31. pp. Viennae.

Material examined : 3 ♂.

Host : Rat.

Location : Intestine.

Description : Male Body 15.625-40 x 0.875-2.375 with pseudometamerism. Proboscis 0.375 x 0.225, nearly cylindrical with broad anterior part, armed with 12 longitudinal rows of hooks with 7 or 8 hooks in each row. Hooks equal, anterior hooks curved. Neck 0.083- 0.1 x 0.207-0.225. Proboscis sheath 0.875- 0.9 x 0.325- 0.4 double walled, ganglion at its base. Lemnisci 2 long, flagelliform with 5-6 nuclei in each. Gonads post-equatorial. Testes 2 large, elongate, contiguous, more or less equal in size. T_1 4.00 x 1.25, T_2 4.00 x 1.25. Cement glands 6-8, compact.

Distribution : Tripura.

Discussion : The present specimens conform with *Miniliformis moniliformis moniliformis*. Variations in measurements are also observed. The species described here with a new locality record.

SUMMARY

The present work is concerned with the description of some acanthocephalid worms recovered from various vertebrate hosts from the state of Tripura. 17 species of *Acanthocephala* belonging to 9 genera and 7 families out of which 4 new species have been described in the present work. General morphology, collection and preservation techniques, key to species have also been appended.

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FRESHWATER ROTIFERS (Rotifera : Eurotatoria)

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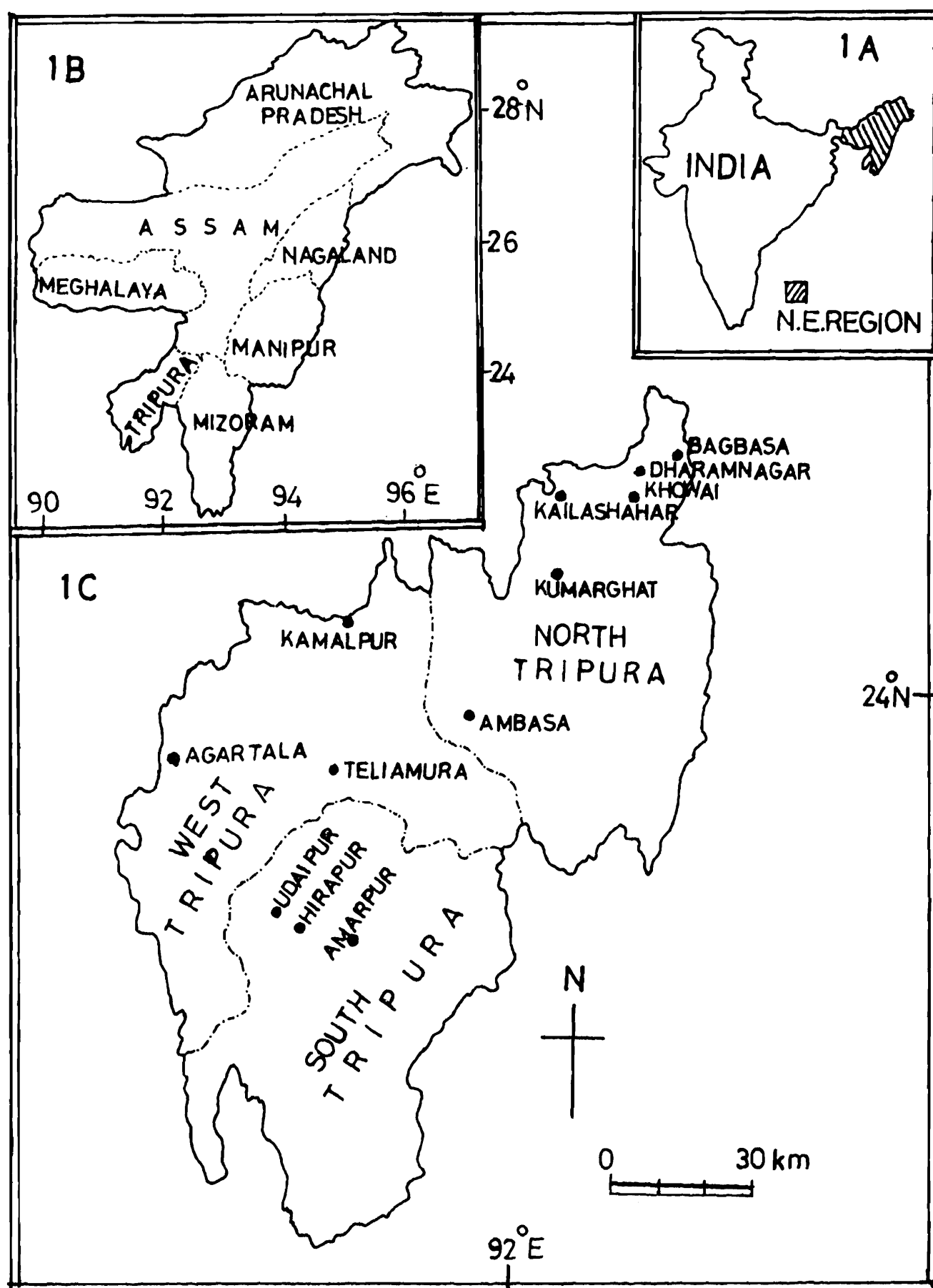
INTRODUCTION

Phylum Rotifera includes pseudocoelomate micro-organisms generally ranging between 40 µm -250 µm in size which are commonly called "Rotatoria" or "Wheel-Animalcules" because of their characteristic 'wheel organ' or 'corona'. They comprise one of the oldest group of invertebrates and depict notable qualitative and quantitative importance in freshwater environs. In fact, about 95% species of this group occur in freshwater; they colonize littoral, limnetic and benthic regions of these biotopes and occur practically in every inland aquatic habitat ranging from a trickle on the rock to large rivers, from bog holes to saline lacustrine ecosystems, from ephemeral pools to the pelagial of great lakes as well as pristine subterranean groundwaters. The rotifers constitute an important component of freshwater biocenosis, an integral link in aquatic food-chain and contribute significantly to zooplankton dynamics and secondary productivity in freshwaters. In addition, these organisms are valuable bio-indicators of water quality and useful tools in ecotoxicological studies and bioassay experiments.

Rotifera have drawn global attention of large number of naturalists and specialists because of their intricate structure, widespread distribution, endless profusion of body shapes inherent in their morphological plasticity and rapid turnover rates. Faunistic studies from distant parts of the world, often transgressing the continents, have resulted in proliferation of scattered taxonomic literature which includes important monographs by Voigt (1957), Bartos (1959), Rudescu (1960), De Beauchamp (1965), Donner (1965), Kutikova

(1970) and Kostë (1978) and useful diagnostic works of Edmondson (1959), Donner (1966), Ruttner-Kolisko (1974), Pontin (1978), Nogrady *et al.* 1993). In addition, revisions on a number of families of this phylum have been attempted recently by Segers (1995), De Smet (1995, 1996), De Smet and Purriot (1996) under *The Guides to the identification of Microinvertebrates of the Continental waters of the World*.

Taxonomic studies on Indian Rotifera, initiated by Anderson (1889), have so far resulted in about 120 papers (Sharma, 1996, 1998) but still reflect paucity of comprehensive regional or statewide faunistic surveys. This generalization holds true for the rotifer fauna of N. E. India in general and the state of Tripura in particular. Referring to the rotifer biodiversity in various states of North Eastern region, Patil (1978) gave a preliminary list of 18 species while Patil (1988) again dealt with the same species. However, useful contributions to the rotifer fauna of this region have been made by Sharma (1980, 1987a, 1987b, 1990) and Sharma and Sharma (1987a, 1987b, 1990, 1997a, 1997b). On the other hand, the information on species composition of these organisms in Tripura is restricted to the works of Bhattacharya and Saha (1988), Sharma (1987a) and Sharma and Sharma (1987a, 1990, 1997a). The studies undertaken by the present authors are subsequently extended to examine more collections and to provide a comprehensive account of the rotifer fauna this state. All the documented taxa are briefly described with suitable illustrations and taxonomic keys. Comments are made on the nature and composition of the rotifer fauna of Tripura as well as on the distribution and ecology of various taxa.



Figures : 1, A-C

Fig. 1, A : Map of India showing North-Eastern Region ; Fig. 1, B : Different States of North-Eastern India ; Fig. 1, C : Map of Tripura State indicating various sampling localities.

MATERIAL AND METHODS

The material for the present study is collected from various localities (Fig. 1, A-C) in Tripura State (Long. 92°10'—92°20' E ; Lat. 22°56'—24°32' N). The collections are obtained from the littoral and limnetic regions of various aquatic biotopes with a nylobolt plankton net (No. 25) and usually preserved in 5% formalin. Special attention is focussed to collect samples from water bodies with various macrophytes. In all about 357 samples, collected from a wide range of ephemeral and perennial freshwater ecosystems of Tripura state, are examined for the present observations. A detailed break up of the examined material is given below :

Districts	Number of samples
North Tripura	127
West tripura	152
South Tripura	73
Total samples	357

Various samples are screened with Wild-stereoscopic binocular microscope, different rotifers are subsequently isolated and mounted in Polyvinyl alcohol-lectophenol mixture. Semi-loricata, illoricate and other soft-bodied forms are mounted in glycerol. Taxonomic characters of the documented taxa are examined with Leitz-Dialux phase contrast microscope and the illustrations are made using a drawing-tube attachment. All the measurements are given in micrometers (µm). The detailed structure of trophi, wherever necessary, is observed.

Identification of various rotifer taxa is largely based on the works of Voigt (1957), Edmondson (1959), Kutikova (1970), Ruttner-Kolisko (1974), Koste (1978), Pontin (1978) and Segers (1995, 1996). Among other individual research papers consulted for this study, some notable contributions were those by Jennings (1903), Murray (1913a, 1913b), Harring (1916), Harring and Myers (1922, 1924, 1926, 1928), Myers (1930), Hauer (1938), Ahlstrom (1940, 1943), Berzins (1955, 1962), Wulfert (1964, 1965, 1966, Sharma (1983), Koste and Shiel (1987).

The system of classification followed in this account is after Koste (1978). Various species and subspecies are arranged alphabetically under their respective genera. The distribution of the taxa documented from Tripura refers to their occurrence in its different districts together with earlier reports wherever available. Distribution in India is indicated by the states from where various taxa are so far reported while that from elsewhere refers to the global distribution.

SYSTEMATIC LIST OF THE EXAMINED TAXA

Phylum	ROTIFERA
Class	EUROTATORIA
Super-order	MONOGONONTA
Order	PLOIMIDA
Family	B R A C H I O N I D A E Wesenberg-Lund, 1899

- Brachionus angularis* Gosse, 1851
- B. bidentatus* Anderson, 1889
- B. budapestinensis* Daday, 1885
- B. calyciflorus f. dorcas* (Gosse, 1851)
- B. calyciflorus f. anuraeiformis* (Brehm, 1909)
- B. caudatus personatus* (Ahlstrom, 1940)
- B. dichotomus reductus* Koste & Shiel, 1980
- B. diversicornis* (Daday, 1883)
- B. donneri* Brehm, 1951
- B. forficula* Wierzejski, 1891
- B. falcatus* Zacharias, 1893
- B. mirabilis* (Daday, 1897)
- B. patulus patulus* Müller, 1786
- B. patulus macracanthus* (Daday, 1905)
- B. quadridentatus quadridentatus* Hermann,
1783
- B. quadridentatus cluniorbicularis* (Skorikov,
1894)
- B. quadridentatus brevispinus* (Ehrenberg,
1832)

B. quadridentatus melheni (Barrois & Daday, 1894)

B. rubens Ehrenberg, 1838

Keratella cochlearis (Gosse, 1851)

K. lenzi Hauser, 1938

K. javana (Hauer, 1938)

K. tropica (Apstein, 1907)

Platytas quadricornis (Ehrenberg, 1838)

Anuraeopsis fissa (Gosse, 1851)

A. coelata (De Beauchamp, 1932)

Family EUCHLANIDAE Bartos, 1959

Beauchampiella eudactylota (Gosse, 1886)

Euchlanis dilatata Ehrenberg, 1832

E. triquetra Ehrenberg, 1838

Dipleuchlanis propatula (Gosse, 1887)

Family MYTILINIDAE Bartos, 1959

Mytilina ventralis (Ehrenberg, 1832)

M. bisulcata (Lucks, 1912)

Family TRICHOTRIDAE Bartos, 1959

Trichotria tetractis (Ehrenberg, 1830)

Macrochaetus sericus (Thorpe, 1893)

Family COLURELLIDAE Bartos, 1959

Colurella obtusa (Gosse, 1886)

C. uncinata (Müller, 1773)

C. sulcata (Stenroos, 1898)

Lepadella (Lepadella) acuminata (Ehrenberg, 1834)

L. (L.) apsidea (Harring, 1916)

L. (L.) cristata (Rousselet, 1893)

L. (L.) ovalis (Müller, 1786)

L. (L.) patella (Müller, 1773)

L. (L.) rhomboides (Gosse, 1886)

L. (L.) triptera Ehrenberg, 1830

Lepadella (Heterolepadella) aspicora Myers, 1934

L. (H.) ehrenbergi (Perty, 1850)

L. (H.) heterostyla (Murray, 1913)

Squatinella mutica (Ehrenberg, 1832)

Family LECANIDAE Bartos, 1959

Lecane (Lecane) aculeata (Jakubski, 1912)

L. (L.) braumi Koste, 1988

L. (L.) crepida Harring, 1914

L. (L.) curvicornis curvicornis (Murray, 1913)

L. (L.) curvicornis lofuana (Murray, 1913)

L. (L.) hastata (Murray, 1913)

L. (L.) hornemanni (Ehrenberg, 1834)

L. (L.) inermis (Bryce, 1892)

L. (L.) lateralis Sharma, 1978

L. (L.) levistyla (Olofsson, 1917)

L. (L.) leontina (Turner, 1892)

L. (L.) ludwigi (Eckstein, 1883)

L. (L.) luna (Müller, 1773)

L. (L.) nana (Murray, 1913)

L. (L.) ohioensis (Herrick, 1885)

L. (L.) papuana (Murray, 1913)

L. (L.) pertica Harring & Myers, 1926

L. (L.) signifera signifera (Jennings, 1896)

L. (L.) signifera ploenensis (Voigt, 1902)

L. (L.) simonneae Segers, 1993

L. (L.) sola Hauer, 1936

L. (L.) unguolata (Gosse, 1887)

L. (Hm.) inopinata (Harring & Myers, 1926)

Lecane (Monostyla) acanthinula (Hauer, 1938)

L. (M.) batillifer Murray, 1913

L. (M.) bulla (Gosse, 1851)

L. (M.) closterocerca (Schmarda, 1859)

L. (M.) hamata (Stokes, 1896)

L. (M.) lunaris (Ehrenberg, 1832)

L. (M.) monostyla (Daday, 1913)

L. (M.) obtusa (Murray, 1913)

L. (M.) pyriformis (Daday, 1905)

L. (M.) quadridentata (Ehrenberg, 1832)

L. (M.) scutata (Harring & Myers, 1926)

L. (M.) sinuata (Hauer, 1938)

L. (M.) thienemanni (Hauer, 1938)

L. (M.) unguitata (Fadeev, 1925)

Family NOTOMMATIDAE Remane, 1933
(partim)

Cephalodella forcicula (Ehrenberg, 1832)

C. gibba (Ehrenberg, 1832)

Scaridium longicaudum (Müller, 1786)

Family TRICHOCERCIDAE Remane, 1933

Trichocerca (Trichocerca) cylindrica (Imhof, 1891)

T. (T.) capucina Wierzejski & Zacharias, 1893

T. (T.) elongata (Gosse, 1886)

T. (T.) jenningsi Voigt, 1951

T. (T.) longiseta (Schränk, 1802)

T. (T.) rattus (Müller, 1776)

T. (T.) pusilla (Lauterborn, 1898)

T. (Diurella) similis (Wierzejski, 1893)

T. (D.) sulcata (Jennings, 1903)

Family ASPLANCHNIDAE Harring & Myers, 1926

Asplanchna brightwelli Gosse, 1850

A. priodonta Gosse, 1850

Family SYNCHAETIDAE Remane, 1933

Synchaeta pectinata Ehrenberg, 1832

Polyarthra vulgaris Carlin, 1943

Family DICRANOPHORIDAE Remane, 1933

Dicranophorus forcipatus (Müller, 1773)

Family GASTROPODIDAE Remane, 1933

Ascomorpha saltans Bartsch, 1870

A. ovalis (Bergendal, 1892)

Order GNESIOTROCHA De Beauchamp, 1965

Sub-order FLOSCULARIACEA Remane, 1933

Family CONOCHILIDAE Bartos, 1959

Conochilus unicornis Rousselet, 1892

Family HEXARTHRIDAE Bartos, 1959

Hexarthra mira (Hudson, 1871)

Family TESTUDINELLIDAE Bartos, 1959

Pompholyx sulcata Hudson, 1885

Testudinella brevicaudata (Yamamoto, 1951)

T. patina (Hermann, 1783)

T. parva (Ternitz, 1892)

T. emarginula (Stenroos, 1898)

T. tridentata (Smirnov, 1931)

Family FILINIIDAE Bartos, 1959

Filinia longiseta (Ehrenberg, 1834)

F. saltator (Gosse, 1886)

F. camascela Myers, 1938

F. opoliensis Zacharias, 1898

Family FLOSCULARIIDAE Bartos, 1959

Sinantherina spinosa (Thorpe, 1893)

Family TROCHOSPHAERIDAE Bartos, 1959

Trochosphaera aequitorialis Semper, 1872

Super-order DIGONONTA Bartos, 1959

Order BDELLOIDEA Remane, 1933

Family PHILODINIDAE Remane, 1933

Rotaria neptunia (Ehrenberg, 1832)

SYSTEMATIC ACCOUNT

Phylum ROTIFERA

Class EUROTATORIA Bartos, 1959

Characters : Ovary with vitellarium. Reproduction parthenogenetic, bisexual or asexual (Bdelloidea). This subclass includes freshwater and brackishwater rotifers and is represented by two superorders i.e., Monogononta and Digononta in this account.

Key to superorders of subclass EUROTATORIA

Ovary single MONOGONONTA

Ovaries paired DIGONONTA

Super-order MONOGONONTA Wesenberg-Lund, 1889

Characters : Ovary unpaired. Reproduction mostly by parthenogenesis, at times bisexual. Forms usually free-swimming.

The monogononts belong to two orders in the present account

Key to orders of superorder MONOGONONTA

Corona of diverse types. Trophi malleate, cardate, forcipate, virgate or incudate. Foot without ciliaries PLOIMIDA

Corona of *Hexarthra*-, *Conochilus*- or *Collotheca*-type. Trophi malleoramate. Ciliated foot present in free swimming larvae GNESIOTROCHA

Order PLOIMIDA Delage, 1897

Characters : Loricæ or illoricæ forms ; body shape variable. Corona of diverse types ; never of *Hexarthra*-, *Conochilus*- or *Collotheca*-type. Trophi malleate, cardate, forcipate, virgate or incudate. Foot, if present, with paired or unpaired toes. Forms creeping, free-swimming, free living, epibionts or ectoparasites ; not forming colonies.

This order is represented by twelve families in present account.

Key to recorded families of order PLOIMIDA

1. Corona of *Brachionus*- or *Euchlanis*-type 2
Corona of *Notommata*- or *Asplanchna*-type 7
2. Trophi malleate, modified for suction LECANIDAE
Trophi malleate, not modified for suction .. 3
3. Head with hood. Corona with lateral lamellae 4
Head without hood. Corona without lateral lamellae COLURELLIDAE
4. Dorsal surface of lorica without any longitudinal sulcus 5
Dorsal surface of lorica with a longitudinal sulcus MYTILINIDAE
5. Only trunk covered with lorica 6
Head, trunk and foot loricate and clearly defined TRICHOTRIDAE
6. Dorsal and ventral plates of lorica fused laterally *Brachionidae*
Dorsal and ventral plates joined laterally by a thin membrane EUCHLANIDAE
7. Corona of *Notommata*-type. Trophi virgate NOTOMMATIDAE
Corona of *Asplanchna*-type. Trophi modified virgate, incudate or forcipate 8

8. Trophi forcipate DICRANOPHORIDAE
Trophi modified virgate or incudate 9
9. Trophi modified virgate 10
Trophi incudate ASPLANCHNIDAE
10. Corona symmetrical. Foot present or absent 11
Corona asymmetrical. Foot with equal or unequal bristle-like toes
.....TRICHOCERCIDAE
11. Corona as a small ring. Stomach with blind extensions GASTROPODIDAE
Corona reduced to small zone around mouth and on anterior lobes or auricles, if present. Stomach without blind extensions
.....SYNCHAETIDAE

Family BRACHIONIDAE Wesenberg-Lund, 1899

Characters : Only trunk covered with lorica ; dorsal and ventral plates of lorica closely fused laterally. Foot present or absent. Trophi malleate. Corona of *Brachionus*-or *Euchlanis*-type. Funnel shaped mouth in buccal area.

Only four genera i.e., *Brachionus*, *Keratella*, *Platylas* and *Anuraeopsis* of the Brachionidae are observed in the material examined from Tripura.

Key to recorded genera of family BRACHIONIDAE

1. Foot present 2
Foot absent 3
2. Foot annulated and retractile within lorica BRACHIONUS
Foot segmented, not retractile PLATYIAS
3. Lorica with distinct occipital spines. Dorsal plate with facets KERATELLA
Lorica without occipital spines. Dorsal plate without any facets ANURAEOPSIS

Genus *Brachionus* Pallas, 1766

Characters : Body oval, more or less flattened dorso-ventrally and distinctly loricate. Head illoricate and retractile. Lorica usually separated into a dorsal and a ventral plate ; basal plate of lorica developed in some species. Anterior

occipital margin with two, four or six spines. Mental margin usually rigid and with a median sinus. Postero-lateral spines present in some species. Postero-median spines present in some species. Foot-opening at the posterior end of lorica between the basis of posterior spines, if present. Foot long, flexible, annulated and retractile ; toes two.

Type species : *Brachionus urceus* (Linnaeus, 1758)

Fourteen species of this genus are examined from Tripura.

Key to recorded taxa of genus *Brachionus*

1. Anterior ventral margin with conspicuous spines 2
Anterior ventral margin without conspicuous spines 4
2. Lateral antennae on conical protuberance ...
.....*Brachionus donneri*
Lateral antennae not on conical protuberance 3
3. Postero-lateral spines short
.....*Brachionus patulus patulus*
Postero-lateral spines long
.....*Brachionus patulus macracanthus*
4. Lorica with a basal plate
.....*Brachionus bidentatus*
Lorica without any basal plate 5
5. Lorica with tubular foot-opening 6
Lorica without tubular foot-opening 10
6. Foot-opening spines long
.....*Brachionus mirabilis*
Foot-opening spines short 7
7. Postero-lateral spines developed 8
Postero-lateral spines wanting, small or lacking 9
8. Postero-lateral spines straight or inwardly directed. Median occipitals moderately long
.....*Brachionus quadridentatus quadridentatus*
Postero-lateral spines divergent. Median occipital distinctly long
.....*B. quadridentatus melheni*

9. Postero-lateral spines lacking
.....*B. quadridentatus cluniorbicularis*
Postero-lateral spines small
.....*B. quadridentatus brevispinus*
10. With six occipital spines 11
With 2-4 occipital spines 13
11. Anterior occipital spines saw-toothed
.....*Brachionus rubens*
Anterior occipital spines not saw-toothed ...
..... 12
12. Median occipital spines longest
.....*Brachionus falcatus*
Median occipital spines rudimentary
.....*Brachinus caudatus persontus*
13. With two occipital spines
.....*Brachionus angularis*
With four occipital spines 14
14. Lorica globular, not separated into dorsal
and ventral plates 15
Lorica compressed, separated into distinct
dorsal and ventral plates 16
15. Median occipitals twice longer than laterals
.....*Brachionus calyciflorus F. Dorcas*
Median occipitals slightly longer than laterals
.....*B. calyciflorus F. Anuraeiformis*
16. Dorsum with plaques. Caudal spines lacking
.....*Brachionus budapestinensis*
Dorsum without plaques. Caudal spines
distinctly developed 17
17. Median occipital spines long
.....*Brachionus dichotomus reductus*
Lateral occipital spines long 18
18. Posterior spines equal, wide apart at base
.....*Brachionus forficula*
Posterior spines unequal, close together at
base*Brachionus diversicornis*

1. *Brachionus angularis* Gosse, 1851
(Figs. 2 & 3)

Characters : Lorica rigid, usually stippled and compressed dorso-ventrally ; with a pattern of cuticular plates in some specimens. Anterior

occipital margin with two median spines flanked by a V-shaped sinus. Foot-opening large and flanked laterally by cuticular protuberances. Posterior spines lacking.

Measurements : Total length 90-126 ; maximum width 82-96.

Distribution : TRIPURA—all districts, also reported earlier from this state by Bhattacharya and Saha (1988) and Sharma and Sharma (1990). INDIA—Widely distributed, reported from Meghalaya, Assam, Tripura, West Bengal, Orissa, Bihar, Andhra Pradesh, Maharashtra, Madhya Pradesh, Delhi, Kashmir, Punjab, Haryana and Chandigarh (Union Territory).

Elsewhere : Cosmopolitan.

2. *Brachionus bidentatus* Anderson, 1889
(Fig. 4)

Characters : Lorica firm, stippled and moderately compressed dorso-ventrally. Dorsal and ventral plates joined together for about 3/4 of length of lorica and then diverge to unite with basal plate. Anterior margin with six occipital spines ; laterals and medians longer than intermediate occipital spines. Postero-lateral spines almost parallel-sided and variable in length. Foot-opening with a symmetrically projecting sheath.

Measurements : Total length 180-220 ; maximum width 105-115.

Distribution : TRIPURA—North and West Tripura ; also reported previously from this state by Sharma and Sharma (1990). INDIA—Meghalaya, Assam, Tripura, West Bengal, Andhra Pradesh, Orissa, Punjab and Haryana.

Elsewhere : Pantropical.

3. *Brachionus budapestinensis* Daday, 1885
(Fig. 5)

Characters : Lorica firm, oval and covered with minute tubercles. Dorsal plate with an ornamentation of cuticular ridges. Anterior occipital margin with four spines ; median occipital spines longer than laterals. Caudal spines lacking. Foot-opening small v-shaped dorsally and a large oval opening ventrally.

Measurements : Total length : 115-120 ; maximum width 80-90 ; lateral occipital spines 18-20 ; median occipital spines 30-35.

Distribution : TRIPURA—West and South Tripura, new record from this state. INDIA—Meghalaya, West Bengal, Madhya Pradesh and Punjab.

Elsewhere : Cosmopolitan.

4. *Brachionus calyciflorus* Pallas, 1766
(Figs. 6 & 7)

Characters : Lorica flexible and oval ; with four broad-based occipital spines of variable length. Posterior and rostrero-lateral spines present or absent, usually of variable length.

This polymorphic brachionid is represented by two forms namely *B. calyciflorus* f. *dorcas* (Gosse, 1851) and *B. calyciflorus* f. *anuraeiformis* (Brehm, 1909)

Measurements : Total length 390-440 ; maximum width 200-260 ; lateral occipital spines 60-78 ; median occipital spines 90-120.

Distribution : TRIPURA—all districts, f. *anuraeiformis* is a new report from Tripura, f. *dorcas* observed earlier by Sharma and Sharma (1990). INDIA—Meghalaya, Tripura, Assam, West Bengal, Orissa, Andhra Pradesh, Madhya Pradesh and Punjab.

Elsewhere : Cosmopolitan.

5. *Brachionus caudatus personatus*
Ahlstrom, 1940
(Fig. 8)

Characters : Lorica rigid, heavily stippled, moderately compressed and with a pattern of cuticular ridges. Lateral occipital spines longer than medians. Posterior spines in the plane axis of the body.

Measurements : Total length 210-225 ; maximum width 145-155 ; lateral occipital spines 18-25 ; posterior spines 40-45.

Distribution : TRIPURA—North and South Tripura, also reported earlier by Bhattacharya

and Saha (1988). INDIA—Punjab, Haryana, West Bengal, Orissa, Tripura and Meghalaya.

Elsewhere : Pantropical.

6. *Brachionus dichotomus reductus*
Koste & Shiel, 1980
(Figs. 9 & 10)

Characters : Lorica firm, stippled, dorso-ventrally compressed and with maximum width in its posterior region. Anterior occipital margin with distinct median spines of variable length. Posterior spines moderately long and divergent.

Measurements : Total length 150-160 ; maximum width 80-94 ; median occipital spines 20-35 ; posterior spines 30-45.

Distribution : TRIPURA—North and West Tripura, represents a new report from this state, INDIA—Meghalaya.

Elsewhere : Australia and Thailand.

7. *Brachionus diversicornis* (Daday, 1883)
(Fig. 11)

Characters : Lorica elongated and compressed dorso-ventrally. Anterior occipital margin with four spines ; median occipital spines short and laterals longer. Posterior spines two, unequal and divergent ; the right posterior spine longer than the left.

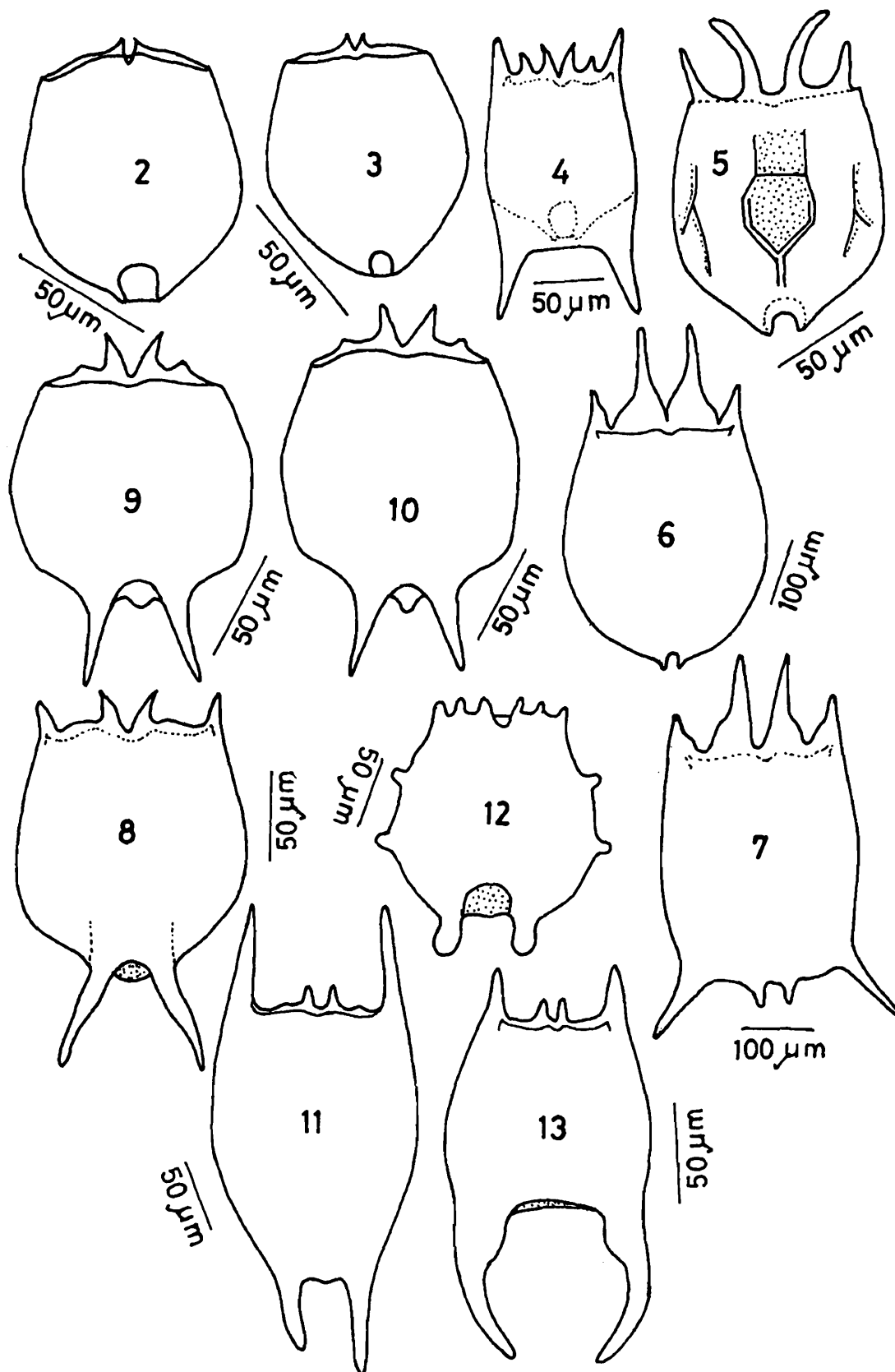
Measurements : Total length 220-280 ; maximum width 95-105 ; lateral occipital spines 70-90 ; right posterior spine 60-90 ; left posterior spine 10-20.

Distribution : TRIPURA—all districts, also reported previously from Tripura by Sharma and Sharma (1990). INDIA—Meghalaya, Assam, Tripura, West Bengal, Orissa, Bihar, Haryana and Punjab.

Elsewhere : Cosmopolitan.

8. *Brachionus donneri* Brehm, 1951
(Fig. 12)

Characters : Lorica rigid, oval, strongly flattened dorso-ventrally and with a gelatinous



Figures : 2-13

Figs. 2 & 3 : *Brachionus angularis* Gosse, ventral view ; Fig. 4 : *B. bidentatus* Anderson, ventral view ; Fig. 5 : *B. budapestinensis* Daday, dorsal view ; Fig. 6, *B. calyciflorus calycilorus f. dorcas* (Gosse), ventral view ; Fig. 7 : *B. calyciflorus f. anuraeiformis* (Brehm), dorsal view ; Fig. 8 : *B. caudatus personatus* Ahlstrom : dorsal view ; Figs. 9 & 10 : *B. dichotomus reductus* Koste & Shiel, ventral views ; Fig. 11 : *B. diversicornis* (Daday), ventral view ; Fig. 12 : *B. donneri* Brehm, ventral view ; Fig. 13 : *B. forficula* Wierzejski, ventral view.

cover. Anterior occipital margin with six blunt spines and ventral anterior margin with four short blunt spines. Lateral antennae located on conical lateral protuberances. Foot-opening deep and flanked with distinct club-shaped projections.

Measurements : Total length 160-195 ; maximum width 90-98.

Distribution : TRIPURA—North and West Tripura, also reported previously from this state by Bhattacharya and Saha (1988). INDIA—Meghalaya, Assam, Tripura, West Bengal and Tamil Nadu.

Elsewhere : Oriental region.

9. *Brachionus forficula* Wierzejski, 1891
(Fig. 13)

Characters : Lorica rigid, finely stippled and moderately compressed dorso-ventrally. Anterior occipital margin with four spines, laterals occipitals longer than medians. Posterior spines stout, inwardly directed and widely separated at their bases ; each with a knee-like swelling on inner side near the base.

Measurements : Total length 100-125 ; maximum width 90-110 ; lateral occipital spines 20-40 ; posterior spines 40-75.

Distribution : TRIPURA—all districts, also recorded earlier by Bhattacharya and Saha (1988) and Sharma and Sharma (1990). INDIA—Meghalaya, Tripura, West Bengal, Orissa, Bihar, Andhra Pradesh, Gujarat and Punjab.

Elsewhere : Pantropical.

10. *Brachionus falcatus* Zacharias, 1898
(Figs. 14 & 15)

Characters : Lorica rigid and compressed dorso-ventrally. Occipital margin with six spines ; intermediate occipitals longest and curved ventrally, laterals and medians short and of almost equal length. Posterior spines long, incurved and widely separated at their bases. Foot-opening situated between the bases of posterior spines.

Measurements : Total length 210-380 ; lorica length 120-180 ; maximum width 108-130.

Distribution : TRIPURA—all districts, also reported earlier by Bhattacharya and Saha (1988) and Sharma and Sharma (1990). INDIA—Meghalaya, Assam, Tripura, West Bengal, Orissa, Bihar, Andhra Pradesh, Madhya Pradesh, Gujarat, Rajasthan, Kerala, Punjab and Haryana.

Elsewhere : Pantropical.

11. *Brachionus mirabilis* (Daday, 1897)
(Fig. 16)

Characters : Lorica rigid, stippled and moderately compressed. Anterior margin with six occipital spines ; medians longest and curved outwards. Ventral plate of lorica produced into two posterior spines extending backwards at an angle of 45°. Foot-opening located between the bases of ventral spines and surrounded by a sheath.

Measurements : Total length 240-260 ; maximum width : 115-125 ; caudal spines 120-130 ; foot-opening spines 80-90.

Distribution : TRIPURA—West Tripura, represents a new report from this state. INDIA—Meghalaya, Assam, West Bengal, Orissa.

Elsewhere : Tropicopolitan.

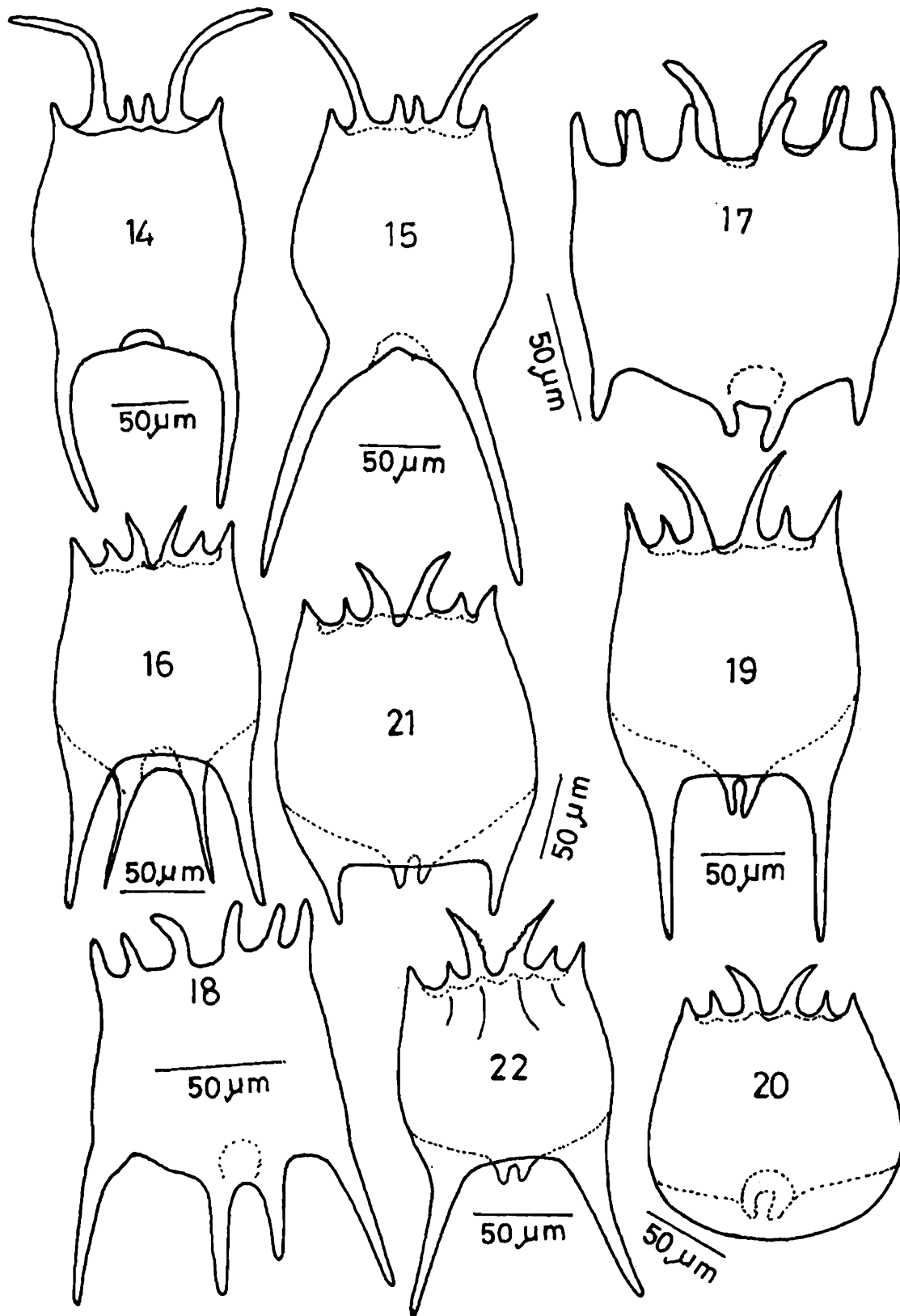
12a. *Brachionus patulus patulus*
(O.F. Müller, 1786)
(Fig. 17)

Characters : Lorica rigid, sub-rectangular and moderately compressed dorso-ventrally ; dorsum with reticulate areolations and with a pattern of cuticular ridges. Both occipital and mental margins with short, blunt spines. Posterior spines short and stout. Foot-opening flanked by asymmetrical spines.

Measurements : Total length 200-220 ; lorica length 145-160 ; maximum width 150-170.

Distribution : TRIPURA—all districts, reported earlier by Bhattacharya and Saha (1988) and Sharma and Sharma (1990). INDIA—Meghalaya, Tripura, West Bengal, Orissa, Andhra Pradesh, Gujarat, Tamil Nadu, Kerala, Rajasthan, Punjab and Kashmir.

Elsewhere : Cosmopolitan.



Figures : 14-22

Fig. 14 & 15 *Brachionus falcatus* Zacharias, ventral and dorsal views ; Fig. 16 ; *B. mirabilis* (Daday), dorsal view ; Fig. 17 : *B. patulus patulus* (Müller), dorsal view ; Fig. 18 : *B. patulus macracanthus* (Daday), dorsal view ; Fig. 19 : *B. quadridentatus quadridentatus* Hermann, dorsal view ; Fig. 20 : *B. quadridentatus cluniorbicularis* (Skorikov), dorsal view ; Fig. 21 : *B. quadridentatus brevispinus* (Ehrenberg) ; Fig. 22 : *B. quadridentatus melhani* (Barrois & Daddy), dorsal view.

12b. *Brachionus patulus macracanthus*
(Daday, 1905)

(Fig. 18)

Characters : Differentiated by its distinctly elongated caudal and foot-opening spines.

Measurements : Total length 210-220 ; lorica length 150-165 ; maximum width 105-110 ; postero-lateral spines 110-120.

Distribution : TRIPURA—North Tripura, represents a new report from this state. INDIA—Meghalaya, West Bengal, and Orissa.

Elsewhere : Neotropics.

13a. *Brachionus quadridentatus quadridentatus* Hermann, 1783.

(Fig. 19)

Characters : Lorica rigid, stippled and moderately compressed dorso-ventrally. Anterior margin with six occipital spines ; median occipital spines longest and ventrally curved, laterals longer than intermediates. Postero-lateral spines well developed. Ventro-posterior spines prolonged to form a foot sheath around the retractile foot.

Measurements : Total length 248-260 ; lorica length 140-152 ; maximum width 148-150.

Distribution : TRIPURA—all districts, also reported earlier from this state by Bhattacharya and Saha (1988) and Sharma and Sharma (1990). INDIA—Meghalaya, Assam, Tripura, West Bengal, Orissa, Bihar, Andhra Pradesh, Madhya Pradesh, Kerala, Rajasthan, Punjab and Kashmir.

Elsewhere : Cosmopolitan

13b. *Brachionus quadridentatus cluniorbicularis* (Skorikov, 1894)

(Fig. 20)

Characters : Postero-lateral spines lacking and postero-lateral angles of lorica rounded.

Measurements : Lorica length 152-160 ; maximum width 145-157.

Distribution : TRIPURA—all districts, also reported earlier by Sharma and Sharma (1990).

INDIA—Meghalaya, Tripura, West Bengal, Orissa, Madhya Pradesh and Ladak.

Elsewhere : Cosmopolitan.

13c. *Brachionus quadridentatus brevispinus*
(Ehrenberg, 1832)

(Fig. 21)

Characters : Postero-lateral spines less than 1/3 of lorica length or even smaller.

Measurements : Lorica length 106-120 ; maximum width 110-130 ; postero-lateral spines 30-40.

Distribution : TRIPURA—North and West Tripura, new report from this state. INDIA—Meghalaya, Assam, West Bengal, Orissa and Andhra Pradesh.

Elsewhere : Cosmopolitan.

13d. *Brachionus quadridentatus melheni*
(Barrois & Daday, 1894)

(Fig. 22)

Characters : Postero-lateral spines long and divergent. Foot sheath distinctly developed.

Measurements : Lorica length 160-180 ; postero-lateral spines 80-90.

Distribution : TRIPURA—North and South Tripura, represents a new report. INDIA—Meghalaya, Bihar and Orissa.

Elsewhere : Tropics and Subtropics.

14 *Brachionus rubens* Ehrenberg, 1838
(Fig. 23)

Characters : Lorica oval, compressed dorso-ventrally ; occipital margin with six spines ; median and intermediate occipital spines with peculiar asymmetrical shape—each spine showing a narrow anterior part, then rounding outwards and forming a broad base ; median occipitals somewhat longer than others. Four inner occipital spines with short strengthening ridges.

Measurements : Total length 170-225 ; maximum width 130-160.

Distribution : TRIPURA—West and South Tripura, also reported earlier by Sharma and Sharma (1990). INDIA—Meghalaya, Assam, Tripura, West Bengal, Orissa, Punjab, Haryana and Rajasthan.

Elsewhere : Cosmopolitan.

Genus *Keratella* Bory de St. Vincent, 1822

Characters : Lorica consists of a dorsal and a ventral plate ; dorsal plate with characteristic facets and more or less distinctly granulated. Occipital margin with four or six spines. Posterior spines often present, one or two ; single posterior spines usually median.

Type species : *Keratella quadrata* (O. F. Müller, 1786)

Only four species of *Keratella* are documented presently from Tripura.

Key to recorded species of genus *Keratella*

1. Lorica without any posterior spine
.....*Keratella lenzi*
Lorica with one or two posterior spines
.....2
2. With single median posterior spine 3
With two unequal postero-lateral spines
.....*Keratella tropica*
3. Dorsum with facets arranged on either side of a median line*Keratella cochlearis*
Dorsum with irregular arrangement of facets
.....*Keratella javana*

15. *Keratella cochlearis* (Gosse, 1851)
(Fig. 24)

Characters : Lorica elongated-oval, finely stippled and with a median posterior spine of variable length. Anterior margin with six occipital spines ; medians longest and ventrally curved, intermediates usually divergent and shorter than laterals. Dorsal plate with a median longitudinal line extending from behind median frontal area ; two enclosed plaques on either side of the median line, with two enclosed lateral polygons.

Measurements : Lorica length 90-130 ; maximum width 60-80 ; posterior spine 25-70

Distribution : TRIPURA—all districts, also reported previously by Bhattacharya and Saha (1988) and Sharma and Sharma (1990). INDIA—Meghalaya, Assam, Tripura, West Bengal, Orissa, Kerala, Kashmir, Ladak, Punjab and Rajasthan.

Elsewhere : Cosmopolitan.

16. *Keratella lenzi* Hauer, 1953
(Fig. 25)

Characters : Lorica oval, rounded posteriorly and without any posterior spine. Anterior occipital margin with six spines ; medians longest, sickle-shaped and ventrally curved. Dorsal plate with three median plaques, the ultimate plaque elongated and its arms running towards the posterior margin in form of a divergent crest.

Measurements : Total length 120-145 ; maximum width 68-80.

Distribution : TRIPURA—all districts, represents a new report. INDIA—Meghalaya, Assam, West Bengal, Orissa and Punjab.

Elsewhere : Pantropical and Pan-subtropical.

17. *Keratella javana* (Hauer, 1938)
(Fig. 26)

Characters : Lorica elongate-oval, finely stippled and with six long and thin occipital spines ; median occipitals longest and outcurved. Dorsal plate with asymmetrical arrangement of facets ; anterior median plaque divided in two asymmetrical pentagonal facets. Posterior spine single and slightly dorsally directed.

Measurements : Lorica length 90-100 ; maximum width 70-80 ; median occipital spines 50-60 ; posterior spine 45-50.

Distribution : TRIPURA—North Tripura, represents a new report from this state. INDIA—Meghalaya.

Elsewhere : Palaeotropical.

18. *Keratella tropica* (Apstein, 1907)
(Fig. 27)

Characters : Lorica elongate-oval, stippled and with six occipital spines ; medians occipitals

longest, pointed and outcurved. Dorsal plate with three median hexagonal plaques and a small squarish area between the last median plaque and the posterior margin of lorica. Posterior spines unequal and variable in length ; the right spine generally longer than the left.

Measurements : Lorica length 120-182 ; maximum width 80-96 ; right posterior spine upto 110 ; left posterior spine upto 30.

Distribution : TRIPURA—all districts ; also reported previously from Tripura by Bhattacharya and Saha (1988) and Sharma and Sharma (1990). INDIA—Meghalaya, Assam, Tripura, West Bengal, Bihar, Orissa, Andhra Pradesh, Madhya Pradesh, Kerala, Gujarat, Rajasthan, Punjab, Kashmir and Ladak.

Elsewhere : Cosmopolitan.

Genus *Platylas* Haring, 1913

Characters : Lorica somewhat compressed dorso-ventrally, separated into a dorsal and a ventral plate. Anterior and posterior margins of lorica with two spines each. Mental margin variable. Foot jointed and retractile, foot-opening located in ventral plate ; toes two.

Type species : *Platylas quadricornis* (Ehrenberg, 1832)

Represented by only one species in the material examined from Tripura.

19. *Platylas quadricornis* (Ehrenberg, 1832) (Fig. 28)

Characters : Lorica rigid, nearly circular, tuberculated and with a dorsal pattern of pentagonal facets. Occipital margin with two stout median spines, with bluntly rounded to nearly truncate tips. Posterior spines short and parallel.

Measurements : Total length 178-230 ; maximum width 165-180.

Distribution : TRIPURA—all districts of this state, also documented previously by Sharma and Sharma (1990). INDIA—Meghalaya, Assam,

Tripura, West Bengal, Orissa, Bihar, Andhra Pradesh, Kerala, Rajasthan, Punjab, Haryana, Kashmir and Ladak.

Elsewhere : Cosmopolitan.

Genus *Anuraeopsis* Lauterborn, 1900

Characters : Lorica thin, ovate or navicular and rounded or obtusely truncate posteriorly. Dorsal and ventral plates of lorica joined laterally by a soft membrane. Foot absent.

Type species : *Anuraeopsis fissa* (Gosse, 1851)

Only two species of *Anuraeopsis* are observed presently from Tripura.

Key to recorded species of genus *Anuraeopsis*
Lorica oval, usually stippled ; without any surface pattern *Anuraeopsis fissa*
Lorica boat-shaped, granulated ; with distinct pattern on dorsum *Anuraeopsis coelata*

20. *Anuraeopsis fissa* (Gosse, 1851) (Figs. 29 & 30)

Characters : Lorica ovate, finely stippled, obtusely pointed posteriorly and without any surface markings or crests. Anterior dorsal margin of lorica with a shallow sinus. Ventral plate projecting a little laterally beyond the dorsal plate in the anterior region.

Measurements : Total length 78-100 ; maximum width 50-68.

Distribution : TRIPURA—North and West Tripura, also reported earlier from this state by Bhattacharya and Saha (1988) and Sharma and Sharma (1990). INDIA—Meghalaya, Assam, Tripura, West Bengal, Orissa, Bihar, Kerala, Rajasthan, Gujarat, Punjab, Chandigarh (U.T.) and Haryana.

Elsewhere : Cosmopolitan.

21. *Anuraeopsis coelata* (De Beauchamp, 1932) (Fig. 31)

Characters : Lorica boat-shaped and granulated ; dorsal plate with two longitudinal

ridges running parallel to each other and then united at the hinder end to form a single ridge. Anterior occipital margin without any spines or serration.

Measurements : Total length 80-95 ; maximum width 45-55.

Distribution : TRIPURA—North Tripura, also reported earlier from this state by Bhattacharya and Saha (1988) and Sharma and Sharma (1990). INDIA—Meghalaya, Assam, Tripura, West Bengal, Orissa and Gujarat.

Elsewhere : Pantropical.

Family EUCHLANIDAE Bartos, 1959

Characters : Lorica thin or strong, dorsal and ventral plates bounded together by a thin membrane ; with or without lateral sulci. Dorsal plate with or without longitudinal groove. Toes very long and baton-shaped or small blade-shaped. Trophi malleate.

This family is presently represented by only three genera.

Key to recorded genera of family EUCHLANIDAE

1. Lorica thin, without lateral sulcus
.....BEAUCHAMPIELLA
- Lorica strong, with lateral sulcus.....2
2. Dorsal plate usually arched and wider than ventral plate EUCHLANIS
- Dorsal plate concave and narrower than ventral plate DIPLEUCHLANIS

Genus *Beauchampiella* Remane, 1929

Characters : Lorica thin, pear-shaped, dorsally bulged and without any lateral sulcus. Toes very long and baton-shaped.

Type species : *Beauchampiella eudactylota* (Gosse, 1886).

This genus is represented by only one species from Tripura.

22. *Beauchampiella eudactylota* (Gosse, 1886) (Fig. 32)

Characters : Body thin, transparent, pear-shaped and with a distinct dorsal bulge. Muscle bands supporting body and foot distinct. Foot two segmented ; first foot-segment thick and stout, second segment elongated. Toes long, baton-shaped and slightly swollen near the tips.

Measurements : Body length 150-180 ; foot length 80-100 ; toes 250-280.

Distribution : TRIPURA—North Tripura, represents a new report from this state. INDIA—Meghalaya, West Bengal, Orissa, Bihar, Andhra Pradesh and Madhya Pradesh.

Elsewhere : Cosmopolitan.

Genus *Euchlanis* Ehrenberg, 1832

Characters : Lorica thin, dorsal and ventral plates bounded by a thin membrane. Dorsal plate usually arched, with or without dorsal keel ; ventral plate generally flat. Foot short, two-segmented ; toes short and with pointed tips. Trophi modified malleate.

Type species : *Euchlanis dilatata* Ehrenberg, 1832.

The genus *Euchlanis* is represented by only two species in the present study.

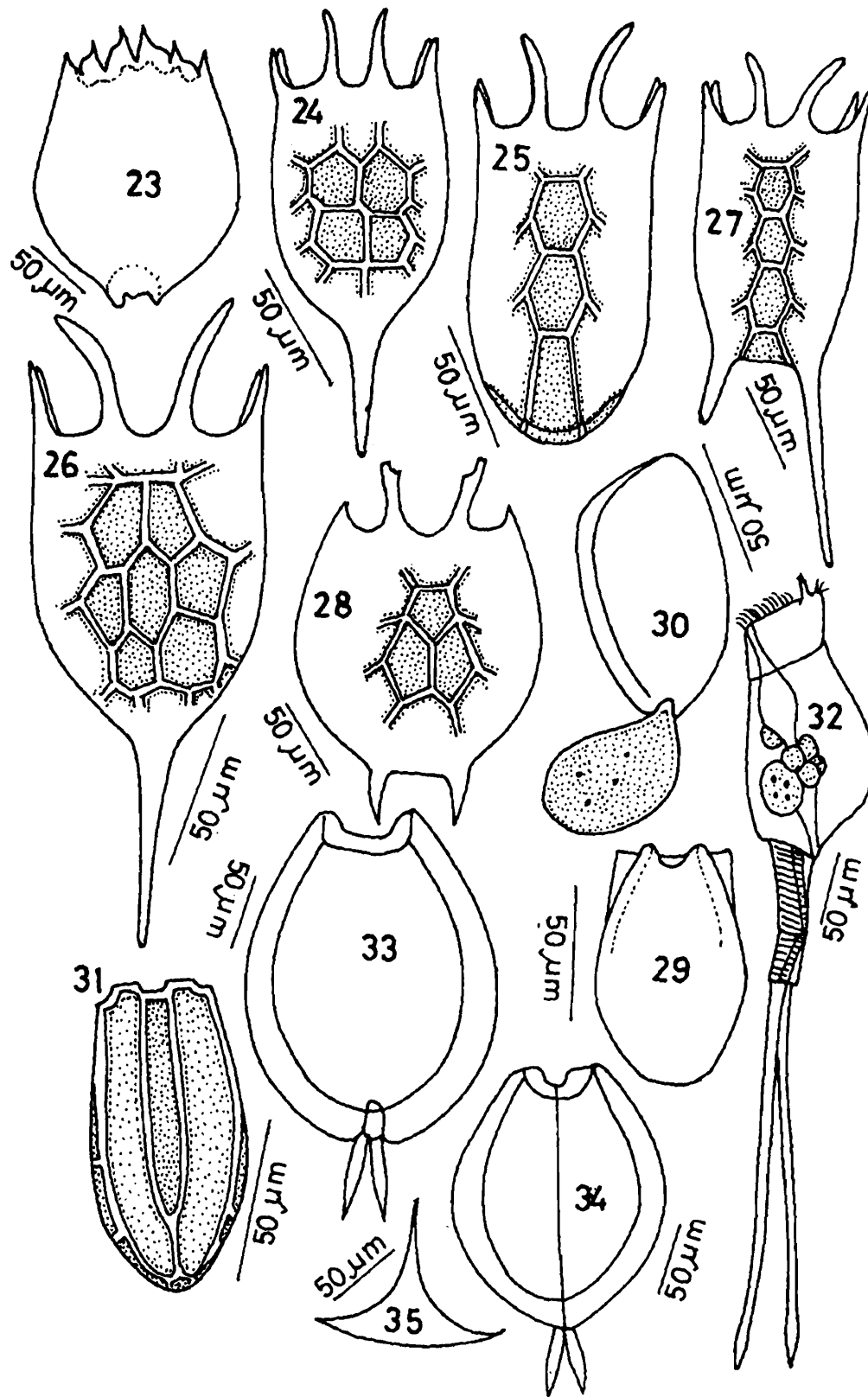
Key to recorded species of genus Euchlanis

- Dorsal plate with a strong median keel. Ventral plate slightly convex*Euchlanis triquetra*
- Dorsal plate with a small hump. Ventral plate nearly flat*Euchlanis dilatata*

23. *Euchlanis dilatata* Ehrenberg, 1832 (Fig. 33)

Characters : Lorica oval, truncate anteriorly and rounded posteriorly. Dorsal plate arched and with a shallow notch at its posterior end. Ventral plate flat, smaller and narrower than dorsal plate. Toes parallel-sided and with pointed tips.

Measurements : Length dorsal plate 180-190 ; length ventral plate 160-170 ; width dorsal plate



Figures : 23-35

Fig. 23 : *Brachionus rubens* Ehrenberg, dorsal view ; Fig. 24 : *Keratella cochlearis* (Gosse), dorsal view ; Fig. 25. *K. lenzi* Hauer, dorsal view ; Fig. 26 : *K. javana* (Hauer), dorsal view ; Fig. 27 : *K. tropica* (apstein), dorsal view ; Fig. 28 : *Platylas quadricornis* (Ehrenberg), dorsal view ; Figs. 29 & 30 : *Anuraeopsis fissa*, dorsal and ventral views ; Fig. 31 : *A. coelata* (De Beauchamp), dorsal view ; Fig. 32 : *Beauchampiella eudactylota* (Gosse), lateral views ; Fig. 33 : *Euchlanis dilatata* Ehrenberg, dorsal view ; Figs. 34 & 35 : *E. triquetra* Ehrenberg, dorsal view and cross section.

135-150 ; width ventral plate 110-120 ; toes 55-70.

Distribution : TRIPURA—all districts of this state, also reported earlier by Bhattacharya and Saha (1988). INDIA—Meghalaya, Assam, Tripura, West Bengal, Orissa, Bihar, Gujarat, Punjab, Ladak and Kashmir.

Elsewhere : Cosmopolitan.

24. *Euchlanis triquetra* Ehrenberg, 1838
(Figs. 34 & 35)

Characters : Lorica elliptical, truncate posteriorly and with lateral flanges ; with a strong dorsal keel extending from anterior to posterior end of lorica. Dorsal plate longer than ventral plate. Toes slender, rod-shaped and with pointed tips.

Measurements : Lorica length 330-350 ; width of lorica 250-270 ; height of lorica 160-180 ; toes 70-90

Distribution : TRIPURA—South Tripura, represents a new report from this state. INDIA—Meghalaya, West Bengal and Bihar.

Elsewhere : Cosmopolitan.

Genus *Dipleuchlanis* De Beauchamp, 1910

Characters : Ventral plate narrower than dorsal plate. Lateral sulci forming a deep groove. Foot three segmented, with setae ; toes long and parallel sided. Unci with 7-10 teeth each.

Type species : *Dipleuchlanis propatula* (Gosse, 1886)

This genus is represented by only one species from Tripura.

25. *Dipleuchlanis propatula* (Gosse, 1886)
(Figs. 36 & 37)

Characters : Lorica firm, oval or ovoid and compressed dorso-ventrally. Dorsal plate concave and smaller than ventral plate. Lateral sulci deep. Toes long and cylindrical.

Measurements : Length dorsal plate 140-150 ; length ventral plate ; 150-165 ; width dorsal plate 70-80 ; width ventral plate 130-140 ; toes 80-90.

Distribution : TRIPURA—North and West Tripura, represents a new report from this state. INDIA—Meghalaya, Assam, West Bengal, Orissa, Bihar, Punjab and Kerala.

Elsewhere : Cosmopolitan.

Family MYTILINIDAE Bartos, 1959

Characters : Trophi malleate. Lorica with or without anterior and posterior spines. Dorsal surface of lorica with a median longitudinal sulcus.

Type species : *Mytilina mucronata* (O. F. Müller, 1773).

Only one genus of this family is documented from Tripura.

Genus *Mytilina* Bory de St. Vincent, 1826

Characters : Body heavily loricate and laterally flattened. Lorica with double dorsal keel and with spines on all four corners ; spines, at times, completely or partly reduced. Foot with indistinct three segments ; toes thin and slender. Corona similar to *Euchlanis*-type.

Type species : *Mytilina mucronata* (O. F. Müller, 1773)

Only two species of the genus *Mytilina* are documented in present account.

Key to recorded species of genus *Mytilina*

Lorica without spines. Toes with distinct spines*Mytilina bisulcata*
Lorica with anterior and posterior margins. Toes without spines*Mytilina ventralis*

26. *Mytilina ventralis* (Ehrenberg, 1832)
(Fig. 38)

Characters : Lorica rigid, laterally compressed and anterior 1/3 part of lorica heavily granulated. Antero-ventral corners with a spine on each side. Postero-dorsal and postero-ventral spines short and variable. Toes two and moderately long.

Measurements : Lorica length : 180-220 ; toes 40-48.

Distribution : TRIPURA—examined from all districts, represents a new report from this state. INDIA—Meghalaya, Assam, West Bengal, Orissa, Bihar, Andhra Pradesh, Gujarat, Madhya Pradesh, Kerala, Punjab, Kashmir, Ladak and Rajasthan.

Elsewhere : Cosmopolitan.

27. *Mytilina bisulcata* (Lucks, 1912)
(Fig. 39)

Characters : Lorica thin, and its anterior end with two folds ; almost rounded in cross-section and dorsal keel with three stumps. Dorsal sulcus indistinct. Toes long slender and terminating into distinct slender spines.

Measurements : Lorica length 145-160 ; toes 50-62 ; spines 8-10.

Distribution : TRIPURA—North Tripura, represents a new record from this state. INDIA—Meghalaya, West Bengal and Orissa.

Elsewhere : Pantropical.

Family TRICHOTRIDAE Bartos, 1959

Characters : Trophi malleates. Head, trunk and foot clearly defined and with lorica. Trunk laterally broad, slightly granulated, often with spines on dorsum.

This family is represented by two genera in this account.

Key to recorded genera of family TRICHOTRIDAE

Lorica with dorsal spines and with anal segment
.....MACROCHAETUS

Lorica without dorsal spines and anal segment
.....TRICHOTRIA

Genus *Trichotria* Bory de St. Vincent, 1827

Characters : Head, trunk and foot strongly loricate. Foot mobile, three-segmented ; second

foot-segment with spines of variable length. Toes long, slender and ending into pointed tips.

Types species : *Trichotria pocillum* (O. F. Müller, 1776)

Only one species belonging to this genus is documented in the present study.

28. *Trichotria tetractis* (Ehrenberg, 1830)
(Fig. 40)

Characters : Lorica heavily stippled ; antero-dorsal corners produced into small spines. Dorsum with distinct pattern of carinal plates and ridges. Second foot-segment longest. Toes long, cylindrical and terminating into acute points.

Measurements : Lorica length 130-160 ; foot 80-105 ; toes 90-110

Distribution : TRIPURA—all districts of this state, also examined previously by Bhattacharya and Saha (1988). INDIA—widely distributed, reported so far from Meghalaya, Assam, Tripura, West Bengal, Orissa, Andhra Pradesh, Madhya Pradesh, Tamil Nadu, Kerala, Gujarat, Punjab and Kashmir.

Elsewhere : Cosmopolitan.

Genus *Macrochaetus* Perty, 1850

Characters : Body scutellate, strongly loricate and granulate ; its margins serrate or with spines. Dorsum with several pairs of mobile spines ; spines also present on posterior margin of lorica and on anal segment. Foot two-segmented ; toes two and thin.

Type species : *Macrochaetus subquadratus* Perty, 1850

Only one species belonging to this genus is examined from Tripura.

29. *Macrochaetus sericus* (Thorpe, 1893)
(Fig. 41)

Characters : Lorica horse-shoe shaped, granulated and with small spines at its external angles. Dorsum with eight spines arranged

symmetrically along its mid-line ; median caudal spines deeply inserted. Foot two-segmented ; first foot-segment with flattened cuticle and two separated spines. Toes short and spindle-shaped.

Measurements : Lorica length 90-110 ; maximum width 95-100 ; second foot-segment 18-20 ; toes 20-22.

Distribution : TRIPURA—North and West Tripura, represents a new report from this state. INDIA—Meghalaya, West Bengal, Orissa, Andhra Pradesh and Madhya Pradesh.

Elsewhere—Pantropical.

Family COLURELLIDAE Bartos, 1959

Characters : Corona with broad lateral lamellae and with hood. Eyes lateral. Lorica comprised of one or two plates, dorso-ventrally or laterally compressed ; with or without ventral and dorsal furrows. Trophi modified malleate.

Three genera belonging to this family are included in this account.

Key to recorded genera of family Colurellidae

1. Lorica laterally compressed, consists of a single plate *Colurella*
Lorica dorso ventrally compressed, with dorsal and ventral plates 2
2. Head shield large, not retractile
..... *Squatinella*
Head shield small, retractile *Lepadella*

Genus *Colurella* Bory de St. Vincent, 1824

Characters : Lorica oval or ovate, laterally compressed and consists of a single plate ; with a ventral median longitudinal cleft. Head plate small and retractile. Foot three-segmented ; toes sharply pointed. Corona similar to *Euchlanis*-type. With or without eye.

Types species : *Colurella uncinata* (O.F. Müller, 1773)

Only three species of the genus *Colurella* are noticed in the collections from Tripura.

Key to recorded species of genera *Colurella*

1. Lorica elongated. Foot forwardly directed *Colurella sulcata*
Lorica not elongated. Foot backwardly directed 2
2. Lorica plumpy, obtuse posteriorly. Posterior angles relatively apart *Colurella obtusa*
Lorica ovate. Posterior angles produced, drawn closely *Colurella uncinata*

30. *Colurella obtusa* (Gosse, 1886)
(Fig. 42)

Characters : Lorica small, oval and with obtuse posterior angles. Foot-opening relatively broad. Toes small, slender and pointed.

Measurements : Lorica length 50-60 ; maximum width 25-28 ; height of lorica 30-40 ; toes 12-18.

Distribution : TRIPURA—all districts, represents a new record from this state. INDIA—Meghalaya, West Bengal and Punjab.

Elsewhere : Cosmopolitan.

31. *Colurella uncinata* (O. F. Müller, 1773)
(Fig. 43)

Characters : Lorica broadly ovate ; posterior angles of lorica produced and downwardly directed, edges drawn closer. Foot small and stout. Toes two, slender and pointed.

Measurements : Lorica length 78-92 ; width of lorica 50-55 ; toes 15-22.

Distribution : TRIPURA—documented presently from all districts, represents a new report from this state. INDIA—Meghalaya and West Bengal.

Elsewhere : Cosmopolitan.

32. *Colurella sulcata* (Stenroos, 1898)
(Fig. 44)

Characters : Lorica slender, elongated and with a longitudinal cleft ; anterior margins of lorica rounded. Posterior angles distinct but not produced. Foot and toes forwardly directed ; toes long, slender and pointed.

Measurements : Lorica length 70-86 ; height of lorica 26-38 ; toes 16-22.

Distribution : TRIPURA—North Tripura, represents a new report from this state. INDIA—Meghalaya, West Bengal, Orissa and Gujarat.

Elsewhere : Cosmopolitan.

Genus *Lepadella* Bory de St. Vincent, 1826

Characters : Lorica oval, ovate, pear-shaped or circular and moderately to strongly compressed dorso-ventrally ; with characteristic head and foot openings. Anterior end often with a stippled collar. Dorsal plate flat, arched or with a keel. Foot three segmented ; toes long and pointed. Corona consists of a single line of cilia, with lateral tufts on buccal field. Trophi malleate.

This genus is divisible into three subgenera. Of these, only two are represented in the examined collections.

Key to recorded subgenera of genera
LEPADELLA

Toes two, equal*Lepadella (Lepadella)*

Toes two, unequal..*Lepadella (Heterolepadella)*

Sub-genus *Lepadella (Lepadella)* Bory de St. Vincent, 1826

Characters : Species differentiated by two equal toes.

Type species : *Lepadella (Lepadella) patella* (Müller, 1786)

This subgenus is presently represented by seven species from Tripura

Key to recorded species and subspecies of
subgenus Lepadella

1. Posterior end of lorica produced into a spine of variable length*Lepadella acuminata*

Posterior end of lorica not produced into any spine 2

2. Lorica with a distinct dorsal keel 3

Lorica without a dorsal keel 5

3. With anterior backwardly directed dorsal crest*Lepadella cristata*

Without any dorsal crest 4

4. Dorsal keel sharp and thin. Lorica pear-shaped or rounded*Lepadella triptera*

Dorsal keel broad. Lorica ovate and compressed*Lepadella rhomboides*

5. Lorica small, upto 70 µm*Lepadella apsidea*

Lorica longer than 70 µm 6

6. Lorica oval to circular and compressed in cross-section*Lepadella ovalis*

Lorica oval, not compressed in cross-section*Lepadella patella*

33. *Lepadella (Lepadella) acuminata*
(Ehrenberg, 1834)
(Fig. 45)

Characters : Lorica broadly oval in outline, moderately compressed dorso-ventrally and its posterior end produced into a pointed spine of variable length. Foot groove oval ; toes pointed.

Measurements : Lorica length 90-110 ; maximum width 60-75 ; toes 25-32.

Distribution : TRIPURA—all districts, represents a new record from this state. INDIA—Meghalaya, Assam, Arunachal Pradesh, West Bengal, Orissa, Bihar and Tamil Nadu.

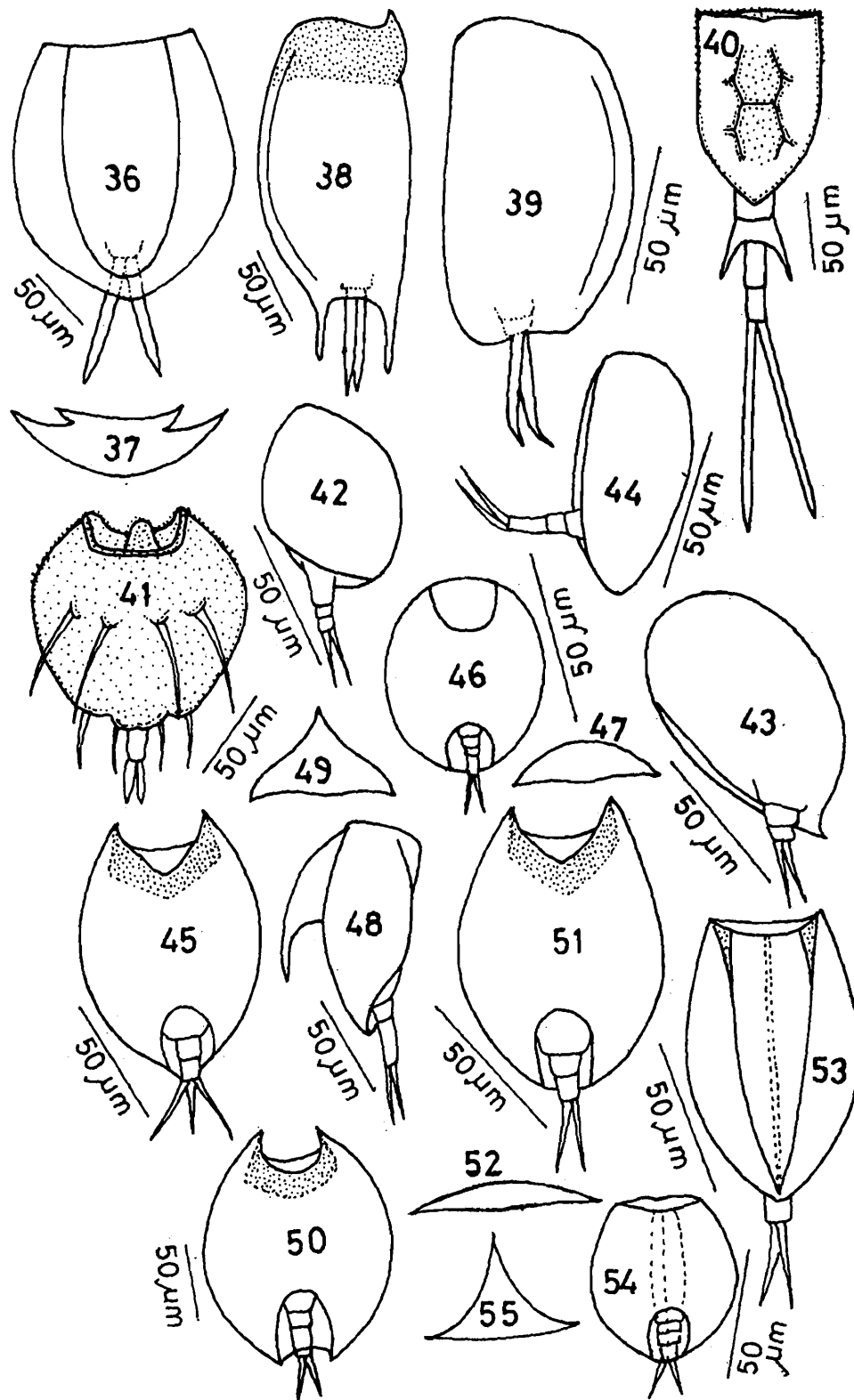
Elsewhere : Cosmopolitan.

34. *Lepadella (Lepadella) apsidea*
Harring, 1916
(Figs. 46 & 47)

Characters : Lorica nearly circular in outline ; dorsal sinus lacking, ventral sinus circular and without any stippled collar. Foot-groove rounded U-shaped ; toes short and pointed.

Measurements : Lorica length 65-72 ; maximum width 50-55 ; toes 10-15.

Distribution : TRIPURA—North Tripura, represents a new report from this state. INDIA—Meghalaya, West Bengal and Panjab.



Figures : 36-55

Fig. 36 & 37 : *Dipleuchlanis propatula* (Gosse), dorsal view and cross-section ; Fig. 38 : *Mytilina ventralis* (Ehrenberg), lateral view ; Fig. 39 : *M. bisulcata* (Lucks), lateral view ; Fig. 40 : *Trichotria tetractis* (Ehrenberg), dorsal view ; Fig. 41 : *Macrochaetus sericus* (Thorpe), dorsal view ; Fig. 42 : *Colurella obtusa* (Gosse), lateral view ; Fig. 43 : *C. uncinata* (Müller), lateral view ; Fig. 45 : *Lepadella (Lepadella) acuminata* (Ehrenberg), ventral view ; Figs. 46 & 47 : *L. (L.) apsida* Haring, ventral view and cross-section ; Figs. 48 & 49 : *L. (L.) cristata* (Rousselet), lateral view and cross-section ; Fig. 50 : *L. (L.) ovalis* (Müller), ventral view ; Figs. 51 & 52 : *L. (L.) patella* (Müller), ventral view and cross-section ; Fig. 53 : *L. (L.) rhomboides* (Gosse), dorsal view ; Figs. 54 & 55 : *L. (L.) triptera* Ehrenberg, dorsal view and cross-section.

Elsewhere : China, America, Central and Eastern Asia, India.

35. *Lepadella (Lepadella) cristata*

(Rousselet, 1893)

(Figs. 48 & 49)

Characters : Lorica oval, with a dorsal median keel and a characteristic dorsal crest. Anterior dorsal margin nearly straight ; anterior ventral margin with a V-shaped sinus. Foot-groove pear shaped ; last foot-joint projecting beyond lorica. Toes long and pointed.

Measurements : Lorica length 90-110 ; maximum width 70-80 ; height of lorica 68-75 ; toes 28-35.

Distribution : TRIPURA—West Tripura, represents a new record from this state. INDIA—Meghalaya and West Bengal.

Elsewhere : Cosmopolitan.

36. *Lepadella (Lepadella) ovalis*

(O. F. Müller, 1786)

(Fig. 50)

Characters : Lorica oval to circular and compressed dorso-ventrally ; dorsal plate convex and ventral plate nearly flat. Dorsal and ventral sinus with stippled collars. Foot-groove nearly parallel-sided. Toes relatively short and pointed.

Measurements : Lorica length 90-130 ; maximum width 80-94 ; toes 20-26.

Distribution : TRIPURA—all districts, also reported earlier from this state by Sharma and Sharma (1987a). INDIA—all states in North Eastern region, West Bengal, Orissa, Bihar, Kerala, Punjab, Haryana, Ladak and Kashmir.

Elsewhere : Cosmopolitan.

37. *Lepadella (Lepadella) patella* (O. F.

Müller, 1773)

(Figs. 51 & 52)

Characters : Lorica oval and dorsal plate

strongly arched ; anterior dorsal and ventral sinus with stippled collars. Foot groove parallel-sided to semicircular and its edges often projecting at the posterior end. Toes pointed.

Measurements : Lorica length 75-105 ; maximum width 60-78 ; toes 18-25.

Distributions : TRIPURA—all districts, documented previously by Sharma and Sharma (1987a) and Bhattacharya and Saha (1988). INDIA—all the states in North Eastern India, West Bengal, Orissa, Bihar, Rajasthan, Gujarat, Punjab, Ladak and Kashmir.

Elsewhere : Cosmopolitan.

38. *Lepadella (Lepadella) rhomboides*

(Gosse, 1886)

(Fig. 53)

Characters : Lorica rhomboid-oval ; dorsal plate with a wide and moderately high median keel, sides of keel strongly convex and meet centrally at an obtuse angle forming a faint ridge. Foot groove variable. Foot long. Toes slender and pointed.

Measurements : Lorica length 80-96 ; maximum width 50-62 ; toes 22-26.

Distribution : TRIPURA—all districts, also examined earlier by Bhattacharya and Saha (1988). INDIA—Meghalaya, Assam, Tripura, Nagaland, Manipur, Mizoram, West Bengal, Tamil Nadu, Gujarat and Punjab.

Elsewhere : Cosmopolitan.

39. *Lepadella (Lepadella) triptera*

Ehrenberg, 1830

(Figs. 54 & 55)

Characters : Lorica small and broadly circular or pear-shaped in outline. Dorsal plate with a high and thin median keel. Anterior end of dorsal plate with a shallow notch, ventral sinus broad and U-shaped. Posterior end of lorica obtusely pointed. Toes short and pointed.

Measurements : Lorica length 52-64 ; maximum width 48-56 ; toes 12-16.

Distribution : TRIPURA—North and South Tripura, represents a new record from this state. INDIA—Meghalaya, Assam, West Bengal, Orissa, Tamil Nadu, Punjab and Ladak.

Elsewhere : Cosmopolitan.

Sub-genus *Heterolepadella* Bartos, 1955

Characters : Differentiated by two unequal and separate toes.

Type species : *Lepadella (Heterolepadella) ehrenbergi* (Perty, 1850)

Three species belonging to this subgenus are noticed from Tripura.

Key to recorded species and subgenus
Heterolepadella

1. Lorica oval
.....*Lepadella (Heterolepadella) aspicora*
Lorica rhomboidal in shape 2
2. Lateral angles of lorica with distinct cusps.
Posterior angles. pointed
.....*Lepadella (Heterolepadella) ehrenbergi*
Lateral and posterior angles bluntly rounded
.....*Lepadella (Heterolepadella) heterostyla*

40. *Lepadella (Heterolepadella) aspicora*
Myers, 1934
(Fig. 56)

Characters : Lorica broadly oval. Dorsal sinus shallow and ventral sinus V-shaped, both with stippled collars. Dorsal plate moderately arched, ventral plate nearly flat. Last foot-segment longest. Toes two, unequal ; right toe longer than the left and toes often twisted.

Measurements : Lorica length 60-72 ; maximum width 55-65 ; right toe 22-26 ; left toe 16-18.

Distribution : TRIPURA—North and West Tripura, represents a new report from this state. INDIA—Meghalaya and West Bengal.

Elsewhere : Mount Desert Island (USA), India and Indonesia.

41. *Lepadella (Heterolepadella) ehrenbergi*
(Perty, 1850)
(Fig. 57)

Characters : Lorica broadly rhomboid ovate in outline. Dorsal plate moderately convex in central region and relatively flat laterally. Lateral angles with median spurs curving outwards and forwards. Posterior angles pointed and posterior margin of lorica slightly concave. Foot-groove broader posteriorly ; toes unequal and pointed.

Measurements : Lorica length 72-90 ; maximum width 72-84 ; right toe 22-26 ; left toe 16-18.

Distribution : TRIPURA—all districts, represents a new record from this state. INDIA—Meghalaya, Assam, Nagland, West Bengal and Orissa.

Elsewhere : Cosmopolitan.

42. *Lepadella (Heterolepadella) heterostyla*
(Murray, 1913)
(Fig. 58)

Characters : Lorica broadly rhomboidal and its edges curving upwards from the blunt lateral angles towards the anterior margin. Dorsal plate strongly convex in its median region. Posterior angles of lorica with semicircular emarginations. Toes unequal and pointed.

Measurements : Lorica length 78-82 ; maximum width 70-82 ; right toe 22-26 ; left toe 16-20.

Distribution : TRIPURA—all districts, also reported earlier by Sharma and Sharma (1987a). INDIA—Meghalaya, Assam, Tripura, Mizoram, West Bengal, Orissa and Bihar.

Elsewhere : Cosmopolitan.

Genus *Squatinella* Bory de St. Vincent, 1826

Characters : Body transparent and with thin lorica. Head and corona enclosed by semicircular head shield. Corona with a ciliated buccal field. Two distinct eye spots present. Trophi weak and

malleate. Foot long and three-segmented ; toes equal, slender and with pointed tips.

Type species : *Squatinella cirrata* (O. F. Müller, 1773)

The collections studied from Tripura include only one species belonging to this genus.

43. *Squatinella mutica* (Ehrenberg, 1832)
(Fig. 59)

Characters : Body transparent and with semicircular head shield ; trunk with oblong-ovate lorica. First foot-segment covered by a shield-like projection of dorsal plate. Toes long, slender and acutely pointed.

Measurements : Total length 160-175' ; maximum width 55-68 ; toes 22-28.

Distribution : TRIPURA—North Tripura, represents a new record from this state. INDIA—Meghalaya, West Bengal and Ladak.

Elsewhere : Cosmopolitan.

Family LECANIDAE Bartos, 1959

Characters : Body loricate and consists of dorsal and ventral plates. Trophi malleate, modified for suction. Buccal area very simple. Foot one or two-jointed ; toes one or two

All the lecanid species documented in this account belong to the genus *Lecane*.

Genus *Lecane* Nitzsch, 1827

Characters : Lorica oval, pear or shield-shaped, with dorsal and ventral plates and usually compressed dorso-ventrally. Antero-lateral edges of lorica prolonged into angles or short spines in some species ; posterior end rounded or extended into a process. Foot short, two segmented ; only second foot-joint mobile. Toes one or two, in the latter case completely or partially fused ; often with short and pointed claws.

All the three subgenera of *Lecane* i.e., *Lecane* (s. str.), *Hemimonostyla* and *Monostyla* observed in the examined material.

Key to recorded subgenera of genus *Lecane*

1. Toes single *Lecane* (*Monostyla*)
Toes two 2
2. Toes always separate *Lecane* (*Lecane*)
Toes partially fused
..... *Lecane* (*Hemimonostyla*)

Sub-genus *Lecane* (*Lecane*) Nitzsch, 1927

Characters : Characterized by two completely separate toes.

Type species : *Lecane luna* (O. F. Müller, 1776)

Twenty species belonging to *Lecane* s. str. are noticed in the present study.

Key to recorded species and subspecies of
Lecane (*Lecane*)

1. Lorica soft, dorsal and ventral plates undifferentiated *Lecane inermis*
Lorica strong, dorsal and ventral plates distinct 2
2. Toes with claws 3
Toes without claws 12
3. Toes with distinct claws 4
Toes with undifferentiated claws 6
4. Claws swollen at base *Lecane hastata*
Claws not swollen at base 5
5. Lorica parallel-sided, anterior spines small *Lecane crepida*
Lorica oblong, anterior spines distinct *Lecane aculeata*
6. Ventral plate with rounded posterior extensions *Lecane lateralis*
Ventral plate without such posterior extension 7
7. Lorica large, claws long
..... *Lecane unguolata*
Lorica moderate, claws short 8
8. Anterior margin with spines at external angles 9
Anterior margin without spines at external angles 10

9. Anterior end wide, toes long 11
Anterior end narrow, toes relatively short
..... *Lecane luna*
10. Posterior segment round
..... *Lecane curvicornis curvicornis*
Posterior segment tricuspidate
..... *Lecane curvicornis lofuana*
11. Anterior margins coincident and concave
..... *Lecane braumi*
Anterior dorsal margin straight, ventral
margin undulating *Lecane papuana*
12. Posterior segment rounded 13
Posterior segment not rounded 20
13. Foot projecting beyond lorica 14
Foot not projecting beyond lorica 16
14. Lorica oval, with small spines at external
angles *Lecane sola*
Lorica elongated, with distinct spines at
external angles 15
15. Anterior external spines cuspidate
..... *Lecane simonneae*
Anterior external spines small
..... *Lecane pertica*
16. Lorica with spines at external angles 17
Lorica without spines at external angles
..... 19
17. Lorica oval, toes small *Lecane levistyla*
Lorica elongated, toes long 18
18. Lorica cylindrical, dorsal plate with rounded
markings *Lecane signifera signifera*
Lorica oval, dorsal plate with distinct
markings *Lecane signifera ploenensis*
19. Lorica gibbous. Posterior segment large. Toes
outcurved *Lecane hornemanni*
Lorica compressed. Posterior segment small.
Toes straight *Lecane nana*
20. Posterior segment produced into a triangular
spine *Lecane ludwigi*
Posterior segment not produced into a
triangular spine 21

21. Posterior segment angular
..... *Lecane leontina*

- Posterior segment lobate
..... *Lecane ohioensis*

44. *Lecane (Lecane) aculeata* (Jakubski, 1912)
(Figs. 60 & 6)

Characters : Lorica elongate-oval, with straight and coincident anterior margins ; ventral plate narrower than dorsal plate and with distinct outcurving spines at its external edges. Toes parallel-sided and terminating into slender claws.

Measurements : Length dorsal plate 55-70 ; length ventral plate 60-68 ; width dorsal plate 48-54 ; width ventral plate 44-48 ; toes 20-22 ; claws 6-8.

Distribution : TRIPURA—North and West Tripura, reported previously by Sharma and Sharma (1987a, 1997a). INDIA—Meghalaya, Tripura, West Bengal and Orissa.

Elsewhere : Pantropical.

45. *Lecane (Lecane) braumi* Koste, 1988
(Fig. 62)

Characters : Lorica broadly elongate-oval, compressed dorso-ventrally, anterior margins slightly concave and without any external spines. Dorsal plate smaller than ventral plate and extending slightly beyond the latter at postero-lateral angles. Toes long and parallel-sided ; claws small and each claw with a distinct basal spicule.

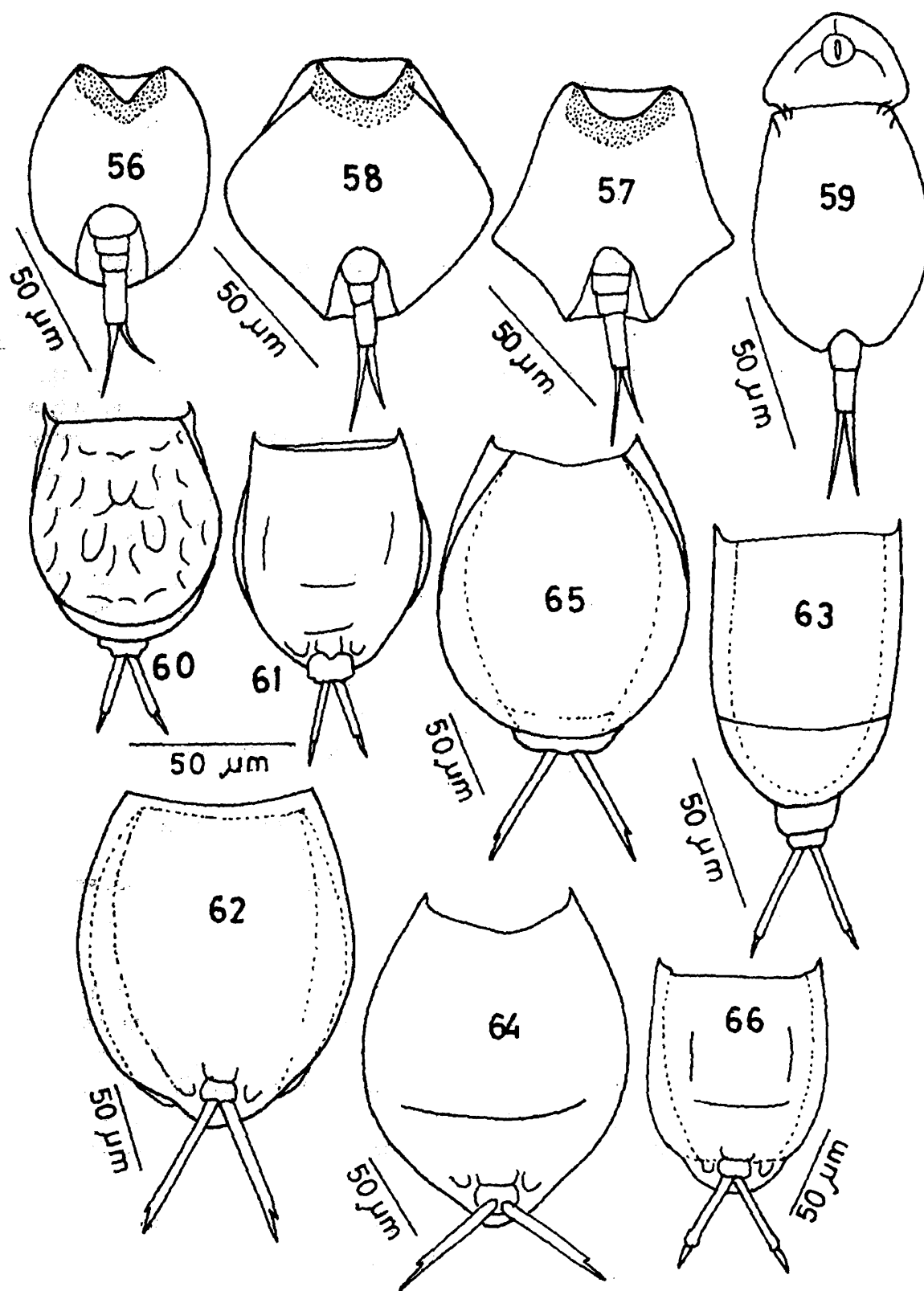
Measurements : Length dorsal plate 150-152 ; width dorsal plate 130-132 ; length ventral plate 168-172 ; width ventral plate 138-140 ; toes 66-68 ; claws 12-14.

Distribution : TRIPURA—North Tripura, reported earlier from this state by Sharma and Sharma (1997a). INDIA—Tripura.

Elsewhere : Palaeotropical.

46. *Lecane (Lecane) crepida* Harring, 1914
(Fig. 63)

Characters : Lorica elongated, parallel-sided, anterior margins almost straight and coincident ;



Figures : 56-66

Fig. 56 : *Lepadella (Heterolepadella) aspicora* Myers, ventral view ; Fig. 57, *L. (H.) ehrenbergi* (Perty), ventral view ; Fig. 58 : *L. (H.) heterostyla* (Murray), ventral view ; Fig. 59 : *Squatinella mutica* (Ehrenberg), dorsal view ; Figs. 60 & 61 : *Lecane (Lecane) aculeata* dorsal and ventral views ; Fig. 62 : *L. (L.) brauni* Koste, ventral views ; Fig. 63 : *L. (L.) crepida* Haring, ventral view ; Fig. 64 : *L. (L.) curvicornis curvicornis* (Murray), ventral views ; Fig. 65 : *L. (L.) curvicornis lofuana* (Murray), dorsal view ; Fig. 66 : *L. (L.) hastata* (Murray), ventral view.

external angles of ventral plate with distinct anteriorly directed spines. Dorsal plate smaller than ventral plate. Second foot-joint squarish and projecting beyond lorica. Toes parallel-sided ; each toe with a distinct and pointed claw.

Measurements : Length dorsal plate 78-84 ; length ventral plate 84-90 ; width dorsal plate 40-44 ; width ventral plate 48-56 ; toes 26-30 ; claws 8-10.

Distribution : TRIPURA—North and South Tripura, also reported by Bhattacharya and Saha (1988) and Sharma and Sharma (1997a). INDIA—Meghalaya, Assam, Tripura, West Bengal, Tamil Nadu, Gujarat and Punjab.

Elsewhere : Tropicopolitan.

47a. *Lecane (Lecane) curvicornis curvicornis*
(Murray, 1913)
(Fig. 64)

Characters : Lorica pyriform, anterior margins coincident and with a V-shaped sinus ; external angles with prominent spines. Dorsal plate narrower than ventral plate and without any surface markings. Posterior segment small ; often rounded. Toes long, claws small and each claw with a basal spicule.

Measurements : Length dorsal plate 145-150 ; length ventral plate 160-172 ; width dorsal plate 145-155 ; width ventral plate 125-134 ; toes 50-60 ; claws 12-18.

Distribution : TRIPURA—West and South Tripura, reported earlier by Sharma and Sharma (1997a). INDIA—Meghalaya, Tripura, West Bengal, Bihar, Andhra Pradesh and Madhya Pradesh.

Elsewhere : Tropicopolitan.

47b. *Lecane (Lecane) curvicornis lofuana*
(Murray, 1913)
(Fig. 65)

Characters : Differentiated by characteristic tricuspidate posterior segment.

Measurements : Length dorsal plate 148-165 ; length ventral plate 162-175 ; width dorsal plate

110-128 ; width ventral plate 100-115 ; toes 50-65 ; claws 12-18.

Distribution : TRIPURA—North Tripura, represents a new record from this state. INDIA—Meghalaya.

Elsewhere : Tropicopolitan.

48. *Lecane (Lecane) hastata* (Murray, 1913)
(Fig. 66)

Characters : Lorica almost oval, anterior margins coincident and anterior external angles of ventral plate with two small anteriorly directed spines. Dorsal plate smaller than ventral plate. Posterior segment broad and rounded. Toes parallel-sided, slightly swollen at their free ends ; claws distinct, with swollen bases.

Measurements : Lorica length 110-122 ; maximum width 90-98 ; toes 40-50 ; claws 10-12.

Distribution : TRIPURA—North and West Tripura, also reported by Sharma and Sharma (1997a). INDIA—Assam, Tripura and West Bengal.

Elsewhere : Tropicopolitan.

49. *Lecane (Lecane) hornemanni*
(Ehrenberg, 1834)
(Fig. 67)

Characters : Lorica broadly oval, anterior margins coincident and without any spines at external angles. Dorsal plate semicircular and broader than ventral plate. Posterior segment large and extending beyond the dorsal plate. Toes stout and tapering gradually to acute, slightly curved points.

Measurements : Length dorsal plate ; 60-82 ; length ventral plate 68-90 ; width dorsal plate 70-90 ; width ventral plate 60-70 ; toes 25-30.

Distribution : TRIPURA—North and West Tripura, also reported earlier by Sharma and Sharma (1997a). INDIA—Meghalaya, Tripura, West Bengal, Andhra Pradesh, Tamil Nadu, Gujarat and Kashmir.

Elsewhere : Tropicopolitan.

50. *Lecane (Lecane) inermis* (Bryce, 1892)
(Fig. 68)

Characters : Lorica elongated and flexible ; anterior margins nearly straight, coincident and without any spines at anterior external angles. Toes small, claws long and pointed.

Measurements : Lorica length 68-80 ; maximum width 42-48 ; toes 22-30 ; claws 10-12.

Distribution : TRIPURA—South Tripura, examined previously by Sharma and Sharma (1997a). INDIA—Meghalaya, Tripura and West Bengal.

Elsewhere : Cosmopolitan.

51. *Lecane (Lecane) lateralis* Sharma, 1978
(Fig. 69)

Characters : Lorica ovate, anterior dorsal margin concave and anterior ventral margin with a shallow sinus flanked by undulating sides. Dorsal plate smaller than ventral plate. Ventral plate with postero-lateral extensions. Toes long, parallel-sided along $\frac{3}{4}$ of their lengths, then tapering and terminating into stout claws ; each claw with one basal spicule.

Measurements : Length dorsal plate 158-160 ; width dorsal plate 130 ; length ventral plate 150-152 ; width ventral plate 138-140 ; toes 52-55 ; claws 12-15.

Distribution : TRIPURA—West Tripura, also observed earlier by Sharma and Sharma (1997a). INDIA—Tripura, Orissa and West Bengal.

Elsewhere : Palaeotropical.

52. *Lecane (Lecane) leontina* (Turner, 1892)
(Fig. 70)

Characters : Lorica oblong-ovate, anterior dorsal and ventral sinus broadly V-shaped ; ventral plate broader than dorsal plate and with triangular spines at external angles. Posterior segment extending over foot as a tail-like projection. Toes long, parallel-sided and terminating into pointed claws ; each claw with a basal spicule.

Measurements : Length dorsal plate 135-170 ; length ventral plate 160-196 ; width dorsal plate 115-128 ; width ventral plate 120-140 ; toes 90-120 ; claws 12-15.

Distribution : TRIPURA—all districts, also reported previously from Tripura by Sharma (1987a), Bhattacharya and Saha (1988) and Sharma and Sharma (1997a). INDIA—widely distributed, reported from all the states in North-Eastern India, West Bengal, Orissa, Bihar, Andhra Pradesh, Madhya Pradesh and Punjab.

Elsewhere : Tropicopolitan

53. *Lecane (Lecane) levistyla* (Olofsson, 1917)
(Fig. 71)

Characters : Lorica broadly subcircular, with straight and coincident anterior margins. Ventral plate oval, less broader than dorsal plate and with small spines at external angles. Toes parallel-sided for about half of their length and then tapering into acute points.

Measurements : Length dorsal plate 95-97 ; length ventral plate 108-110 ; width dorsal plate 92-94 ; width ventral plate 68-72 ; toes 38-40.

Distribution : TRIPURA—West Tripura, reported earlier by Sharma and Sharma (1997a). INDIA—known only from Tripura.

Elsewhere : Holarctic.

54. *Lecane (Lecane) ludwigi* (Eckstein, 1883)
(Fig. 72)

Characters : Lorica oval ; anterior margins coincident, slightly concave and with prominent spines at external angles of ventral margin. Dorsal plate truncate posteriorly and broader than ventral plate. Posterior segment produced into a long, triangular spine. Toes long, slender, parallel-sided and terminating into distinct conical points.

Measurements : Length dorsal plate 110-126 ; length ventral plate 130-155 ; width dorsal plate 70-82 ; width ventral plate 65-70 ; toes 40-47.

Distribution : TRIPURA—North Tripura, also reported earlier from this state by Sharma and

Sharma (1997a). INDIA—Meghalaya, Assam, Tripura, West Bengal, Orissa, Bihar, Andhra Pradesh and Punjab.

Elsewhere : Cosmopolitan.

55. *Lecane (Lecane) luna* (O. F. Müller, 1776)
(Fig. 73)

Characters : Lorica ovate to subcircular; dorsal plate broader than ventral plate ; anterior ventral sinus V-shaped and with cuspidate external angles. Toes stout, parallel-sided, slightly swollen at their bases and with distinct claws ; each claw with a distinct basal spicule.

Measurements : Length dorsal plate 120-140 ; length ventral plate 135-150 ; width dorsal plate 108-120 ; width ventral plate 106-114 ; toes 40-52 ; claws 8-12.

Distribution : TRIPURA—all districts, also reported by Sharma (1987a), Bhattacharya and Saha (1988) and Sharma and Sharma (1997a). INDIA—widely distributed and reported so far from all states of North-Eastern region, West Bengal, Orissa, Bihar, Gujarat, Rajasthan, Punjab, Kashmir and Ladak.

Elsewhere : Cosmopolitan.

56. *Lecane (Lecane) nana* (Murray, 1913)
(Fig. 74)

Characters : Lorica small and broadly subcircular ; anterior margins coincident, slightly convex and external angles produced into distinct edges. Ventral plate narrower than dorsal plate, almost parallel-sided anteriorly and then tapering. Toes slender and produced into curved, pointed tips.

Measurements : Length dorsal plate 48-62 ; length ventral plate 52-68 ; width dorsal plate 48-62 ; width ventral plate 44-56 ; toes 20-22.

Distribution : TRIPURA—North Tripura, also reported by Sharma and Sharma (1997a). INDIA—Meghalaya, Tripura, West Bengal, Rajasthan and Gujarat.

Elsewhere : Cosmopolitan.

57. *Lecane (Lecane) ohioensis* (Herrick, 1885)
(Fig. 75)

Characters : Lorica oval and anterior external margins with stout spines ; dorsal plate truncate posteriorly, ventral plate narrower than dorsal plate. Posterior segment broad and with a spade-shaped process. Toes long, parallel-sided and with short, pointed tips.

Measurements : Length dorsal plate 90-106 ; length ventral plate 125-130 ; width dorsal plate 72-80 ; width ventral plate 65-70 ; toes 32-35.

Distribution : TRIPURA—North Tripura, also reported earlier by Sharma and Sharma (1997a). INDIA—West Bengal, Meghalaya and Tripura.

Elsewhere : Tropicopolitan.

58. *Lecane (Lecane) papuana* (Murray, 1913)
(Fig. 76)

Characters : Lorica oval to circular ; anterior dorsal margin straight, anterior ventral margin with a shallow median sinus flanked by undulating sides. Ventral plate slightly narrower than dorsal plate. Posterior segment small and rounded. Toes moderately long, parallel-sided and terminating into small claws ; each claw with a distinct basal spicule.

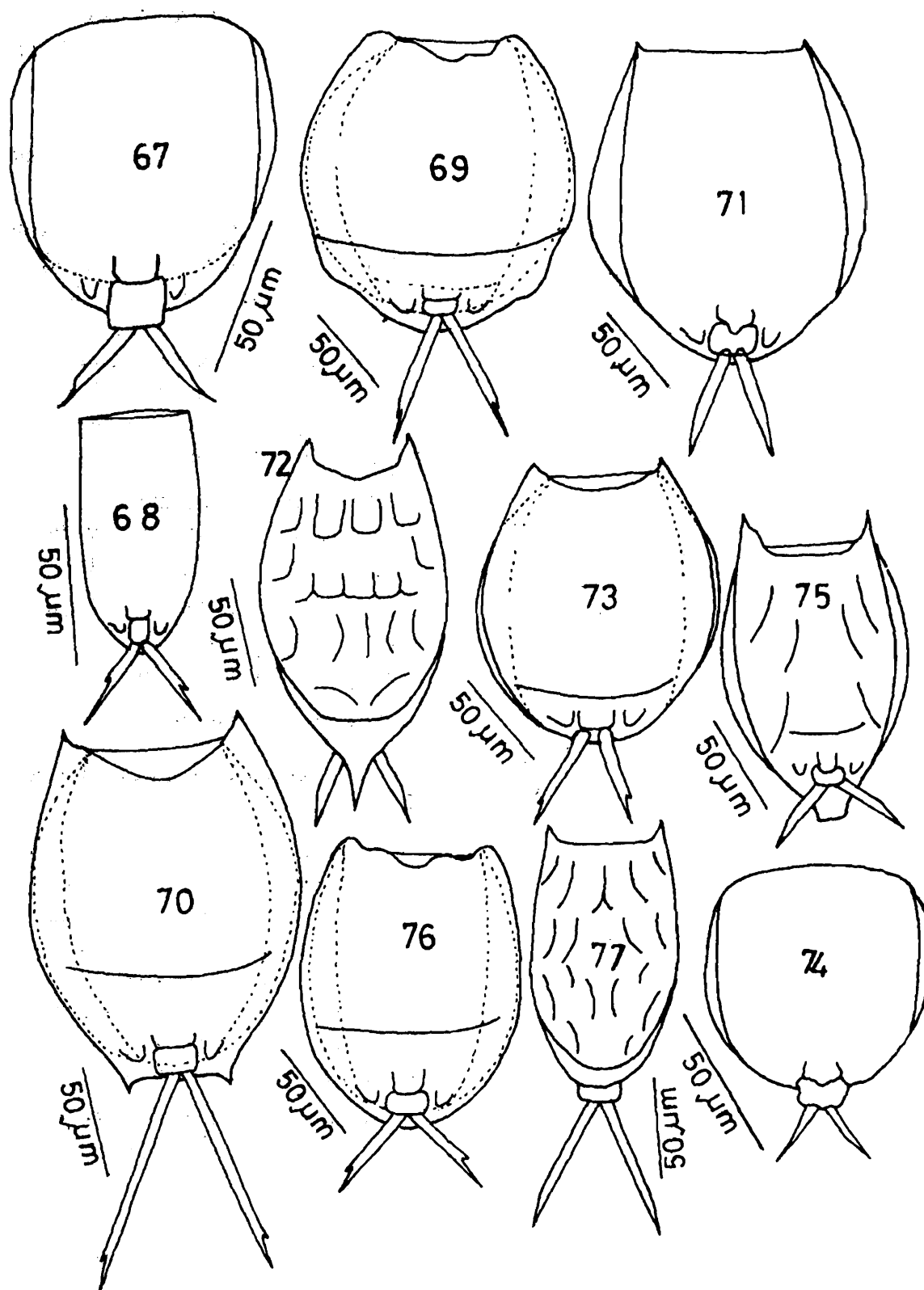
Measurements : Length dorsal plate 105-122 ; length ventral plate 122-135 ; width dorsal plate 100-110, width ventral plate 95-100 ; toes 32-40 ; claws 10-12.

Distribution : TRIPURA—all districts, also examined previously by Sharma and Sharma (1997a). INDIA—Meghalaya, Assam, Tripura, Nagaland, Manipur, West Bengal, Orissa, Bihar, Tamil Nadu, Kashmir and Ladak.

Elsewhere : Tropicopolitan.

59. *Lecane (Lecane) pertica* Harring &
Myers, 1926
(Fig. 77)

Characters : Lorica elongate-oval, anterior margins coincident and with small spines at external angles. Dorsal plate oval, broader than



Figures : 67-77

Fig. 67 : *Lecane (lecan) hornemanni* (Ehrenberg), ventral view ; Fig. 68 : *L. (L.) inermis* (Bryce), ventral view ; Fig. 69 : *L. (L.) lateralis* Sharma, ventral view ; Fig. 70 : *L. (L.) leontina* (Turner), ventral view ; Fig. 71 : *L. (L.) levistyla* (Olofsson), ventral view ; Fig. 72 : *L. (L.) nana* (Murray), ventral view ; Fig. 73 : *L. (L.) ohioensis* (Herrick), ventral view ; Fig. 74 : *L. (L.) papuana* (Murray), ventral view ; Fig. 75 : *L. (L.) ohioensis* (Herrick), ventral view ; Fig. 76 : *L. (L.) papuana* (Murray), ventral view ; Fig. 77 : *L. (L.) pertica* Harring & Myers, dorsal view.

ventral plate and with surface markings. Ventral plate elongated and with a few markings. Toes long, parallel-sided and with long, pointed tips.

Measurements : Length dorsal plate 112-125 ; length ventral plate 120-134 ; width dorsal plate 65-72 ; width ventral plate 60-68 ; toes 70-75.

Distribution : TRIPURA—South Tripura, reported earlier by Sharma and Sharma (1997a). INDIA—Meghalaya, Assam, Tripura and West Bengal.

Elsewhere : Tropicopolitan.

60a. *Lecane (Lecane) signifera signifera*
(Jennings, 1896)
(Fig. 78)

Characters : Lorica oblong, anterior margins straight, coincident and with small spines at external angles. Dorsal plate rounded posteriorly and with rounded surface markings. Ventral plate narrower than dorsal plate. Toes long, parallel-sided and with pointed tips.

Measurements : Length dorsal plate 110-126 ; length ventral plate 120-140 ; width dorsal plate 82-100 ; width ventral plate 78-96 ; toes 45-68.

Distribution : TRIPURA—North and South Tripura, reported by Sharma and Sharma (1997a). INDIA—Meghalaya, Tripura, West Bengal and Bihar.

Elsewhere : Tropicopolitan.

60b. *Lecane (Lecane) signifera ploenensis*
(Voigt, 1902)
(Fig. 79)

Characters : Lorica elongate-oval and with relatively longer spines at anterior external angles. Dorsal plate truncate posteriorly and with strong surface markings. Toes relatively elongated and terminating into acute points.

Measurements : Length dorsal plate 118-130 ; length ventral plate 125-145 ; width dorsal plate 90-98 ; width ventral plate 80-90 ; toes 45-70.

Distribution : TRIPURA—North and West Tripura, also reported earlier by Sharma and

Sharma (1997a). INDIA—Meghalaya, Mizoram, Tripura, West Bengal, Gujarat and Punjab.

Elsewhere : Cosmopolitan.

61. *Lecane (Lecane) simonneae* Segers, 1993
(Fig. 80)

Characters : Lorica elongate-oval, anterior margins straight and nearly coincident. Ventral plate elongated, narrower than dorsal plate and with distinct cuspidate spines at external angles. Posterior segment broad and semicircular. Second foot-segment robust and projecting beyond lorica. Toes long, parallel-sided for nearly half of their length and then tapering into distinct acute points.

Measurements : Length dorsal plate 90-92 ; length ventral plate 105-107 ; width dorsal plate 68-70 ; width ventral plate 65-68 ; toes 50-55.

Distribution : TRIPURA—North Tripura also documented earlier by Sharma and Sharma (1997a). INDIA—South India, Tripura.

Elsewhere : Palaeotropical.

62. *Lecane (Lecane) sola* Hauer, 1936
(Fig. 81)

Characters : Lorica small, oval, with straight and coincident anterior margins. Dorsal plate with distinct pattern. Ventral plate smaller than dorsal plate and with small spines at its external angles. Second foot-segment elongated, projecting beyond posterior end of lorica. Toes parallel-sided for about half of their length and then tapering into pointed tips.

Measurements : Length dorsal plate 60 ; length ventral plate 70 ; width dorsal plate 62 ; width ventral plate 55 ; toes 26.

Distribution : TRIPURA—North Tripura (as reported earlier by Sharma and Sharma, 1997a). INDIA—Tamil Nadu, Tripura.

Elsewhere—Pantropical.

63. *Lecane (Lecane) unguolata* (Gosse, 1887)
(Fig. 82)

Characters : Lorica large, ovate ; anterior margins nearly straight and with characteristic

triangular cuspidate spines at external angles. Dorsal plate narrower than ventral plate. Posterior segment large. Toes parallel-sided, with long stout claws ; each claw with a prominent basal spicule.

Measurements : Length dorsal plate 190-224 ; length ventral plate 240-260 ; width dorsal plate 160-180 ; width ventral plate 185-200 ; toes 80-95 ; claws 35-45.

Distribution : TRIPURA—all districts, also examined earlier by Bhattacharya and Saha (1988) and Sharma and Sharma (1997a) and. INDIA—Meghalaya, Assam, Tripura, Mizoram, Nagaland, West Bengal, Orissa, Bihar, Andhra Pradesh, Gujarat and Punjab.

Elsewhere : Cosmopolitan.

Sub-genus *Lecane* (*Hemimonostyla*) Bartos, 1959

Characters : Species of this subgenus differentiated by two, partly fused toes.

Type species : *Lecane* (*Hemimonostyla*) *agilis* (Bryce, 1892)

This subgenus is represented by only one species in the fauna of Tripura.

64. *Lecane* (*Hemimonostyla*) *inopinata*
(Harring & Myers, 1926)
(Fig. 83)

Characters : Lorica oval, anterior margins straight and coincident. Dorsal plate oval, truncate posteriorly and without any surface markings. Ventral plate narrower than dorsal plate and with a few longitudinal ridges. Toes fused for about 1/3 of their length and tapering into distinct, curved claws.

Measurements : Length dorsal plate 58-65 ; length ventral plate 68-74 ; width dorsal plate 60-68 ; width ventral plate 56-62 ; toes 18-22 ; claws 6-8.

Distribution : TRIPURA—North Tripura, also reported earlier from this state by Sharma and Sharma (1997a). INDIA—Meghalaya, Assam, Tripura, West Bengal, Orissa and Andhra Pradesh.

Elsewhere : Tropicopolitan.

Sub-genus *Lecane* (*Monostyla*) Ehrenberg, 1830

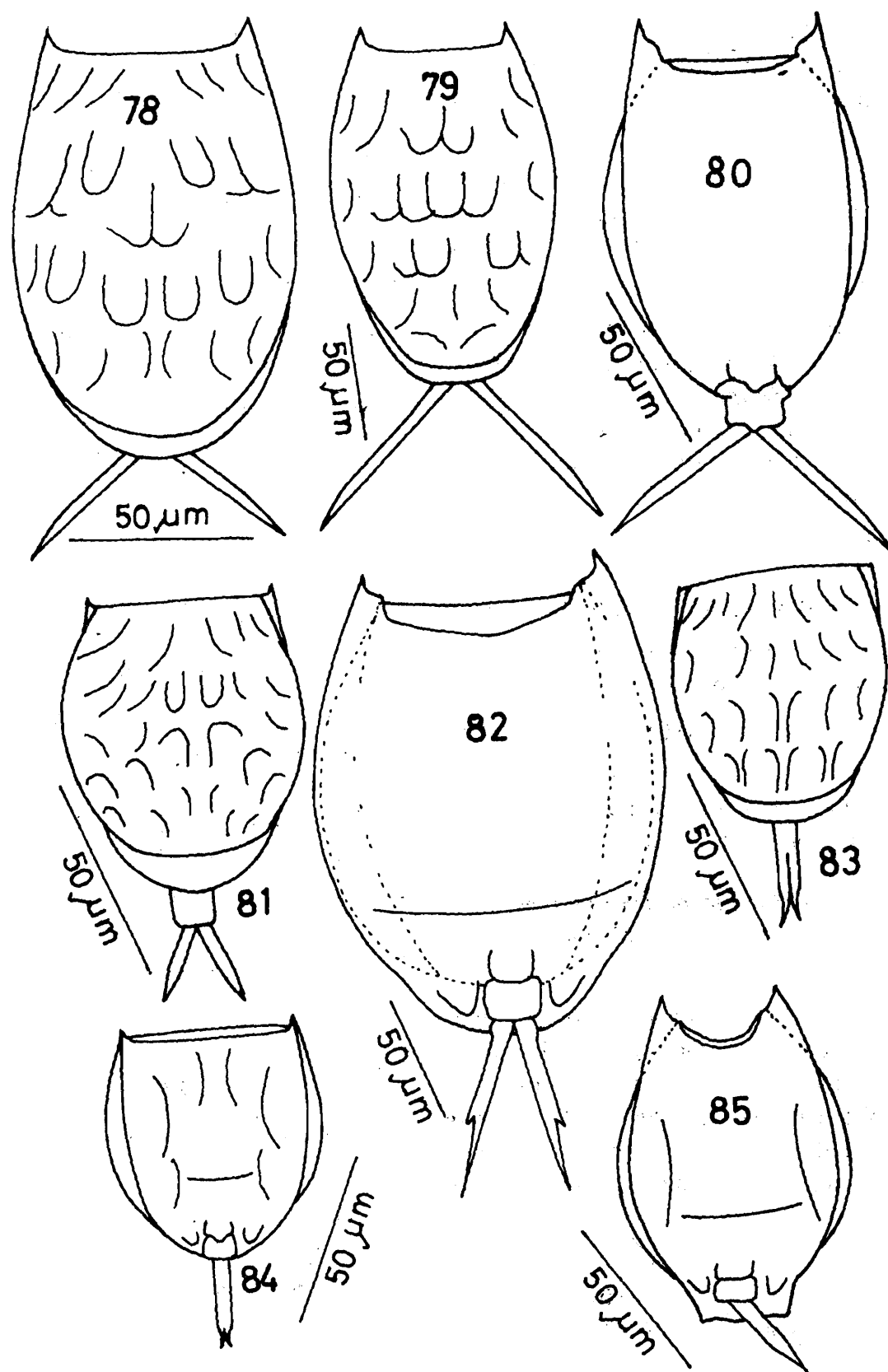
Characters : Species of this sub-genus characterized by the presence of a single toe.

Type species : *Lecane* (*Monostyla*) *cornuta* (O. F. Müller, 1786)

Fourteen species belonging to this subgenus are documented from Tripura.

Key to recorded species of subgenus *Lecane* (*Monostyla*)

1. Toe with claw (s) 2
Toe without claw 8
2. Toe with single claw
.....*Lecane* (*M.*) *scutata*
Toe with two claws 3
3. Claws small 4
Claws longer and distinct 5
4. Lorica broadly circular. Anterior ventral margin undulating
.....*Lecane* (*M.*) *unguitata*
Lorica oval or elongate-oval. Anterior ventral margin not undulating 6
5. Lorica obtuse, with distinct anterior external corner*Lecane* (*M.*) *obtusa*
Lorica elongate-oval, anterior angles with small spines*Lecane* (*M.*) *acanthinula*
6. Anterior margin with two curved median spines*Lecane* (*M.*) *quadridentata*
Anterior margin without any median spines 7
7. Anterior margins slightly concave
.....*Lecane* (*M.*) *lunaris*
Anterior dorsal and ventral margin sinuate*Lecane* (*M.*) *bullata*
8. Lorica with lateral spine-like projections*Lecane* (*M.*) *monostyla*
Lorica without such lateral projections 9
9. Posterior segment angular and plate-like*Lecane* (*M.*) *batillifer*
Posterior segment rounded 10



Figures : 78-85

Fig. 78 : *Lecane (Lecane) signifera signifera* (Jennings), dorsal view ; Fig. 79 : *L. (L.) signifera ploenensis* (Voigt), dorsal view ; Fig. 80 : *L. (L.) simonneae* Segers, ventral view ; Fig. 81 : *L. (L.) sola* Hauer, dorsal view ; Fig. 82 : *L. (L.) unguilata* (Gosse), ventral view ; Fig. 83 : *Lecane (Hemimonostyla) inopinata* (Harring & Myers), dorsal view ; Fig. 84 : *Lecane (Monostyla) acanthinula* (Hauer), ventral view ; Fig. 85 : *L. (M.) batillifer* (Murray), ventral view.

10. Antero-lateral corners rounded. Anterior margins straight *Lecane (M.) pyriformis*
Antero-lateral angles distinct or with spines 11
11. Antero-lateral corners distinct
..... *Lecane (M.) closterocerca*
Antero-lateral corners with distinct spines 12
12. Antero-ventral corners with distinct triangular spines *Lecane (M.) thienemanni*
Antero-ventral corners without any such spines 13
13. Anterior margins deeply sinuate
..... *Lecane (M.) sinuata*
Anterior dorsal margin slightly concave, ventral margin with a U-shaped sinus
..... *Lecane (M.) hamata*

65. *Lecane (Monostyla) acanthinula*
(Hauer, 1938)

(Fig. 84)

Characters : Lorica small, oval and with straight anterior margins. Dorsal plate ovate, ventral plate narrower than dorsal plate and with small spines at external angles. Posterior segment small. Toe parallel-sided for half of its length, then slightly narrowing and with two claws ; each claw with a small basal spine.

Measurements : Length dorsal plate 60 ; length ventral plate 70 ; width dorsal plate 62 ; width ventral plate 52 ; toe 22 ; claws 8.

Distribution : TRIPURA—South Tripura, reported so far only by Sharma and Sharma (1997a). INDIA—Kerala and Tripura.

Elsewhere : Oriental region.

66. *Lecane (Monostyla) batillifer*
(Murray, 1913)
(Fig. 85)

Characters : Lorica ovate, anterior dorsal margin narrow and concave. Anterior ventral margin with a deep sinus and with triangular

cusps at external angles. Posterior segment small, plate-like and with angular free ends. Toe slender, parallel-sided for half of its length and tapering to an acute point.

Measurements : Length dorsal plate 72-70 ; length ventral plate 83-91 ; width dorsal plate 59-74 ; width ventral plate 52-68 ; toe 29-32.

Distribution : TRIPURA—North Tripura, reported earlier by Sharma and Sharma (1997a). INDIA—known so far only from Tripura.

Elsewhere : Australia, Thailand.

67. *Lecane (Monostyla) bulla* (Gosse, 1851)
(Fig. 86)

Characters : Lorica oblong-ovate ; anterior dorsal margin with a shallow sinus, anterior ventral margin with a deep sinus flanked with small cusps at external angles. Toes long and terminating into a long and pointed claw with distinct basal spicules ; claw with a distinct median line but not divided.

Measurements : Length dorsal plate 126-142 ; length ventral plate 134-152 ; width dorsal plate 96-108 ; width ventral plate 90-100 ; toes 50-65 ; claw 16-22.

Distribution : TRIPURA—all districts, also documented earlier by Sharma (1987a), Bhattacharya and Saha (1988) and Sharma and Sharma (1997a). INDIA—all states of North-Eastern region, West Bengal, Orissa, Bihar, Andhra Pradesh, Tamil Nadu, Rajasthan, Gujarat, Punjab and Kashmir.

Elsewhere : Cosmopolitan.

68. *Lecane (Monostyla) closterocerca*
(Schmarda, 1859)
(Fig. 87)

Characters : Lorica broadly oval and anterior margins slightly concave ; external angles rounded or produced into small corners. Ventral plate narrower than dorsal plate. Toe parallel-sided for about 1/2 of its length and then tapering to a slender point.

Measurements : Length dorsal plate 60-68 ; length ventral plate 62-75 ; width dorsal plate 56-68 ; width ventral plate 50-62 ; toe 25-35.

Distribution : TRIPURA—North and West Tripura, reported earlier by Sharma and Sharma (1997a). INDIA—all states in North-Eastern India, Orissa, Tamil Nadu, Gujarat, Rajasthan, Punjab, Kashmir and Ladak.

Elsewhere : Cosmopolitan.

69. *Lecane (Monostyla) hamata* (Stokes, 1896)
(Fig. 88)

Characters : Lorica elongate-oval. Anterior dorsal margin with a shallow lunate sinus ; anterior ventral margin with a deep V-shaped sinus and with acute angled distinct cusps at its external angles. Ventral plate narrower than dorsal plate. Toe parallel-sided about half of its length and then tapering to an acute point.

Measurements : Length dorsal plate 78-82 ; length ventral plate 86-90 ; width dorsal plate 60-65 ; width ventral plate 50-56 ; toe 28-32.

Distribution : TRIPURA—North and South Tripura, also examined previously by Sharma (1987a). INDIA—Meghalaya, Assam, Tripura, Mizoram, West Bengal, Orissa, Tamil Nadu, Gujarat, Rajasthan, Punjab and Kashmir.

Elsewhere : Cosmopolitan.

70. *Lecane (Monostyla) lunaris*
(Ehrenberg, 1832)
(Fig. 89)

Characters : Lorica ovate, anterior margins with a shallow sinus ; dorsal plate semicircular to pear-shaped, ventral plate broadly oval and narrower than dorsal plate. Toe long, parallel-sided ; claw pointed, with a median furrow and two basal spicules.

Measurements : Length dorsal plate 108-120 ; length ventral plate 120-126 ; width dorsal plate 95-105 ; width ventral plate 84-92 ; toe 60-75 ; claw 18-20.

Distribution : TRIPURA—North and West Tripura, also examined earlier by Sharma and

Sharma (1997a). INDIA—all states in North-Eastern region, West Bengal, Orissa, Bihar, Gujarat and Kashmir.

Elsewhere—Cosmopolitan.

71. *Lecane (Monostyla) monostyla* (Daday, 1913)
(Fig. 90)

Characters : Lorica small, oval, with straight and coincident anterior margins ; dorsal plate with characteristic lateral spine-like processes, ventral plate with very small spines at external angles. Toe parallel-sided for 3/4 of its length and then tapering to an acute point.

Measurements : Length dorsal plate 50 ; length ventral plate 62 ; width dorsal plate 52 ; width ventral plate 48 ; toe 26.

Distribution : TRIPURA—West Tripura (as reported earlier by Sharma and Sharma, 1997a). INDIA—Tripura and Kerala.

Elsewhere : Cosmopolitan.

72. *Lecane (Monostyla) obtusa* (Murray, 1913)
(Fig. 91)

Characters : Lorica oval, without surface markings ; anterior margins straight, coincident and with minute spines at external angles. ventral plate narrow than dorsal plate. Toe cylindrical, slightly swollen in its middle region ; claw pointed, with basal spicules.

Measurements : Length dorsal plate 60-70 ; length ventral plate 64-78 ; width dorsal plate 62-68 ; width ventral plate 52-60 ; toe 20-25 ; claw 8-10.

Distribution : TRIPURA—South Tripura, also reported earlier by Sharma and Sharma (1997a). INDIA—Tripura, West Bengal, Andhra Pradesh.

Elsewhere : Pantropical.

73. *Lecane (Monostyla) pyriformis*
(Daday, 1905)
(Fig. 92)

Characters : Lorica broadly oval, anterior margins straight or slightly convex, coincident

and with rounded external angles ; ventral plate narrower than dorsal plate. Toe parallel-sided for some distance and then tapering into a slender tip.

Measurements : Length dorsal plate 58-65 ; length ventral plate 60-72 ; width dorsal plate 52-58 ; width ventral plate 48-56 ; toe 20-26.

Distribution : TRIPURA—North Tripura, also reported earlier by Sharma and Sharma (1997a). INDIA—Meghalaya, Tripura, West Bengal, Orissa, Bihar and Punjab.

Elsewhere : Cosmopolitan.

74. *Lecane (Monostyla) quadridentata*
(Ehrenbeg, 1832)
(Fig. 93)

Characters : Lorica ovate to pyriform, anterior dorsal margin with two outcurved spines, ventral margin with a V-shaped sinus and its external angles produced into minute spines. Dorsal plate narrower than ventral plate. Toe long and parallel-sided ; claw pointed and with two distinct basal spicules.

Measurements : Length dorsal plate 110-142 ; length ventral plate 120-152 ; width dorsal plate 86-104 ; width ventral plate 90-118 ; toe 45-60 ; claw 15-20.

Distribution : TRIPURA—all districts, also examined by Sharma and Sharma (1997a). INDIA—widely distributed, reported so far from Meghalaya, Assam, Manipur, Mizoram, Nagaland, Tripura, Orissa, Bihar, Andhra Pradesh, Madhya Pradesh, Rajasthan, Punjab, Haryana and Kashmir.

Elsewhere : Cosmopolitan.

75. *Lecane (Monostyla) scutata* (Harring & Myers, 1926)
(Fig. 94)

Characters : Lorica broadly oval, anterior margins coincident and slightly concave ; anterior ventral margin produced into sharp corners at its external angles. Ventral plate narrower than dorsal plate and almost parallel-sided. Toe parallel-sided ; claw short and pointed.

Measurements : Length dorsal plate 68-74 ; length ventral plate 74-82 ; width dorsal plate 60-68 ; width ventral plate 56-62 ; toe 20-22 ; claw 6-8.

Distribution : TRIPURA—North and West Tripura, also reported earlier by Sharma and Sharma (1997a). INDIA—Meghalaya, Tripura and West Bengal.

Elsewhere : Arctic-temperate region.

76. *Lecane (Monostyla) sinuata* (Hauer, 1938)
(Fig. 95)

Characters : Lorica broadly oval, anterior body opening small ; anterior dorsal margin with V-shaped sinus, anterior ventral margin with deep notch flanked by curving margins and small spines at external angles. Toe parallel-sided and ending into an acute point.

Measurements : Length dorsal plate 80-92 ; length ventral plate 86-98 ; width dorsal plate 70-82 ; width ventral plate 68-75 ; toe 25-32.

Distribution : TRIPURA—North Tripura, reported by Sharma and Sharma (1997a). INDIA—Tripura, Meghalaya, West Bengal, Gujarat.

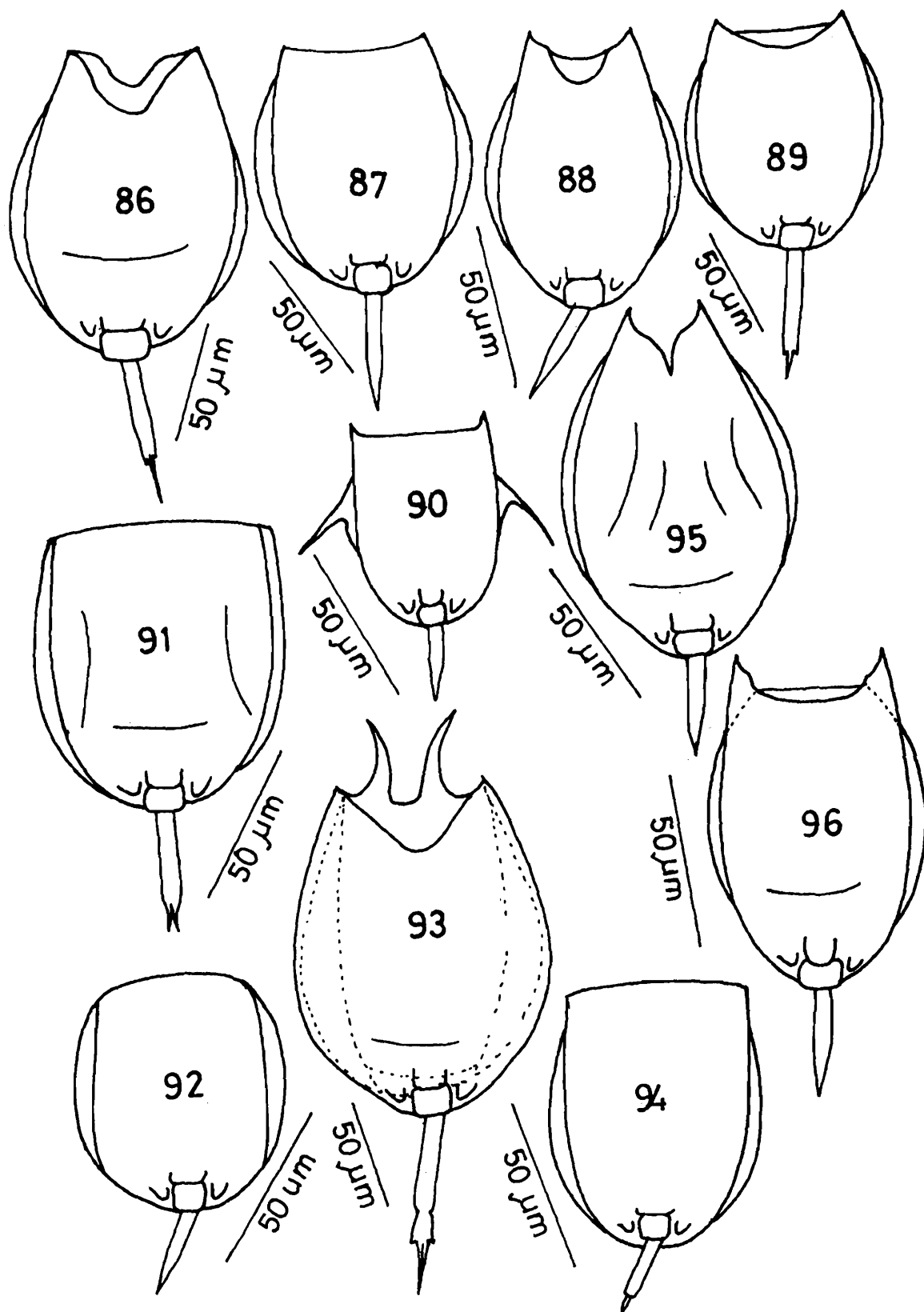
Elsewhere : Pantropical.

77. *Lecane (Monostyla) thienemanni*
(Hauer, 1938)
(Fig. 96)

Characters : Lorica elongate-oval, anterior dorsal margin straight, anterior ventral margin with a shallow sinus and its external angles produced into two stout triangular spines. Dorsal plate slightly truncate posteriorly and broader than ventral plate. Toe parallel-sided for about half of its length and the tapering to an acute point.

Measurements : Length dorsal plate 68-75 ; length ventral plate 78-84 ; width dorsal plate 60-65 ; width ventral plate 52-58 ; toe 30-45.

Distribution : TRIPURA—South Tripura, also reported by Sharma and Sharma (1997a).



Figures : 86-96

Fig. 86 : *Lecane (Monostyla) bulla* (Gosse), ventral view ; Fig. 87 : *L. (M.) closterocerca* (Schmarda), ventral view ; Fig. 88 : *L. (M.) hamata* (Stokes), ventral view ; Fig. 89 : *L. (M.) lunaris* (Ehrenberg), ventral view ; Fig. 90 : *L. (M.) monostyla* (Daday), ventral view ; Fig. 91 : *L. (M.) obtusa* (Murray), ventral view ; Fig. 92 : *L. (M.) pyriformis* (Daday), ventral view ; Fig. 93 : *L. (M.) quadridentata* (Ehrenberg), ventral view ; Fig. 94 : *L. (M.) scutata* (Harring & Myers), ventral view ; Fig. 95 : *L. (M.) sinuata* (Hauer), ventral view ; Fig. 96 : *L. (M.) thienemanni* (Hauer) ventral view.

INDIA—Mèghalaya, Tripura, West Bengal and Gujarat.

Elsewhere : Pantropical.

78. *Lecane (Monostyla) unguitata*
(Fadeev, 1925)
(Fig. 97)

Characters : Lorica almost circular, anterior opening relatively smaller ; anterior dorsal margin straight, anterior ventral margin undulating and with a fairly deep median sinus with rounded external angles. Dorsal plate pyriform and smaller than ventral plate. Toe parallel-sided ; claw pointed, with an indistinct furrow and with two distinct basal spicules.

Measurements : Length dorsal plate ; 110-128 ; length ventral plate 120-140 ; width dorsal plate 84-96 ; width ventral plate 90-108 ; toe 30-35 ; claw 10-15.

Distribution : TRIPURA—North and West Tripura ; also reported earlier by Sharma (1987a) and Sharma and Sharma (1997a). INDIA—Meghalaya, Assam, Tripura, West Bengal, Orissa, Bihar and Gujarat.

Elsewhere : Palaeotropical.

Family NOTOMMATIDAE Remane, 1933
(*partim*)

Characters : Corona ventral (*Notommata*-type), often with ciliated auricles. Trunk usually spindle-shaped. Foot generally not clearly set off from the body. Toes present. Trophi virgate and modified for suction.

Two genera belonging to this family are included in the present account.

Key to recorded genera of family
NOTOMMATIDAE

Foot and toes longer than body....SCARIDIUM
Foot and toes not longer than body
.....CEPHALODELLA

Genus *Cephalodella* Bory de St. Vincent, 1826

Characters : Body cylindrical, slightly curved and cuticle somewhat stiffened ; with a thin dorsal and a ventral plate. Foot short, Toes slightly bent and pointed. Corona consists of a simple circumapical band of cilia and with ventral buccal field. Trophi virgate, variously shaped in different species.

Type species : *Cephalodella catellina* (O. F. Müller, 1786)

Two species of this genus are examined in the collections from Tripura

Key to recorded species of genus Cephalodella
Toes gradually tapering and with conical tips ...
.....*Cephalodella gibba*
Toes with few basal spines on inner side
.....*Cephalodella forficula*

79. *Cephalodella gibba* (Ehrenberg, 1832)
(Fig. 98)

Characters : Body elongated and gibbous dorsally. Lorica firm and plates distinct ; lateral clefts narrow anteriorly and widening distally to the posterior end. Toes long, curved, gradually tapering and with conical tips. Rami symmetrical, free ends of manubria curved.

Measurements : Total length 270-295 ; toes 85-90 ; trophi 60-68.

Distribution : TRIPURA—North and West Tripura, represents a new record. INDIA—Meghalaya, West Bengal, Gujarat, Kashmir and Ladak.

Elsewhere : Cosmopolitan.

80. *Cephalodella forficula* (Ehrenberg, 1832)
(Fig. 99)

Characters : Body elongated, slender and spindle-shaped ; cuticle thin and flexible. Head distinct and slightly oblique anteriorly. Trunk cylindrical. Foot distinct and almost rhomboidal. Toes short, curved forwards and acutely pointed ; with characteristic knob-like basal spine and another small spine. Sub-unci fan shaped.

Measurements : Total length 145-172 ; toes 30-35.

Distribution : TRIPURA—South Tripura, a new report from this state. INDIA—Meghalaya, West Bengal and Andhra Pradesh.

Elsewhere : Cosmopolitan.

Genus *Scaridium* Ehrenberg, 1830

Characters : Body cylindrical or spindle-shaped. Lorica thin, foot three-segmented ; terminal foot-segment longest. Corona simple, with ventral ciliated zone. Trophi virgate.

Type species : *Scaridium longicaudum* (O. F. Müller, 1786)

Only one species belonging to this genus is examined presently from Tripura.

81. *Scaridium longicaudum*
(O. F. Müller, 1786)
(Fig. 100)

Characters : Lorica thin and cylindrical ; foot three-segmented, distal segment longest. Toes long, almost parallel-sided and with blunt tips. Trophi symmetrical ; unci broad.

Measurements : Total length 364-380 ; foot 112-120 ; toes 126-135.

Distribution : TRIPURA—West and South Tripura, also new record from this state. INDIA—Meghalaya, Assam, Mizoram, Nagaland, West Bengal, Orissa, Bihar, Gujarat and Punjab.

Elsewhere : Cosmopolitan.

Family TRICHOCERCIDAE Remane, 1933

Characters : Body arched, cylindrical, asymmetrical and spindle-shaped or sacciform ; often with a keel or striated area. Foot present, reduced or absent ; with equal or unequal bristle like toes. Corona of *Asplanchna*-or *Notommata*-type. Trophi virgate and asymmetrical. Lateral antennae usually placed asymmetrically.

This family is represented by genus *Trichocerca* in the examined material.

Genus *Trichocerca* (Lamarck, 1801)

Characters : Body more or less elongated, cylindrical and asymmetrical ; lorica thin to rigid and with one or two keels or striated areas. Foot short ; with equal or unequal toes, substyles sometimes present. Corona simple, one or two palps on the apical buccal field. Lateral antennae often very asymmetrical. Trophi virgate, more or less asymmetrical.

This genus includes two subgenera in this account.

Key to recorded subgenera of TRICHOCERCA

Toes equal or right toe at least 1/3 the length of the left toe *Trichocerca* (*Diurella*)
Toes unequal, right toe strongly reduced or less than 1/3 the length of the left toe
..... *Trichocerca* (*Trichocerca*)

Sub-genus *Trichocerca* (*Trichocerca*) Lamarck, 1801

Characters : Right toe less than 1/3 the length of the left toe or even rudimentary.

Type species : *Trichocerca* (*Trichocerca*) *rattus* (O. F. Müller, 1776)

Seven species belonging to this subgenus are documented in the present account.

Key to recorded species of *Trichocerca* (*Trichocerca*)

1. Lorica with a dorsal hood-like projection *Trichocerca* (*Trichocerca*) *capucina*
Lorica without any hood-like projection 2
2. Anterior end with spines 5
Anterior end without spines 3
3. Without any dorsal keel. Anterior end with folds *Trichocerca* (*Trichocerca*) *pusilla*
With one or two dorsal keels. Anterior end without folds 4

4. With double dorsal keel
 *Trichocerca (Trichocerca) elongata*
 With single dorsal keel
 *Trichocerca (Trichocerca) rattus*
5. Anterior end with one spine 6
 Anterior end with two unequal spines
 *Trichocerca (Trichocerca) longiseta*
6. Anterior end with very small ventral spine
 *Trichocerca (Trichocerca) jenningsi*
 Anterior end with distinct, curved dorsal spine
 *Trichocerca (Trichocerca) cylindrica*

82. *Trichocerca (Trichocerca) cylindrica*
 (Imhof, 1891)
 (Fig. 101)

Characters : Body long and cylindrical ; anterior end with a median dorsal spine and a number of longitudinal folds. Lorica thin, with a striated area and a single dorsal keel. Left toe almost as long as lorica ; right toe reduced to a small scaly spine. Lateral antennae located in the middle of the dorsal crest. Trophi symmetrical, manubria with curved free ends, unci moderately broad and rami curved.

Measurements : Body length 280-350 ; left toe 110-140 ; right toe 18-20.

Distribution : TRIPURA—North Tripura, also reported earlier by Bhattacharya and Saha (1988). INDIA—Meghalaya, Tripura, West Bengal, Orissa, and Kashmir.

Elsewhere : Palaearctic, Nearctic regions and Sri Lanka.

83. *Trichocerca (Trichocerca) capucina*
 (Wierzejski & Zacharias, 1893)
 (Fig. 102)

Characters : Body cylindrical, curved and with a dorsal keel. Head long, with five palps and two tentacles ; with a dorsal plate-like projection and number of folds in the contracted specimens. Left toe upto about 1/2 of the body length, right toe small.

Measurements : Body length 220-265 ; left toe 85-110 ; right toe 25-28.

Distribution : TRIPURA—North and West Tripura, represents a new report from this state. INDIA—Meghalaya.

Elsewhere : Cosmopolitan.

84. *Trichocerca (Trichocerca) elongata* (Gosse, 1886)
 (Fig. 103)

Characters : Body elongated, cylindrical and with two keels extending upto 1/3 to 2/5 of the body length ; anterior margin of body without any spine. Knob-like lateral antennae located posteriorly. Foot short and distinct. Left toe about 1/2 of the total length, right toe about 1/3 of the left toe and substyles present.

Measurements : Body length 280-300 ; left toe 160-185 ; right toe 32-35.

Distribution : TRIPURA—South Tripura, a new record from this state. INDIA—Meghalaya.

Elsewhere : Cosmopolitan.

85. *Trichocerca (Trichocerca) jenningsi*
 Voigt, 1957
 (Fig. 104)

Characters : Body cylindrical ; anterior end produced ventrally into a small anteriorly directed spine. Posterior end of lorica with a small projection over the foot. Foot small. Left toe long and right toe small ; 2-3 substyles present at the base of foot. Trophi asymmetrical ; left manubrium longer and curved.

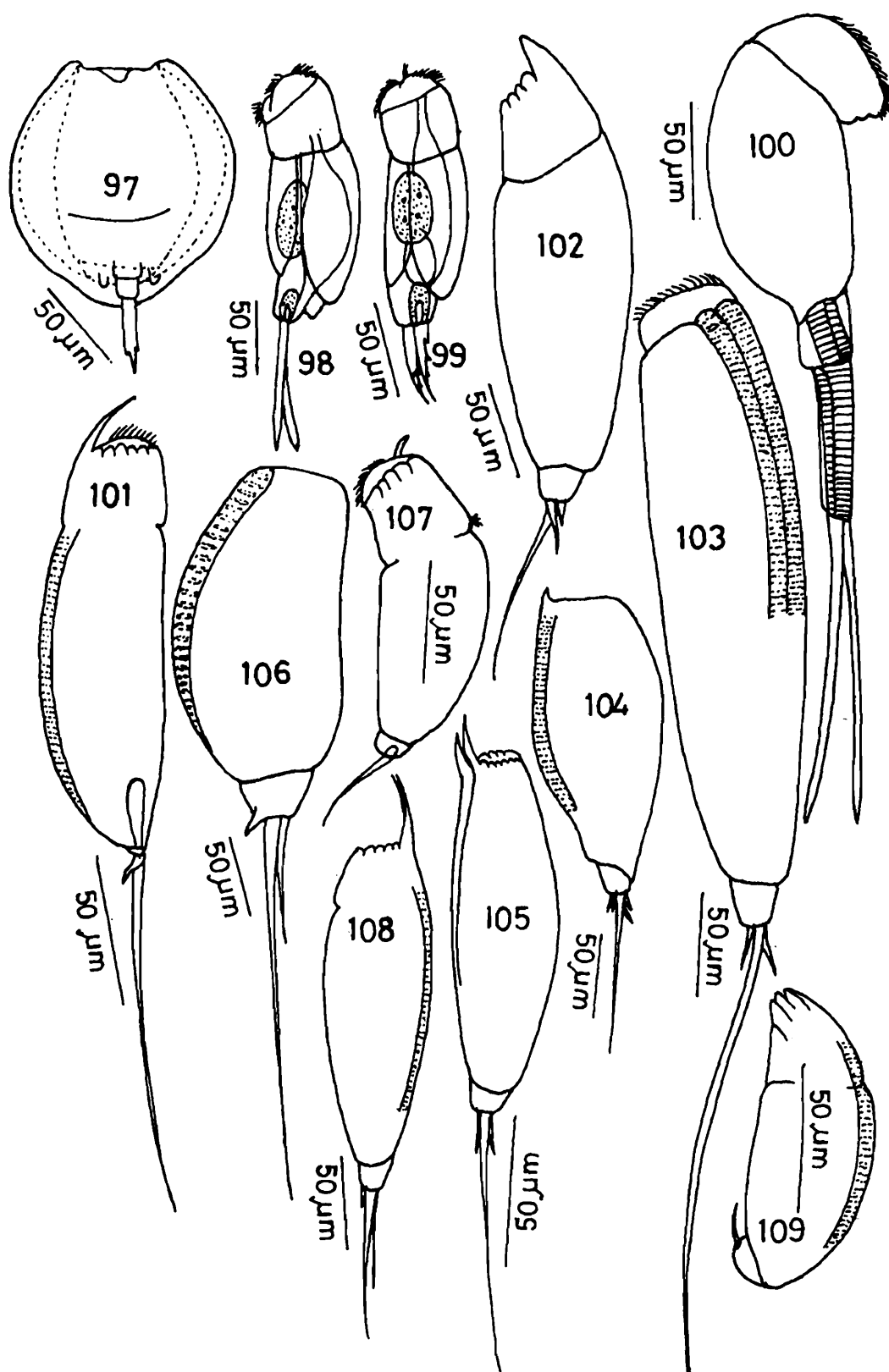
Measurements : Body length 165-190 ; left toe 140-155 ; right toe 25-32.

Distribution : TRIPURA—North Tripura, represents a new record from this state. INDIA—Meghalaya.

Elsewhere : Cosmopolitan.

86. *Trichocerca (Trichocerca) longiseta*
 (Schränk, 1802)
 (Fig. 105)

Characters : Lorica long and cylindrical ; anterior margin with a long spine, another half



Figures : 97-109

Fig. 97 : *Lecane (Monostyla) unguitata* (Fadeev), ventral view ; Fig. 98 : *Cephalodella gibba* (Ehrenberg), lateral view ; Fig. 99 : *C. forficula* (Ehrenberg), lateral view ; Fig. 100 : *Scaridium longicaudum* (Müller), lateral view ; Fig. 101 : *Trichocerca (Trichocerca) cylindrica* (Imhof), lateral view ; Fig. 102 : *T. (T.) capucina* (Wierzejski & Zacharias), lateral view ; Fig. 103 : *T. (T.) elongata* (Gosse), lateral view ; Fig. 104 : *T. (T.) jenningsi* Voigt, lateral view ; Fig. 105 : *T. (T.) longiseta* (Schrank), lateral view ; Fig. 106 : *T. (T.) rattus* (Müller), lateral view ; Fig. 107 : *T. (T.) pusilla* (Lauterborn), lateral view ; Fig. 108 : *Trichocerca (Diurella) similis* (Wierzejski), lateral view ; Fig. 109 : *T. (D.) sulcata* (Jennings), lateral view.

long spine and two small projections. Keel and striated area extending upto middle of the trunk. Foot small and distinct. Left toe equal to about half of the body length or more and right toe small ; substyli present.

Measurements : Body length 128-135 ; left toe 90-105.

Distribution : TRIPURA—West Tripura, also reported earlier by Bhattacharya and Saha (1988). INDIA—Meghalaya, Tripura, Kashmir and Ladak.

Elsewhere : Cosmopolitan.

87. *Trichocerca (Trichocerca) rattus*
(Müller, 1776)
(Fig. 106)

Characters : Body elongated and with a broad striated keel extending upto half of its length. Lateral antennae located in anterior portion of body. Left toe smaller than body ; right toe reduced.

Measurements : Body length 140-168 ; left toe 125-135.

Distribution : TRIPURA—West and South Tripura, represents a new report from this state. INDIA—West Bengal, Kashmir, Ladak, Punjab, Gujarat.

Elsewhere : Cosmopolitan.

88. *Trichocerca (Trichocerca) pusilla*
(Lauterborn, 1898)
(Fig. 107)

Characters : Body short and cylindrical ; with distinct head and without any crest for striated area. Anterior end straight but with longitudinal folds in contracted specimens. Toes unequal ; left toe long and ventrally directed, right toe very small.

Measurements : Body length 82-95 ; left toe 40-55 ; right toe 10-15.

Distribution : TRIPURA—South Tripura, represents a new report from this state. INDIA—Meghalaya, West Bengal, Orissa and Bihar.

Elsewhere : Cosmopolitan.

Sub-genus *Trichocerca (Diurella)* Bory de St. Vincent, 1824

Characters : Both toes equally long or the right toe at least 1/3 the length of the left toe.

Type species : *Trichocerca (Diurella) tigris* (O. F. Müller, 1786)

Only two species belonging to this subgenus are documented from Tripura.

Key to recorded species of Trichocerca (Diurella)

Lorica long, with two anterior spines. Toes long *Trichocerca (Diurella) similis*
Lorica short, without spine. Toes small, ventrally curved *Trichocerca (Diurella) sulcata*

89. *Trichocerca (Diurella) similis*
(Wierzejski, 1893)
(Fig. 108)

Characters : Body long and anterior end with two long spines dorsally separated by a small hump. Dorsal keel extending from base of anterior spines upto about 1/3 the body length. Foot two-segmented ; first foot-segment overlapped by the projecting posterior end of lorica. Toes short and unequal, spines present at the base of the toes.

Measurements : Body length 148-162 ; left toe 60-72 ; right toe 32-45.

Distribution : TRIPURA—all districts, also reported by Bhattacharya and Saha (1988). INDIA—Meghalaya, Tripura, West Bengal, Orissa, Bihar and Gujarat.

Elsewhere : Cosmopolitan.

90. *Trichocerca (Trichocerca) sulcata*
(Jennings, 1903)
(Fig. 109)

Characters : Lorica short, dorsally curved ; anterior end with a number of longitudinal folds. Striated area extending upto 2/3 of the dorsum. Foot small and ventrally displaced. Toes very small and ventrally curved. Trophi large and asymmetrical.

Measurements : Body length 70-85 ; toes 15-20 ; trophi 40-45.

Distribution : TRIPURA—South Tripura, represents a new report from this state. INDIA—Meghalaya.

Elsewhere : Cosmopolitan.

Family ASPLANCHNIDAE Haring & Myers, 1926

Characters : Body large and without lorica ; cuticle thin and transparent. Foot absent or present. Corona consists of a simple girdle of arcs and tufts of cirri around head a very small area around mouth. Intestine, cloaca and anus present or absent. Trophi incaudate. Often viviparous.

This family is represented by only one genus in the present account.

Genus *Asplanchna* Gosse, 1850

Characters : Body illoricate, transparent and with thin cuticle ; sacciform, bell-shaped or with humps or projections. Foot absent ; pedal glands sometimes present. Corona consists of a broken single ring of cilia. Vitellarium horse-shoe shaped or globose. Often viviparous, with one or several embryos.

Type species : *Asplanchna priodonta* Gosse, 1850

Two species belonging to this genus are observed from Tripura.

Key to recorded species of genus *Asplanchna*
 Vitellarium spherical, with eight nuclei. Protonephredia with four flame bulbs each
*Asplanchna priodonta*
 Vitellarium horse-shoe shaped, with 20-32 nuclei. Protonephredia with 10-20 flame bulbs each
*Asplanchna brightwelli*

91. *Asplanchna brightwelli* Gosse, 1850
 (Fig. 110)

Characters : Body large, thin, transparent and sacciform. Contractile vesicle irregular. Protonephredia long, each with 10-20 flame cells. Vitellarium horse-shoe shaped and with 20-32

nuclei. Inner margin of each ramus with a small tooth.

Measurements : Total length 450-700 ; trophi 60-70.

Distribution : TRIPURA—North and West Tripura, represents a new report from this state. INDIA—Meghalaya, Assam, West Bengal, Orissa, Andhra Pradesh, Punjab, Kashmir and Ladak.

Elsewhere : Cosmopolitan.

92. *Asplanchna priodonta* Gosse, 1850
 (Fig. 111)

Characters : Body thin, transparent and rounded to sacciform in its shape. Contractile vesicle small and rounded. Protonephredia with four flame bulbs each. Gastric glands rounded. Vitellarium rounded and with eight nuclei. Rami serrate on inner side, broad at free ends and each with lateral prolongation at the base.

Measurements : Total length 460-700 ; trophi 60-70.

Distribution : TRIPURA—South and West Tripura, also reported earlier from this state by Bhattacharya and Saha (1988). INDIA—Meghalaya, Tripura, West Bengal, Bihar, Gujarat and Kashmir.

Elsewhere : Cosmopolitan.

Family SYNCHAETIDAE Remane, 1933

Characters : Body sacciform, bell-shaped or conical ; lorica absent or present. Foot and toes present, sometimes strongly reduced or absent. Corona of *Asplanchna*-type, reduced to small zone around the mouth and on anterior lobes or auricles, if present. Trophi virgate, with or without hypopharynx.

Two genera belonging to the family Synchaetidae are noticed from Tripura.

Key to recorded genera of family Synchaetidae
 Body with flattened paddle-like appendages. Foot lacking*Polyarthra*
 Body without such appendages. Foot present*Synchaeta*

Genus *Synchaeta* Ehrenberg, 1832

Characters : Body illoricate, conical or fusiform. Foot short and unsegmented ; toes two, short and pointed. Corona broad and with a broken circumapical band ; apical field usually with styli and ciliated auricles. Cerebral eye single or double. Digestive tract straight, with two spherical gastric glands. Vitellarium with 8-12 nuclei.

Type species : *Synchaeta pectinata* Ehrenberg, 1832.

This genus is represented by only one species from Tripura.

93. *Synchaeta pectinata* Ehrenberg, 1832
(Fig. 112)

Characters : Body bell-shaped and tapering posteriorly ; apical field doomed and with paired ciliated auricles. Eye single and red or purple in color. Lateral antennae located in the posterior third region of body. Foot small and broad ; foot-glands small. Toes smaller.

Measurements : Total length 240-276 ; toes 6-8.

Distribution : TRIPURA—North Tripura, represents a new report. INDIA—Meghalaya, Kashmir and Nilgiri Hills (Tamil Nadu).

Elsewhere : Cosmopolitan.

Genus *Polyarthra* Ehrenberg, 1834

Characters : Body illoricate, slightly flattened dorso-ventrally and with four groups of three feathered sword-shaped serrate blades or paddles each ; two groups dorso-lateral and two groups ventro-lateral. Corona with a circumapical band of cilia and two cylindrical ciliated antennae. Trophi large and virgate. Cerebral eye large and red. Vitellarium with 4, 8, or 12 nuclei. Foot lacking.

Type species : *Polyarthra vulgaris* Carlin, 1943.

Only one species belonging to this genus is found in the material observed from Tripura.

94. *Polyarthra vulgaris* Carlin, 1943
(Fig. 113)

Characters : Body cylindrical and with paired ventral appendages ; blades pinnate to feather-shaped and slightly longer than body ; each blade with a distinct mid-rib and lateral ribs. Apical field with two ciliated antennae. Lateral antennae located in the posterior third part of the body. Vitellarium with eight nuclei.

Measurements : Body length 100-142 ; length of blades 110-130 ; ventral appendages 30-35.

Distribution : TRIPURA—all districts of this state, also reported previously by Bhattacharya and Saha (1988). INDIA—Meghalaya, Assam, Tripura, West Bengal, Orssia, Bihar and Punjab.

Elsewhere : Cosmopolitan.

Family DICRANOPHORIDAE Remane, 1933

Characters : Forms illoricate or partly loricate. Corona similar to *Notommata*-type, under a hook-like rostrum ; mouth almost in center of corona ; lateral tufts like auricles. Trophi forcipate and protrusible.

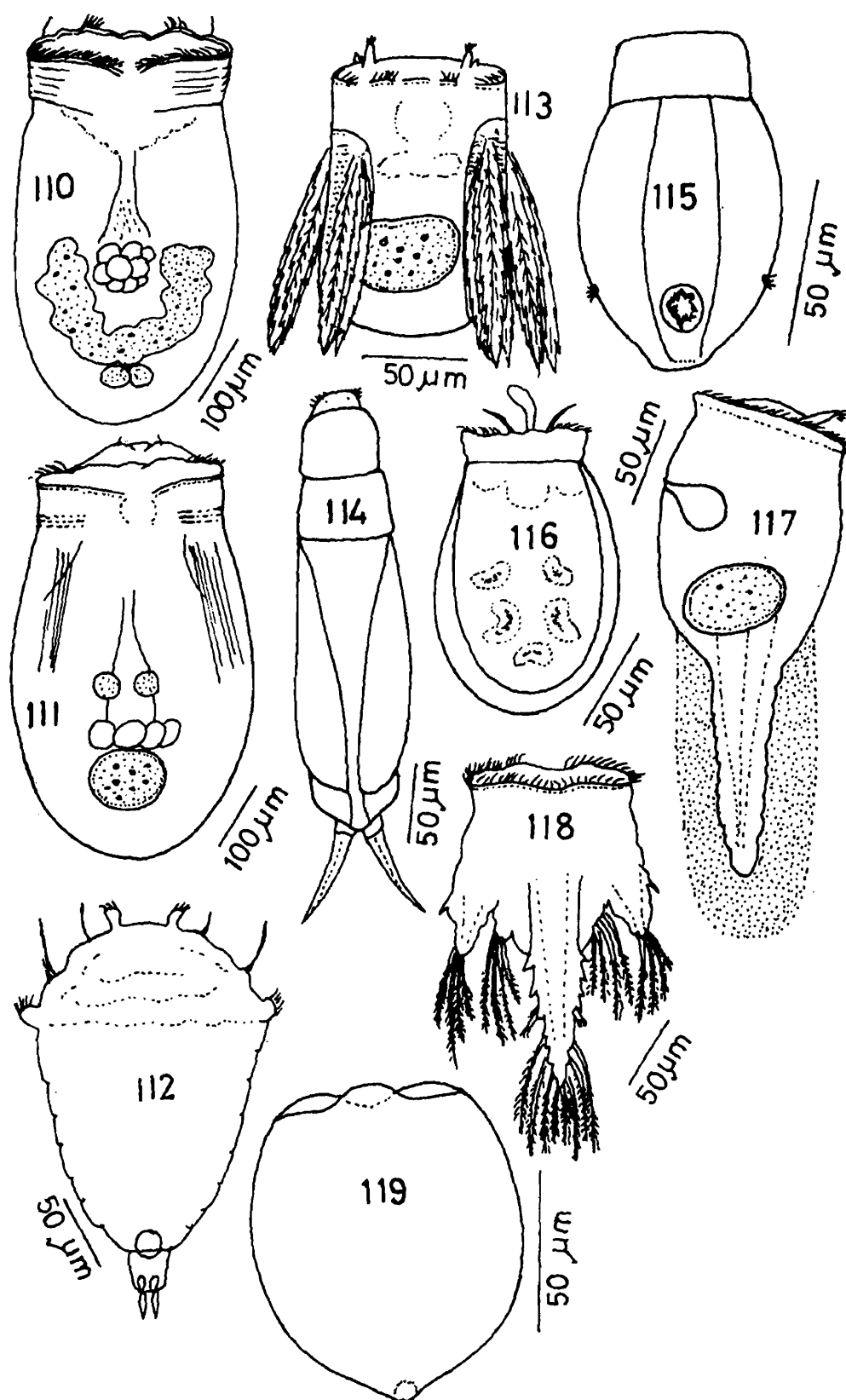
Only one genus of the family Dicranophoridae is included in the present account.

Genus *Dicranophorus* Nitzsch, 1827

Characters : Body generally slender and spindle-shaped ; with cuticular plates and longitudinal folds. Foot usually small ; toes long or moderately long, ventrally directed and terminating into claws in some species. Corona with ventral broad field ; rostrum mostly well developed.

Type species : *Dicranophorus forcipatus* (O. F. Müller, 1773)

The material examined from Tripura indicated only one species of this genus.



Figures : 110-119

Fig. 110 : *Asplanchna brightwelli* Gosse dorsal view ; Fig. 111 : *A. priodonta* (Gosse), dorsal view ; Fig. 112 : *Synchaeta pectinata* Ehrenberg, dorsal view ; Fig. 113 : *Polyarthra vulgaris* Carlin, dorsal view ; Fig. 114 : *Dicranophorus forcipatus* (Muller), dorsal view ; Fig. 115 : *Ascomorpha saltans* Bartsch, dorsal view ; Fig. 116 : *A. ovalis* (Bergendal), dorsal view ; Fig. 117 : *Conochilus unicornis* Rousselet, lateral view (individual) ; Fig. 118 : *Hexarthra mira* (Hudson), dorsal view ; Fig. 119 : *Pompholyx sulcata* Hudson, dorsal view.

95. *Dicranophorus forcipatus*

(O. F. Müller, 1773)

(Fig. 114)

Characters : Body elongated and with straight ventral margin ; head and neck distinct. Rostrum short, broader, rounded anteriorly and with two small, red eye spots. Corona ventral and nearly as long as head. Foot short and two-segmented ; toes moderately long, with folds and terminating into pointed tips. Retrocerebral organ narrow anteriorly. Rami with two terminal spines and 5-10 teeth in inner side. Unci with row of strong teeth.

Measurements : Total length 315-340 ; toes 50-65.

Distribution : TRIPURA—South Tripura, represents a new report from this state. INDIA—Meghalaya and West Bengal.

Elsewhere : Cosmopolitan.

Family GASTROPODIDAE Remane, 1933

Characters : Body oval, sac or bottle-shaped ; foot present or absent. Apical field with or without tentacle. Trophi virgate. Gastric glands with blind sacs.

This family is represented by single genus in the present study.

Genus *Ascomorpha* Perty, 1850

Characters : Body sacciform to oval and with thin lorica. Corona with a single circumapical ring of cilia ; apical field with a finger or sickle-shaped stiff tentacle and tufts of cilia. Mastax modified for suction ; trophi virgate.

Type species : *Ascomorpha ecaudis* (Perty, 1850)

Two species of this genus are noticed in the samples examined from Tripura.

Key to species of genus Ascomorpha

Body elevated, with one accretion body
.....*Ascomorpha saltans*

Body compressed, with numerous accretion bodies
.....*Ascomorpha ovalis*

96. *Ascomorpha saltans* Bartsch, 1870

(Fig. 115)

Characters : Body oval, elevated in cross-section and with four longitudinal folds. Styli on apical field long, palp finger-like and generally dorsally bent. Retrocerebral sac long. Protonephredia with three flame bulbs each. Only one irregular accretion body present.

Measurements : Total length 108-130 ; trophi 26-30.

Distribution : TRIPURA—South Tripura, represents a new report from this state. INDIA—Meghalaya, West Bengal and Ladak.

Elsewhere : Cosmopolitan.

97. *Ascomorpha ovalis* (Bergendal, 1892)

(Fig. 116)

Characters : Body oval, moderately compressed dorso-ventrally ; cuticle stiffened to form thin lorica. Dorsal and ventral plates of lorica bounded laterally by a thin membrane. Accretion bodies numerous.

Measurements : Body length 110-125 ; maximum width 90-95.

Distribution : TRIPURA—North Tripura and West Tripura, represents a new report from this state. INDIA—West Bengal and Madhya Pradesh.

Elsewhere : Pantropical.

Order GNESIOTROCHA De Beauchamp, 1965

Characters : Larvae free-swimming, with ciliated foot. Adults creeping, sessile or pelagic. Only members of the family Testudinellidae with lorica.

It is represented by only Suborder : Flosculariacea is the present account.

Sub-order FLOSCULARIACEA Remane, 1933

Characters : Body loricate or illoricate. Trophi malleoramate. Corona of *Hexarthra*-or *Conochilus*-type. Foot, if present, without toes ;

in the living forms or in juvenile stages, it terminates into a ciliated cap. Numerous foot glands present. Includes solitary, free-swimming colonies or sessile forms ; sessile forms often with a gelatinous sheath or tube made up of detritus.

Six families belonging to suborder Flosculariacea are documented in present account.

*Key to recorded families of Suborder
FLOSCULARIACEA*

1. Body loricate ; lorica with a distinct foot-opening.....TESTUDINELLIDAE
Body illoricate.....2
2. Foot present.....3
Foot absent 4
3. Forms free-swimming ; colonial or solitary CONOCHILIDAE
Forms sessile ; solitary or colonial FLOSCULARIDAE
4. Body conical, bell or vase-shaped, with appendages 5
Body sacciform or spherical, without appendages TROCHOSPHERIDAE
5. Body with six arm-like appendages HEXARTHRIDAE
Body with 3-4 cuticular setae FILINIIDAE

Family CONOCHILIDAE Remane, 1933

Characters : Usually in colonies and often with a gelatinous case. Lorica absent ; foot stout and without holdfast ; toes absent. Corona unlobed, horse-shoe shaped, with mouth in middle or near dorsal edge. Trophi malleoramate.

This family is represented by only one genus in the material examined from Tripura.

Genus *Conochilus* Ehrenberg, 1834

Characters : Forms colonial but sometimes solitary and with gelatinous case. Body conical or

vase-shaped and with long, contractile and unsegmented foot. Corona consists of a horse-shoe shaped double band of cilia ; mouth near dorsal edge of corona. Digestive tract U-shaped, anus situated dorsally.

Type species : *Conochilus hippocrepis* (Schränk, 1803)

Only one species belonging to this genus is presently examined from Tripura.

98. *Conochilus unicornis* Rousselet, 1892
(Fig. 117)

Characters : Forms colonial, with 5-25 individuals bounded by a gelatinous case. Body vase-shaped ; foot contractile. Apical field conically domed and mouth located in its center. Lateral antennae fused and located on apical field.

Measurements : Total length (individual) 360-520.

Distribution : TRIPURA—North and South Tripura, represents a new report from this state. INDIA—Meghalaya and West Bengal.

Elsewhere : Cosmopolitan.

Family HEXARTHRIDAE Bartos, 1959

Characters : Forms pelagic. Body illoricate and with six arm-like mobile appendages ; appendages with bristles and spines. Foot absent. Corona of *Hexarthra*-type. Trophi malleoramate.

This family is represented by only one genus in the present account.

Genus *Hexarthra* Schmarda, 1854

Characters : Body conical ; six arm-like appendages with pinnate bristles at their tips. Corona wavy, with double band of cilia and with or without ventral lip. Some species with two club-shaped dorsal appendages located at the posterior end of the body. Unci with variable number of teeth. Subitaneous eggs attached to anal opening.

Type species : *Hexarthra mira* (Hudson, 1871)

Only one species of this genus is observed in the material examined from Tripura.

99. *Hexarthra mira* (Hudson, 1871)
(Fig. 118)

Characters : Body conical or bell-shaped. With six arm-like appendages (one dorsal, one ventral, two latero-dorsal and two latero-ventral) and each ending with pinnate bristle. Ventral arm with three pairs of spines and eight bristles. Two ciliated club-shaped appendages located at posterior end of the body. Each ramus with six teeth.

Measurements : Body length 160-225.

Distribution : TRIPURA—all districts, also reported earlier from this state by Bhattacharya and Saha (1988). INDIA—Meghalaya, Assam, Tripura, West Bengal, Bihar, Tamil Nadu, Rajasthan, Punjab and Kashmir.

Elsewhere : Cosmopolitan.

Family TESTUDINELLIDAE Bartos, 1959

Characters : Creeping or semi-pelagic forms ; not in tubes or in colonies. Body loricate, without any appendages ; with a distinct foot-opening. Foot, if present, tubiform and terminally ciliated.

Two genera belonging to this family are reported in the present account.

Key to recorded genera of family
TESTUDINELLIDAE

Foot present. Lorica strongly built. Benthic forms
.....TESTUDINELLA

Foot lacking. Lorica moderately strong. Pelagic forms
.....POMPHOLYX

Genus *Pompholyx* Gosse, 1851

Characters : Body oval or elliptical or shield-shaped, with thin lorica and without foot. Cloacal opening located at posterior end of lorica ; eggs attached to posterior end with retractile threads. Corona consists of a simple circumapical band of

cilia. Trophi malleoramate ; unci with numerous teeth. Vitellarium with 12 nuclei.

Type species : *Pompholyx complanata* Gosse, 1851

Pompholyx is represented by only one species from Tripura.

100. *Pompholyx sulcata* Hudson, 1885
(Fig. 119)

Characters : Lorica broadly oval and tapering behind its middle region ; with four longitudinal furrows and divided into dorsal and ventral bulges in cross-section. Anterior occipital margin with a lobe-like projection dorsally ; ventral margin with two lateral elevations flanking a shallow median sinus. Cloacal aperture terminal.

Measurements : Lorica length 100-130 ; maximum width 70-85.

Distribution : TRIPURA—examined from all districts, represents a new report from this state. INDIA—Meghalaya, Assam, West Bengal, Orissa, Punjab, Kashmir and Ladak.

Elsewhere : Cosmopolitan.

Genus *Testudinella* Bory de St. Vincent, 1826

Characters : Body loricate, circular, elliptical, oval or vase-shaped and more or less compressed. Foot-opening ventral, located near middle or in the posterior half or posterior end of lorica. Foot annulated and terminating with a band of cilia. Corona with a circumapical band of cilia. Position of lateral antennae diagnostic. Vitellarium horse-shoe shaped.

Type species : *Testudinella clypeata* (O. F. Müller, 1786)

The collections examined from Tripura indicate five species of *Testudinella*.

Key to recorded species of genus Testudinella

1. Foot-opening located at posterior end 2
- Foot-opening not located at posterior end
.....3

2. Dorsal median spine long. Foot-opening elongated *Testudinella tridentata*
3. Dorsal median spine small. Foot-opening small *Testudinella brevicaudata*
3. Lorica circular, foot-opening located in the middle *Testudinella patina*
Lorica of other shapes, foot-opening located behind middle 4
4. Lorica pear-shaped. Foot-opening elliptical *Testudinella parva*
Lorica vase-shaped. Foot-opening slit-shaped *Testudinella emarginula*

101. *Testudinella brevicaudata*

(Yamamoto, 1951)

(Fig. 120)

Characters : Lorica broadly oval, with maximum width behind its middle and produced posteriorly into a rectangular projection. Anterior dorsal margin with small median spine. Foot-opening almost semicircular and located ventrally at posterior projection of lorica.

Measurements : Lorica length 80-90 ; maximum width 65-70.

Distribution : TRIPURA—South Tripura, represents a new report from this state. INDIA—Assam.

Elsewhere : Palaeotropical.

102. *Testudinella patina* (Hermann, 1783)

(Fig. 121)

Characters : Lorica almost circular and dorso-ventrally flattened. Dorsum slightly convex and anterior dorsal margin rounded. Lateral antennae situated anterior to middle region of lorica. Foot-opening circular and located in the middle part on the ventral side, foot annulated, retractile, ventrally projecting and with a terminal ciliated cap.

Measurements : Lorica length 150-175 ; maximum width 150-165.

Distribution : TRIPURA—all districts, also reported earlier from this state by Sharma (1990). INDIA—Meghalaya, Assam, Tripura, West

Bengal, Orissa, Bihar, Andhra Pradesh, Gujarat, Punjab and Kashmir.

Elsewhere : Cosmopolitan.

103. *Testudinella parva* (Ternetz, 1892)

(Fig. 122)

Characters : Lorica pear-shaped and with maximum width in the posterior region ; convex in cross-section. Anterior dorsal margin slightly elevated and with a shallow depression ; anterior ventral margin with median notch. Lateral antennae located behind the middle region of lorica. Foot-opening elliptical and located at a short distance from posterior margin of lorica.

Measurements : Lorica length 100-125 ; maximum width 90-105.

Distribution : TRIPURA—West Tripura, represents new record from this state. INDIA—Meghalaya, Assam and West Bengal.

Elsewhere : Cosmopolitan.

104. *Testudinella emarginula* (Stenroos, 1898)

(Fig. 123)

Characters : Lorica vase-shaped and with maximum width slightly behind its anterior end ; biconcave in cross-section. Anterior dorsal margin with a plate-like process and ventral margin with a shallow notch. Foot-opening slit-shaped and located near posterior end of lorica.

Measurements : Lorica length 9-105 ; maximum width 70-80.

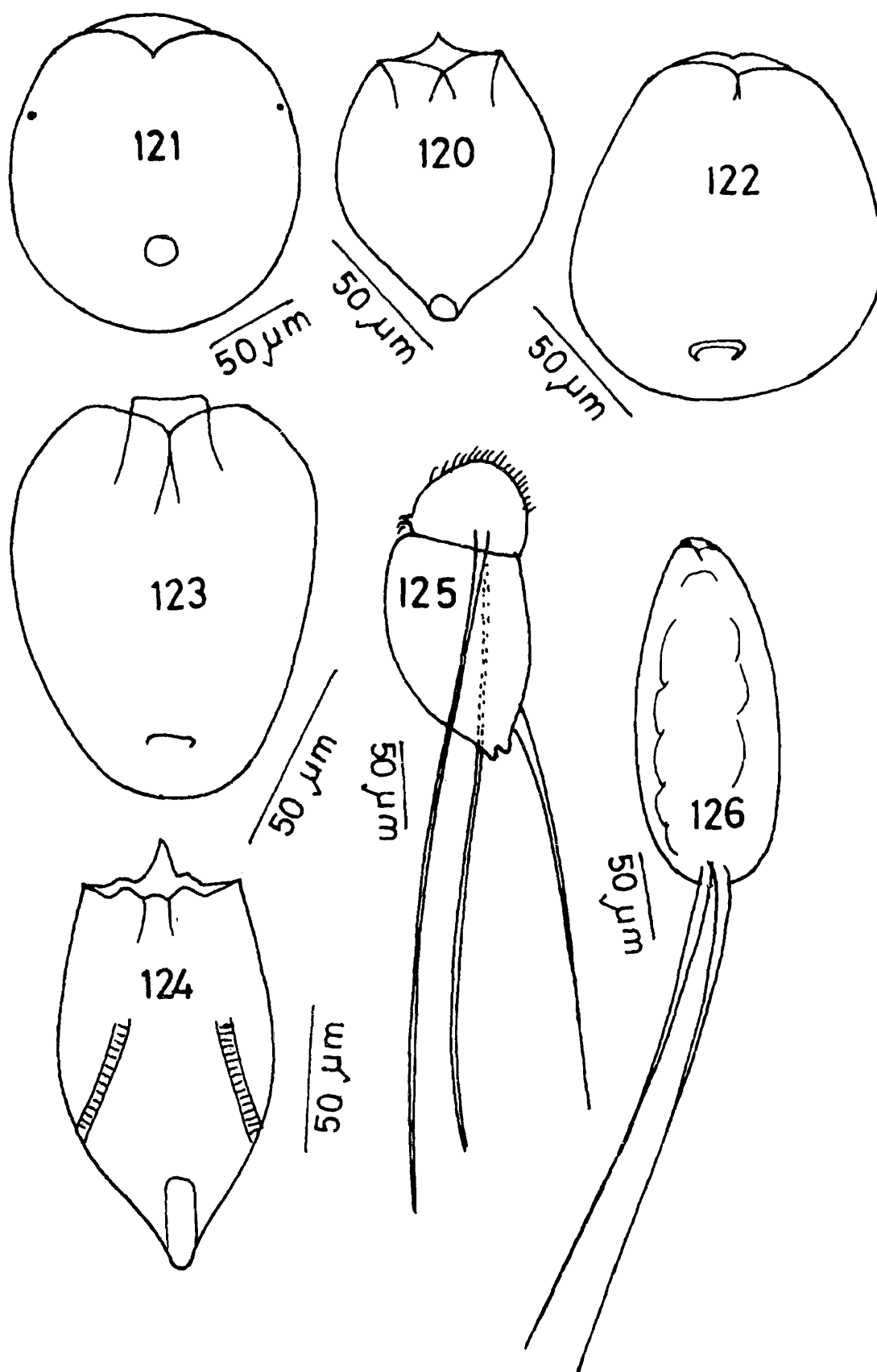
Distribution : TRIPURA—South Tripura, also reported earlier from this state by Sharma (1990). INDIA—Meghalaya, Assam, Tripura, West Bengal, Orissa and Bihar.

Elsewhere : Cosmopolitan.

105. *Testudinella tridentata* Smirnov, 1931

(Fig. 124)

Characters : Lorica vase-shaped, compressed dorso-ventrally, with maximum width behind its middle and then tapering gradually to a posterior lobate projection. Anterior dorsal margin with



Figures : 120-126

Fig. 120 : *Testudinella brevicaudata* (Yamamoto), ventral view ; Fig. 121 : *T. patina* Hermann, ventral view ; Fig. 122 : *T. parva* (Ternetz), ventral view ; Fig. 123 : *T. emarginula* (Stenroos), ventral view ; Fig. 124 : *T. tridentata* Smirnov, ventral view ; Fig. 125 : *Filinia longiseta* (Ehrenberg), lateral view ; Fig. 126 : *F. saltator* (Gosse), lateral view.

long median spine. Foot-opening elongated, located at posterior ventral end of lorica ; foot annulated and with ciliated tip.

Measurements : Lorica length 125-130 ; maximum width 70-75.

Distribution : TRIPURA—North Tripura, also reported earlier from this state by Sharma (1990). INDIA—Tripura and Assam.

Elsewhere : Cosmopolitan.

Family FILINIIDAE Bartos, 1959

Characters : Body without lorica and with three or four cuticular setae. Circumapical band with a single ring of cilia. Trophi malleoramate.

Only one genus belonging to this family is reported in the present account.

Genus *Filinia* Bory de St. Vincent, 1824

Characters : Body illoricate, cylindrical or sacciform ; with two movable antero-lateral spines and one or two terminal or subterminal setae. Anus terminal ; foot absent. Corona consists of a single circumapical ring of cilia. Dorsal antenna at level with anterior setae ; lateral antennae behind the middle region of the body. Eyes two, situated on apical field.

Type species : *Filinia passa* (O. F. Müller, 1786)

Four species of *Filinia* are observed in the material collected from Tripura.

Key to recorded species of genus *Filinia*

1. With two anterior setae and one caudal seta 2
 With only two anterior setae *Filinia saltator*
2. Body vase-shaped *Filinia camascela*
 Body not vase-shaped 3
3. Body spindle-shaped, anterior and caudal setae broad-based *Filinia opoliensis*
 Body cylindrical, setae not broad-based *Filinia longiseta*

106. *Filinia longiseta* (Ehrenberg, 1834) (Fig. 125)

Characters : Body cylindrical and with two long movable antero-lateral setae and one long immobile posterior seta. Anterior setae usually folded ventrally. Posterior seta inserted usually 25 µm away from the caudal end of body.

Measurements : Body length 145-170 ; antero-lateral setae 300-330 ; posterior seta 150-190.

Distribution : TRIPURA—all districts, also reported earlier by Bhattacharya and Saha (1988). INDIA—Meghalaya, Assam, Tripura, West Bengal, Bihar, Orissa, Madhya Pradesh, Gujarat, Rajasthan, Punjab and Haryana.

Elsewhere : Cosmopolitan.

107. *Filinia saltator* (Gosse, 1886) (Fig. 126)

Characters : Body cylindrical, with only two long movable antro-lateral setae ; caudal seta lacking.

Measurements : Body length 120-135 ; anterior setae 250-290.

Distribution : TRIPURA—North and South Tripura, new report from this state. INDIA—known only from Bihar.

Elsewhere : Tropicopolitan.

108. *Filinia camascela* Myers, 1938 (Fig. 127)

Characters : Body vase-shaped, with maximum width nearly in the middle region. Anterior dorsal margin straight, anterior ventral margin slightly elevated and with a shallow median sinus. Body with two lateral and one caudal stout and broad-based setae (spines) ; lateral setae nearly double the length of body.

Measurements : Body length 80-105 ; lateral setae 90-160 ; caudal seta 100-135.

Distribution : TRIPURA—South and West Tripura. INDIA—represents a new record from this country.

Elsewhere : Pantropical.

109. *Filinia opoliensis* (Zacharias, 1898)
(Fig. 128)

Characters : Body long and cylindrical. Anterior setae long and broad-based ; posterior seta long and inserted terminally and an additional small seta or spine located at its base.

Measurements : Body length 150-190 ; anterior setae 180-270 ; posterior long seta 220-240 ; posterior small seta 45-60.

Distribution : TRIPURA—North and West Tripura, reported earlier by Bhattacharya and Saha (1988). INDIA—Meghalaya, Assam, Tripura, West Bengal, Orissa, Bihar, Madhya Pradesh, Gujarat, Rajasthan and Punjab.

Elsewhere : Cosmopolitan.

Family FLOSCULARIIDAE Bartos, 1959

Characters : Adults usually sessile (solitary or colonial) or pelagic. Wheel-organ *Hexarthra*—type ; corona circular or of different shapes, with 2-8 lobes. Foot present.

This family is represented by only one genus in the present account.

Genus *Sinantherina* Bory de St. Vincent, 1826

Characters : Sessile and form spherical aggregation of individuals radiating from a point ; colony not in gelatinous matrix. Corona heart-shaped, with a shallow dorsal notch.

Type species : *Sinantherina socialis* (Linnaeus, 1758)

This genus is presently represented by only one species.

110. *Sinantherina spinosa* (Thorpe, 1893)
(Fig. 129)

Characters : With upto 30 individuals in colony, attached with their foot. Trunk with distinct hook-like spines on ventral side.

Measurement : Body length (individual) 900-1000.

Distribution : TRIPURA—West and South Tripura, new report from this state. INDIA—Assam (personal communication).

Elsewhere : Pantropical.

Family TROCHOSPHAERIDAE Bartos, 1959

Characters : Body spherical or sacciform, without lorica. Corona as a single band of cilia encircling the body (*Trochosphaera*) or borne apically on a short neck (*Horaella*). Trophi malleoramate. Anus terminal or subterminal. Vitellarium rounded or sickle-shaped.

Only one genus of this family is recorded in this study.

Genus *Trochosphaera* Semper, 1872

Characters : Body spherical and transparent ; corona consists of a band of cilia encircling body around middle or towards one end. Vitellarium sickle-shaped. Anus sub-terminal.

Type species : *Trochosphaera aequitorialis* Semper, 1872

This genus includes only one species in the present account.

111. *Trochosphaera aequitorialis*
Semper, 1872
(Fig. 130)

Characters : Body spherical, encircled by a circular band of cilia (corona) in its middle.

Measurement : Body (diameter) 500-650.

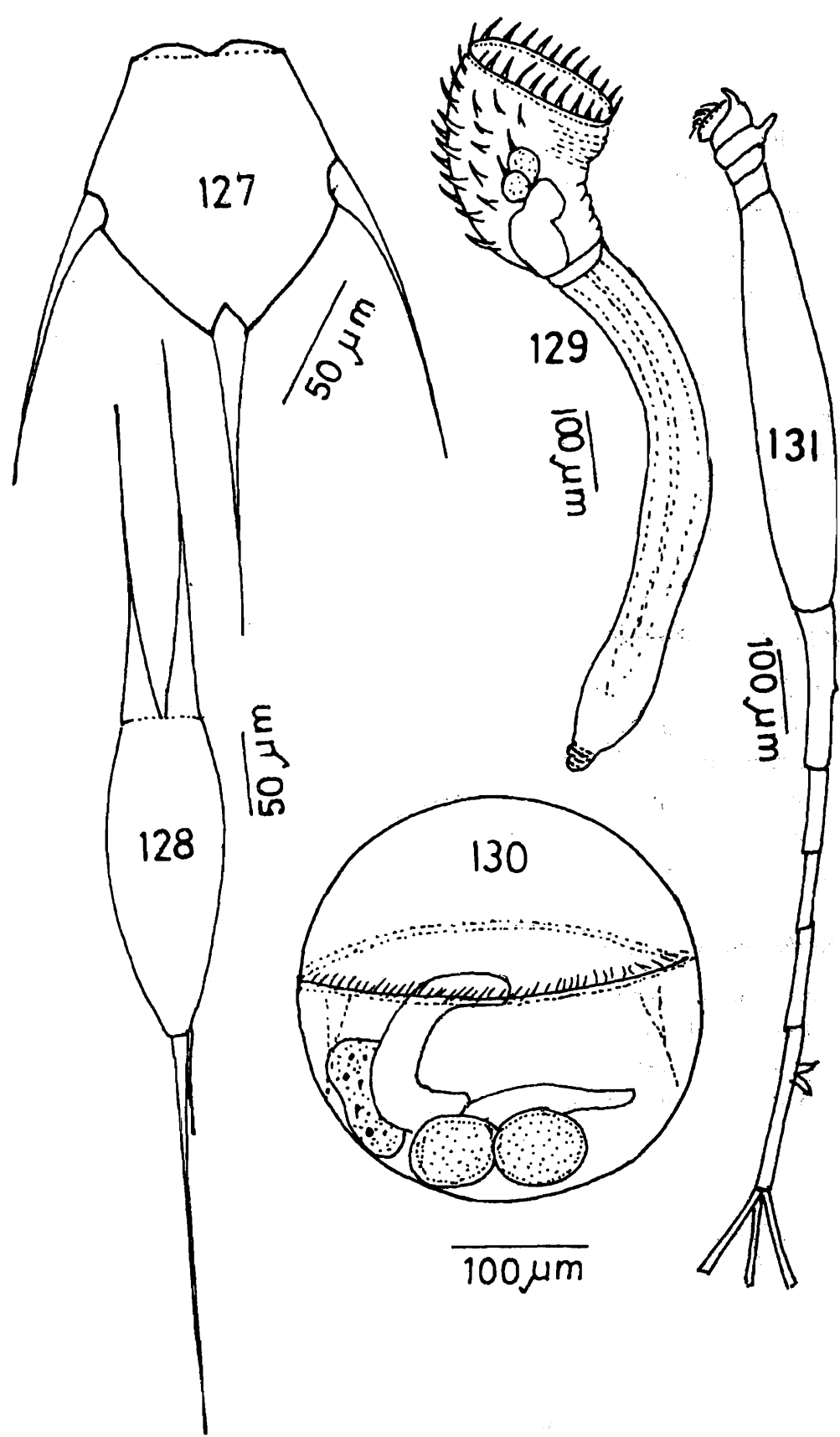
Distribution : TRIPURA—West and South Tripura. INDIA—represents a new record from this country.

Elsewhere : Pantropical.

Super-order DIGONONTA Bartos, 1959

Characters : Body thin, Ovaries paired, with vitellarium. Reproduction asexual.

This superorder is represented by only one order in the present study.



Figures : 127-131

Fig. 127 : *Filinia cumascela* Myers, dorsal view ; Fig. 128, *F. opoliensis* (Zacharias), dorsal view ; Fig. 129 : *Sinantherina spinosa* (Thorpe), lateral view ; Fig. 130 : *Trochosphaera aequitorialis* Semper, lateral view ; Fig. 131 : *Rotaria neptunia* (Ehrenberg), lateral view.

Order BDELLOIDEA Remane, 1933

Characters : Body elongated, fusiform and with telescopically retractile segments. Ciliated rostrum on head and with a dorsal antenna. Trophic ramate. Corona with two ciliated discs on pedicles (*Philodina*-type) or on a ventral ciliated area (*Adineta*-type).

The order Bdelloidea is represented by only one family in this account.

Family PHILODINIDAE Remane, 1933

Characters : Corona *Philodina*-type. Rostrum retractile. Stomach lumen tube-shaped and ciliated. Food excrete not formed into pellets.

The material examined from Tripura indicates only one genus of the Philodinidae.

Genus *Rotaria* Scopoli, 1777

Characters : Body fusiform and usually elongated ; foot three-segmented. Eyes, if present, located on rostrum. Viviparous.

Type species : *Rotaria rotatoria* (Pallas, 1776)

Only one species belonging to this genus is reported presently from Tripura.

112. *Rotaria neptunia* (Ehrenberg, 1832)
(Fig. 131)

Characters : Body long, slender and fusiform. Rostrum with two eyes and with an arched rostral papilla. Palp-like antennae on first neck segment. Trunk long, narrowing gradually. Foot long, slender and telescopic, with a pair of pointed spurs ; last foot-segment with three slender and equal toes.

Measurements : Total length 1200-1500 ; trunk 450-650 ; foot 550-700 ; toes 60-75.

Distribution : TRIPURA—North and West Tripura, represents a new report from this state. INDIA—Meghalaya, Assam, West Bengal, Bihar, Orissa and Andhra Pradesh.

Elsewhere : Cosmopolitan.

DISCUSSION

Although faunistic studies on Indian Rotifera began more than one century ago and have so far resulted in about 120 contributions (Sharma, 1996, 1998), investigations on their biodiversity in North-Eastern India (12 publications) and that of Tripura (6 publications) are still limited. Referring to the latter state in particular, significant information is even restricted to the works of Sharma and Sharma (1990, 1997a). The present study, therefore, assumes special importance in view of the stated lacuna and deals with 112 species (119 taxa) of the rotifers collected from varied freshwater biotopes of Tripura. The documented richness is the second highest recorded from any state of India and follows the record of 145 species from West Bengal (Sharma, 1995) while it nearly equals the report of 111 species (124 taxa) from the state of Meghalaya (Sharma and Sharma, 1997b). In addition, the examined species comprise about 34% and 84.8% of the rotifer taxocoenosis of India and North-Eastern region respectively. Forty-two species represent new reports from Tripura, three species are new to N. E. Region while two species are new to India. This is in addition to the recent report (Sharma and Sharma, 1997a) of 30 new records of *Lecane* spp. from Tripura, including two new records from India and eleven new reports from this region.

Among 63 genera and 25 families of Eurotatoria so far known from India, 31 genera and 19 families are represented in the Tripura fauna which, in turn, is only marginally higher than the report of 30 genera and 17 families from Meghalaya (Sharma and Sharma, 1997b). The present study is characterised by qualitative predominance of the monogonont rotifers (111 species) and paucity of the bdelloids (1 species). The former are dominated by the Ploimida (86.6%) while members of the order Gnesiotrocha comprise a relatively small fraction (14 species). The stated features correspond with general composition of the faunas of Meghalaya (Sharma and Sharma, *loc. cit.*) and India (Sharma, 1991, 1996, 1998) and also with the Oriental Rotifera (Sudzuki, 1989).

Family-wise break-up of the composition of the rotifer fauna of Tripura (TABLE : 1) compares well with that of India and North-Eastern India. Lecanidae (42 species) > Brachionidae (21 species) > Colurellidae (14 species), in the stated qualitative order, constitute a dominant fraction (68.6%) which, in turn, also compares well with the fauna of Meghalaya (63.7%) and N. E. region (62.7%). Besides, two other families namely Trichocercidae (9 species) > Testudinellidae (6 species), together, comprise an important component (13.3%) of the species documented in this account. Further, the qualitative significance of the mentioned 'families broadly corresponds with the rotifer faunas of some South-East Asian countries particularly that of Thailand, Malaysia and Philippines.

The cosmopolitan species constitute significant component (62.5%) of the rotifer fauna of Tripura ; their contribution compares well with the report (Sharma and Sharma, 1997b) from Meghalaya but is higher than that in Indian Rotifera (52%, Sharma, 1998) and in N. E. India (58.4% ; B. K. Sharma, personal communication). On the other hand, Pantropical (16 species) and Tropicopolitan (12 species) elements, together, comprise the second important fraction (25.0%) in the present study which is higher than their contributions in the rotifer communities of Meghalaya (17%) and India (20%). The stated characteristics compare well with many tropical rotifer faunas from different parts of the world (Green, 1972 ; Pejler, 1977 ; Fernando, 1980a, 1980b ; Dumont, 1983 ; Dussart *et al.* 1984 ; Sanoamuang *et al.* 1995 ; Segers, 1996 ; Sharma, 1996, 1998).

The rotifer taxocenosis of Tripura depicts a notable component (12.5%) of biogeographically interesting elements which, in turn, corresponds with the Meghalaya fauna. This category includes two important Australasian elements namely *Brachionus dichotomous reductus* and *Lecane batillifer*. These taxa have been originally described from Australia and have since been reported only from Thailand (Sanoamuang *et al.* 1995 ; Sanoamuang, 1998). Further, the stated rotifers are so far known from India only from its

North Eastern region ; the former is reported from Meghalaya (Sharma and Sharma, 1997b) while *L. batillifer* is examined from Tripura (Sharma and Sharma, 1997a). *Lecane acanthinula* is the sole Oriental species documented in the present study. *Brachionus donneri*, an interesting brachionid described from India and considered to be an Oriental element (refer : Sudzuki, 1989), now depicts Pantropical distribution. The rotifer fauna of Tripura also reveals six Palaeotropical elements namely *Keratella javana*, *Lecane braumi*, *L. lateralis*, *L. simonneae*, *L. unguitata* and *Testudinella brevicaudata*. All these species, except *L. lateralis* and *L. unguitata*, are so far recorded exclusively from North-Eastern India ; the former Indian endemic *L. lateralis* appears to the widely distributed in tropical and subtropical parts of the old and new world. The occurrence of Holarctic *Lecane levistyla* in Tripura deserves special attention as this interesting lecanid has been reported for the first time outside the Northern hemisphere (refer Sharma and Sharma, 1997a).

The rotifer communities of Tripura include several species of regional distribution importance. Of these, *Keratella lenzi*, *Lecane hastata*, *L. pertica*, *L. scutata*, *Filinia camascela*, *F. saltator*, *Sinantherina spinosa*, *Testudinella tridentata*, *T. parva* and *Trochosphaera aequitorialis* require special mention. *Filinia camascela* and *Trochosphaera aequitorialis* represent new reports from India. *F. saltator* is so far recorded only from Bihar (Sharma *et al.* 1992) and its distributional range is presently extended to N. E. India. *K. lenzi* exhibits disjunct distribution in this country (Sharma, 1996) while the rest of the mentioned species are recorded till now from N. E. region. The examined material, however, does not include any endemic element ; this may not be treated as indicator of lack of such species but lays future emphasis on proper sampling of littoral, benthic, and bdelloid rotifers.

The qualitative predominance of the 'tropic centred' genera such as *Lecane* and *Brachionus* in the rotifer fauna of Tripura imparts it a general tropical character (*vide* Green, 1972 ; Pejler,

1977 ; De Ridder, 1981 ; Dussart *et al.* 1984 ; Sanoamuang *et al.* 1995 ; Segers, 1996 ; Sharma, 1998). Segers (*loc. cit.*) asserted the importance of the former genus in tropical rotifer communities while Pejler (*loc. cit.*) reported *Brachionus* to be entirely missing in Arctics but this genus gained increasing importance while approaching the equatorial region. Tropical nature of the Tripura fauna is also indicated earlier by occurrence of a large fraction of Pantropical and Tropicopolitan elements. This generalisation is, however, further supported by occurrence of fewer species of 'temperate centred' *Keratella* in the present study as well as poor species richness of predominantly temperate genera like *Cephalodella* and *Synchaeta* in this account.

The material examined from Tripura is characterised by relative paucity of *Brachionus* spp. than certain other states of India. Among 22 species of this brachionid documented from India, only 14 species (12.5%) are reported in this study ; the qualitative richness corresponds with the observations from Meghalaya (Sharma and Sharma, 1997b). This interesting feature may be due to fewer permanent lentic biotopes sampled presently and is also attributed to acidic to circumneutral nature of a large number of water bodies in Tripura. The latter generalisation confirms the remarks by Fernando and Zankai (1981), Sanoamuang *et al.* (1995), Segers (1996) and Sharma (1998). Further, this aspect is also supported by the occurrence of several acidophilic elements in the present study namely *Brachionus dichotomus reductus*, *B. mirabilis*, *B. patulus macracanthus* (allocated to the newly erected genus *Platinous* by Segers *et al.* 1993), *Euchlanis triquetra*, *Dipleuchlanis propatula*, *Mytilina bisulcata*, *Colurella sulcata*, *Lepadella cristata*, *L. triptera*, *Squatinella mutica*, *Testudinella brevicaudata* and *T. tridentata*. The stated indicators broadly confirm with the remarks by Sharma and Sharma (1997b) based on the observations from Meghalaya. Besides, alkaline waters sampled in the present study depict typical alkalophilic species such as *Anuraeopsis fissa*, *Brachionus angularis*, *B. budapestinensis*, *B.*

calyciflorus, *B. caudatus*, *B. falcatus*, *B. forficula*, *B. rubens*, *Keratella tropica*, *Asplanchna brightwelli*, *Polyarthra vulgaris*, *Pompholyx sulcata*, *Filinia longiseta*, *F. opoliensis* and *Rotaria neptunia*. In addition, *Brachionus donneri*, *Keratella lenzi* and *K. javana* are presently assigned to the category of "species preferring special waters" (*vide* Sudzuki, 1989) since little is so far known about the ecology of these species.

Anuraeopsis fissa, *Brachionus bidentatus*, *B. falcatus*, *B. forficula*, *B. mirabilis*, *Keratella tropica*, *Macrochaetus sericus*, *Lecane aculeata*, *L. ludwigi*, *L. stenroosi*, *L. quadridentata*, *Sinantherina spinosa* and *Filinia opoliensis* are presently designated as warm-stenothermal species (refer Koste, 1978). The present study indicates several eurythermal elements such as *Brachionus angularis*, *B. calyciflorus*, *B. rubens*, *Euchlanis dilatata*, *Lepadella ovalis*, *L. patella*, *L. inermis*, *Polyarthra vulgaris* and *Testudinella patina*. On the other hand, cold-stenothermal elements are represented by *Lecane levistyla*, *L. scutata*, *Trichocerca cylindrica*, *Keratella cochlearis* and *Testudinella emarginula*. In addition, the present observations reveal a number of eutrophic indicators namely *Brachionus angularis*, *B. calyciflorus*, *B. bidentatus*, *B. falcatus*, *B. budapestinensis*, *B. rubens*, *Keratella tropica*, *Mytilina ventralis*, *Lecane curvicornis*, *L. bulla*, *L. leontina*, *Asplanchna brightwelli*, *A. priodonta*, *Trichocerca similis*, *Polyarthra vulgaris*, *Pompholyx sulcata*, *Ascomorpha ovalis*, *Conochilus unicornis*, *Sinantherina spinosa*, *Filinia longiseta*, *F. opoliensis* and *Rotaria neptunia*.

The present observations register variations in overall qualitative diversity of Rotifera in different districts of Tripura. The maximum species richness (84 species, 90 taxa) is noticed in North Tripura which, in turn, is followed by the reports of 72 species (75 taxa) from West Tripura and 64 species (67 taxa) from South Tripura. More extensive collections, particularly from West and South Tripura, are likely to add more species. The district-wise rotifer richness, however, broadly

corresponds with the report from Meghalaya (Sharma and Sharma, 1997b). Referring to the different aquatic biotopes sampled in the present study, the littoral or periphytic rotifer communities indicate maximum diversity (60-65 species), the rice-field ecosystems reveal up to 28-33 species/sample while limnetic collections from domestic ponds/lacustrine environs indicate 18-24 species. The stated general features correspond broadly with the observations from Meghalaya (Sharma and Sharma, 1997b).

To sum up, the present account depicts fairly rich and diversified rotifer taxocoenosis of Tripura which is characterised by fairly higher species and generic diversity. Planktonic rotifers are well documented in this study while littoral or periphytic communities need more attention in future investigations. On the other hand, special attention is yet to be focussed to the sampling and analysis of benthic, sessile, colonial and bdelloid rotifers with particular emphasis to document endemic taxa. In general, the rotifer fauna of Tripura still needs updating and further investigations, on the suggested lines, are likely to reveal more than 200 species from this state.

SUMMARY

One hundred and twelve species of Rotifera, belonging to 31 genera and 19 families, documented presently from Tripura depict fairly rich and diversified taxocenosis. The reported species comprise about 34% of Indian Rotifera and 84.8% of the rotifer fauna of North-Eastern India. The present study indicates forty-two new records from Tripura while two species are new to India and three species are new to N. E. region. Cosmopolite (70 species, 62.5%) > Pantropical (16 species, 14.3%) > Biogeographically interesting (14 species, 12.5%) > Tropicopolite (12 species, 10.7%) elements comprise the stated qualitative order. The members of the third category include two Australasian (*Brachionus dichotomus reductus* and *Lecane batillifer*), one Oriental (*Lecane acanthinula*), one Holarctic (*Lecane levistyla*), six Palaetropical, (*Keratella javana*, *Lecane braumi*, *L. lateralis*, *L.*

simonneae, *L. unguitata* and *Testudinella brevicaudata*) and three cold-water taxa. Besides, several species namely *Keratella lenzi*, *Lecane hastata*, *L. scutata*, *Filinia camascela*, *F. saltator*, *Sinantherina spinosa*, *Testudinella parva*, *T. brevicaudata* and *Trochosphaera aequitorialis* depict examples of regional distributional importance. The qualitative significance of cosmopolitan, pantropical and tropicopolitan species as well as richness of species of the 'tropic-centred' *Lecane* and *Brachionus* imparts a general tropical character to the rotifer fauna of Tripura.

Acidic to circumneutral water bodies of Tripura reveal several interesting acidophilic elements namely *Brachionus dichotomus reductus*, *B. mirabilis*, *B. patulus macracanthus*, *Euchlanis triquetra*, *Dipleuchlanis propatula*, *Mytilina bisulcata*, *Colurella sulcata*, *Lepadella cristata*, *L. triptera*, *Squatinella mutica*, *Testudinella brevicaudata* and *T. tridentata*. On the other hand, alkaline biotopes indicate alkalophilic species such as *Anuraeopsis fissa*, *Brachionus angularis*, *B. budapestinensis*, *B. calyciflorus*, *B. caudatus*, *B. falcatus*, *B. forficula*, *B. rubens*, *Keratella tropica*, *Asplanchna brightwelli*, *Polyarthra vulgaris*, *Ponpholyx sulcata*, *Filinia longiseta*, *F. opoliensis* and *Rotaria neptunia*. *Anuraeopsis fissa*, *Brachionus bidentatus*, *B. falcatus*, *B. forficula*, *B. mirabilis*, *Keratella tropica*, *Macrochaetus sericus*, *Lecane aculeata*, *L. ludwigi*, *L. stenroosi*, *L. quadridentata*, *Sinantherina spinosa* and *Filinia opoliensis* are presently designated as warm-stenothermal species. Eurythermal elements include *Brachionus angularis*, *B. calyciflorus*, *B. rubens*, *Euchlanis dilatata*, *Lepadella ovalis*, *L. patella*, *L. inermis*, *Polyarthra vulgaris* and *Testudinella patina* while cold-stenothermal elements are represented by *Lecane levistyla*, *L. scutata*, *Trichocerca cylindrica*, *Keratella cochlearis* and *Testudinella emarginula*. The present observations also reveal several eutrophic indicators namely *Brachionus angularis*, *B. calyciflorus*, *B. bidentatus*, *B. falcatus*, *B. budapestinensis*, *B. rubens*, *Keratella tropica*, *Mytilina ventralis*, *Lecane curvicornis*, *L. bulla*,

L. leontina, *Asplanchna brightwelli*, *A. priodonta*, *Trichocerca similis*, *Polyarthra vulgaris*, *Pompholyx sulcata*, *Ascomorpha ovalis*, *Conochilus unicornis*, *Sinantharina spinosa*, *Filinia longiseta*, *F. opoliensis* and *Rotaria neptunia*.

The present study reveals 84 species (90 taxa) from North Tripura, 72 species (75 taxa) from West Tripura and 64 species (67 taxa) from South Tripura. Littoral or periphytic communities indicate maximum diversity (60-65 species), the rice-field ecosystems reveal up to 28-33 species/sample while limnetic collections indicate 18-24 species. Planktonic rotifers are well documented, littoral or periphytic communities require more attention while special attention is to be focussed to sample and analyse benthic, sessile, colonial and bdelloid rotifers. In general, the rotifer fauna of Tripura still needs updating and further investigations are likely to reveal more than 200 rotifer species from this state.

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HIRUDINEA : LEECHES

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INTRODUCTION

Harding and Moore (1927) provided a comprehensive account of the Indian leeches. The other workers like Baugh (1960), Bhatia (1930), Chelladurai (1934), Chandra (1966), Julka and Ghosh (1976) Sanjeeva Raj (1951), and Sanjeeva Raj and Gladstone (1981) contributed their might to the taxonomy as well as distributional records of a number of species of India. Thus till now 50 species and 8 subspecies are so far known from India, out of which nothing is recorded from the state of Tripura.

The present study is based on the material available from the different survey parties from Head Quarters and also from Eastern Regional Station, Z.S.I., Shillong. This comprises five species including one subspecies belonging to 4 genera under 2 families all of whom form new locality records.

It provides diagnostic characters on the basis of material studied and also from literature. Host relationship with habitats and distribution of all species have been forwarded.

SYSTEMATIC ACCOUNT

Phylum ANNELIDA

Class CLITELLATA

Order HIRUDINEA

Suborder ARHYNCHOBDELLAE

Family I ERPOBDELLIDAE

Genus 1. *Barbronia* Johansson, 1918

(1) *B. Weberi* (Blanchard, 1897).

Genus 2. *Herpobdelloidea* Kaburaki, 1921.

(2) *H. laterocolata* Kaburaki, 1921.

Family II HIRUDIDAE

Genus 3. *Hirudinaria* Whitman, 1886.

(3) *H. manillensis* (Lesson, 1842).

Genus 4. *Haemadipsa* Tennent, 1859.

(4) *H. zeylanica* (Moquin-Tandon, 1826).

(4a) *H. zeylanica agilis* Moore, 1927.

(5) *H. sylvestris* Blanchard, 1894.

Family I. ERPOBDELLIDAE

Diagnosis : Small or medium size, aquatic in habit ; terete or subterete anteriorly and flattened towards the posterior end; eyes three or six pairs arranged in two transverse rows on labial and buccal groups; pharynx long, mouth with muscular ridges but without jaws; testes sacs small and numerous; gastric caeca absent.

Genus 1. *Barbronia* Johansson

1918. *Barbronia* Johansson, *Sarasin V. Roux, Nova-calendonia Zoologic*, 2 (3) : 373-396.

Diagnosis : Small, 25-35 mm long ; complete somite quinquannulate; eyes one pair on labials and two pairs on buccals; gonopores on XII and XIII, separated by a full somite; no dorsal canal from stomach to exterior.

Remarks : Only a single species has been recorded from Tripura.

(1) *Barbronia weberi* (Blanchard)

1897. *Dina weberi* Blanchard. *Zool. Erheb. Reise in Neiderlandish Ost. Indian*, 4 : 332-355.

1918. *Barbronia rouxi* Johansson, *Sarasin V. Roux, Nova-calendonia Zoologie*, 2 (3) : 373-396.

1927. *Barbronia weberi* : Moore, *Fauna British India : Hirudinea*, pp. 135-140.

1983. *Barbronia weberi* : Chandra, *Rec. zool. Surv. India*, **80** (3 & 4) : 280.

Material : 5 exs ; Narayanpur, 4 kms E. of Pacherthal, N. Tripura ; 24.iv.92 ; collector B. P. Halder and party.

Diagnosis : Living colour blackish-red ; eyes three pairs, one large pair on II and two small pairs on the sides of the anterior annulus of IV ; gonopores separated four and one-half annuli ; accessory copulatory pores and areas at X/XI and XIII/XIV.

Host and habitat : It occurs under stones in the hilly streams, ponds and lakes. No host so far been recorded.

Distribution : INDIA : Tripura - North district, Himachal Pradesh, Jammu & Kashmir, Madhya Pradesh and Uttar Pradesh.

Elsewhere : Afganistan, Borneo, Celebes, Java and Sumatra.

Remarks : Although this species was widely distributed in the Islands of S. E. Asia, the Indian records were from highlands of northern and north-eastern districts.

This is the first record of this species from Tripura.

Genus 2. *Herpobdelloidea* Kaburaki

1921. *Herpobdelloidea* Kaburaki, *Rec. Ind. Mus.*, **18** : 705.

Diagnosis : Eyes one pair on head and five pairs on somites iv to ix ; gonopores separated by five annuli.

(2) *Herpobdelloidea lateroculata* Kaburaki

1921. *Herpobdelloidea lateroculata* Kaburaki, *Rec. Ind. Mus.*, **18** : 705.

1976. *Herpobdelloidea lateroculata* : Mahajan & Chandra, *Rec. zool. Surv. India*, **71** : 147.

Material : 11 exs., Narayanpur, 4 kms E. of Pacherthal, N. Tripura ; 24.iv.92 ; collector B. P. Halder and party.

Diagnosis : Larger forms attain a length of about 27 mm and width of about 3 mm ; form very slender, attenuated anteriorly ; colour pale buff when alive but generally white in preserved state ; eyes five or six pairs, the first pair larger and dorsal on somite IV, the remaining submarginal on somites V to VIII or V to IX ; gonopores separated by two and one-half to three annuli.

Host and habitats : It is found on the stem of the water hyacinth in the ponds. No specific host is known so far.

Distribution : INDIA : Tripura N. district, Assam, Madhya Pradesh, Maharashtra, Manipur, Rajasthan, Uttar Pradesh and W. Bengal. Occurs only in India.

Remark : This is the first record of the species from Tripura.

Family II HIRUDIDAE

Diagnosis : Size medium to large ; colour variable-green, brown or reddish with pattern of black stripes ; eyes five pairs forming lateral crescent ; pharynx short ; mouth with toothed jaws ; testes arranged segmentally in pairs ; gastric caeca present.

Genus 3. *Hirudinaria* Whitman

1886. *Hirudinaria* Whitman, *Quart. Journ. Micr. Sci.*, **26** : 317.

Diagnosis : Size medium to large ; colour deep green with pattern of black stripes ; lip with median ventral fissure ; eyes five pairs ; gonopores separated by five or seven annuli ; jaws large with tooth and numerous prominent papillae.

(3) *Hirudinaria manillensis* (Lesson)

1842. *Hirudo manillensis* Lesson, *Revue Zoologique Societe Cuvierieme*, p. 8.

1927. *Hirudinaria manillensis* : Moore, *Fauna British India : Hirudinea*, p. 218.

1977. *Hirudinaria manillensis* : Soota and Ghosh *Newsl. zool. Surv. India*, **3** (6) : 360.

Material : 5 exs., Amar colony, W. Tripura,

27.v.89; collector R. H. Kamble and party. 1 ex., Pathalia ghat, W. Tripura; 30.v.89; collector R. H. Kamble and party. 6 exs., Chelia kola, W. Tripura; 4.vi.89; collector R. H. Kamble and party. 1 ex., Kanchan chera, N. Tripura; 11.vi.89; collector V. T. Darlong and party. 5 exs.; Aglapur, 3 kms from Dharmanagar, N. Tripura; 13.iv.92; collector B. P. Halder and party.

Diagnosis : Size large, form robust; colour light brown dorsally and light green ventrally; narrow olive-green stripes four pairs on dorsum, gradually disappears with the increase of size; eyes five pairs; gonopores separated by five annuli; sensillae prominent; lip with median ventral fissure; jaws large with prominent papillae of two sizes; teeth about one hundred; epididymis large and ejaculatory bulb fusiform; autrium short and pyriform; vaginal stalk absent; common oviduct and vaginal duct opening together directly into female bursa.

Host and habitat : It is found in the paddy field, ponds, canals, swamps and ditches. It attacks man and domestic animals.

Distribution : INDIA : Tripura-West and North districts, Andhra Pradesh, Assam, Bihar, Karnataka, Kerala, Madhya Pradesh, Maharastra, Orissa, Tamil Nadu, Uttar Pradesh and W. Bengal.

Elsewhere : In the lowland of entire Oriental Region.

Remarks : This is the first record of the species from Tripura.

Genus 4. *Haemadipsa* Tennent

1859. *Haemadipsa* Tenent, *Ceylon-Leeches*, 1 : 301.

Diagnosis : Terrestrial in habit; size, medium, form slender; colour brown, usually longitudinally striped; eyes five pairs, large, the first four pairs usually on continuous annuli but the third and the fourth pairs may be separated by a partial or complete annulus; gonopores separated by five annuli; jaws three, prominent but without papillae.

(4) *Haemadipsa zeylanica* (Moquin-Tandon)

1826. *Sanguisuga zeylanica* Moquin-Tandon, *Monographic de la famille des Hirudinees Montpellier*, p. 120.
1894. *Haemadipsa zeylanica* : Blanchard, *Mus. Zool. Anthr. Eth du Dresden*, no. 4 : 8.
1977. *Haemadipsa zeylanica* : Chandra, *Rec. zool. Surv. India*, 73 (1-4) : 189.

Diagnosis : Size medium, slender, cylindroid, tapering from posterior sucker pedicel to head; colour brown, mottled or flecked with black, with a median dorsal stripe and marginal pale-yellow stripes; eyes five pairs, third and fourth pairs on continuous annuli; well developed prehensile papillae on caudal sucker; sucker rays 71-73.

(4a). *Haemadipsa zeylanica agilis* Moore

1927. *Haemadipsa zeylanica agilis* Moore, *Fauna British India : Hirudinea*, p. 266.
1977. *Haemadipsa zeylanica agilis* : Chandra, *Rec. zool. Surv. India*, 73 (1-4) : 189.

Material : 1 ex. Santipur, 2 km N. E. of Pachethal, N. Tripura; 20.iv.92; collector B. P. Halder and party.

Diagnosis : Median head tessellae present; dorsal, intermediate and paramedian segmental papillae prominent.

Host and habitat : It is found in grass lands and jungles. It attacks grazing cattles. It is a common land leech of western Himalayas.

Distribution : INDIA : North Tripura, Andaman Is., Arunachal Pradesh, Himachal Pradesh, Uttar Pradesh and West Bengal.

Occurs only in India.

(5) *Haemadipsa sylvestris* Blanchard

1894. *Haemadipsa sylvestris* Blanchard, *Ann. Mus. civico di Storia Naturale, Genova*, (2) 14 : 114.
1967. *Haemadipsa sylvestris* : Soos, *Acta, Zool. Hung.*, 13 (3-4) : 425.

Material : 3 exs., Amar colony, W. Tripura ; 27.v.89; collector R. H. Kamble and party. 8 exs., Anandabazar, 12 kms N. of Dharmanagar, N. Tripura; 12.iv.92; collector B. P. Halder and party. 14 exs., Dharmanagar, N. Tripura; 14.iv.92;

collector B. P. Halder and party. 11 exs., Baruakandi, 5 kms N. of Dharmanagar, N. Tripura; 14.iv.92; collector B. P. Halder and party. 5 exs., W. Panisagar, 15 kms N. of Pacherthal, N. Tripura; 19.iv.92; collector B. P. Halder and party; 8 exs., Santipur, 2 kms N. E. of Pacherthal, N. Tripura; 20.iv.92; collector B. P. Halder and party. 7 exs., Pachmora, 2 kms S. E. of Pacherthal, N. Tripura; 21.iv.92 collector B. P. Halder and party 12 exs., Kamalpur, 9 kms N. W. of Pacherthal, N. Tripura; 22.iv.92; collector B. P. Halder and party. 7 exs., Santinagar, 4 kms E. of Pacherthal, N. Tripura; 23.iv.92; collector B. P. Halder and party. 8 exs.; Narayanpur, 4 kms E. of Pacherthal, N. Tripura; 24.iv.92 ; collector B. P. Halder and party. 2 exs., South Pulinpur, 8 kms W. of Teliamora, N. Tripura; 27.iv.92; collector B. P. Halder and party. 3 exs.; Champaknagar, 29 kms from Teliamora, W. Tripura; 28.iv.92; collector B. P. Halder and party.

Diagnosis : Larger form about 50 mm long, dorsum convex and venter flattened; colour brown but the mid-dorsal field paler with three dorsal black stripes of which median narrower,

sometimes broken; third and fourth pair of eyes separated by a complete annulus ; prehensile papilla absent.

Host and habitat : It is found in the damp places under bricks and stones or buried in the moist soil. It is also found in the vicinity of water and sometimes enters water voluntarily. It swims well. It attacks man and domestic animals.

Distribution : INDIA : Tripura-East, West and North districts, Andaman Is., Arunachal Pradesh, Assam, Meghalaya, Sikkim, Uttar Pradesh and W. Bengal.

Elsewhere : Borneo, Myanmar, Java and Sumatra.

SUMMARY

The present account deals with five species and one subspecies from Tripura. All of the species are recorded for the first time from the area. The diagnostic characters of leeches of this state have been provided. Hosts, habitats and distribution of all species have been mentioned.

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FRESHWATER OLIGOCHAETA

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INTRODUCTION

Freshwater Oligochaeta comprising three distinct families of the phylum Annelida are a group of worms inhabiting ponds, lakes, streams and even drains and all places where there is water throughout the year stagnant or flowing. In warm atmosphere they are found swimming on the water surface with characteristic wriggling movement or adhering to submerged vegetation or living in underwater mud sometimes forming tubes around their bodies. In colder months they apparently disappear from the surface and lie inside mud or hide themselves within the bark of submerged weeds. In size they range from microscopic to about 200 mm., pale red to deep brown in colour, slender to relatively robust in appearance. Some of these forms are provided with specialised organelles called gills or branchiae arranged either serially a pair per segment at the anterior or middle portion of body or in a hollow depression or branchial fossa at the hind end of their bodies with variable number of gills. The most constant and dependable character identifiable even in the preserved state are the locomotor organelles or setae which are of various morphological patterns as regards shape, size, number and of immense taxonomical importance for the determination of genera and species.

Our knowledge of the systematics of freshwater oligochaeta of India is derived from the pioneer work of Annandale (1905-1906), Stephenson (1907-1925), Aiyar (1926-1930), Naidu (1962-1966), and Mukhopadhyay (in press). As a result 67 species under 20 genera and 3 families have so far been recorded from India. This figure however does not include any species from the State of Tripura. The present material collected

from the State of Tripura reveals the occurrence of 7 species, all constitute new records from the area and of them one species is reported for the first time from the Indian Sub-Continent.

MATERIAL AND METHOD

Collection : Geographically Tripura is hilly, plain landscape studded with fertile valleys. Plain land is fertile for cultivation having ponds and lakes in good number and atmosphere is humid with good rainfall and hence freshwater habitat are abundant here. Collection of specimens lying in surface stratum of water was made with an excess quantity of water and then sorting out the specimens with the help of a pipette and bent needle. Those living in mud and silt are collected along with the underwater soil and subsequently washing the specimens out; those living among the weeds and algal masses are collected along with the substratum and then sorting them out with the help of a wide mouthed pipette on a white based enamel tray.

Preservation : The most suitable method of preservation of these delicate soft bodied specimens is to put them directly into 4% formalin solution. Narcotisation before preservation with gradually increasing dose of alcohol help only to disintegrate these soft specimens and therefore, this procedure is usually avoided, which however, can be of some help only for the relatively robust specimens of the family Tubificidae. Preservation with formalin brings about some degree of opacity in dermal structure but this is usually overcome during studies by bleaching the specimens with some weak bleaching agent. Study of these preserved specimens are done with the help of glycerine under cover glass.

Study : The best result of study is obtained by examining the specimens in living condition whenever opportunity permits. In the laboratory preserved material is treated with glycerine before study to bring about some degree of transparency of specimens. During the process of study the setae are examined in minutest details, besides the prostomium, sexual organs, position of nephridia, blood vessels, branchial organs, etc. For detailed study of setae the material is to be placed under oil immersion lens.

MORPHOLOGY AND TERMINOLOGY

Prostomium : Anterior part of the body above the mouth opening. It may be conical, rounded, semicircular, triangular or sharply or bluntly pointed and may even be extended in the form of a whip-like proboscis.

Setae : These constitute the organ of locomotion. As a rule these are arranged in dorsal and ventral bundles, one pair in each segment lying mid-dorsally and mid-ventrally. These are usually microscopic with varying shape and size and are of highest taxonomic importance.

Dorsal bundle : Constituted of dorsal setae which are of three kinds, viz. hairs, needles and crotchets.

Hair : Slender, elongated and look like an individual hair.

Needle : Short, broad, tip simple pointed or bifid or pectinate-with or without a median swelling called the nodulus; the body of the shaft is sometimes bent in the form of a sickle.

Crotchets : These resemble simple or double pointed hooks; when double the teeth may be equal or unequal, pointed, blunt or pectinate.

Ventral bundle : The setae are characteristically double pointed and hook-like with a median nodulus placed at different position of the body. In appearance these resemble the English letter 'f' usually begin from the 2nd segment and the number per bundle is greater than in the dorsal ones.

Branchiae of gills : Specialised organelles for gaseous exchanges and present only in a few genera. These may be simple extensions of the body arranged serially on the middorsal line on the body, each having a loop of blood vessel (*Branchiodrilus*) or leaf-like expansion of the hind end of the body in a separate hollow area or the branchial fossa (*Dero*), sometimes guarded by a pair of lateral extensions or palps (*Aulophorus*).

Pharynx : A dilatation of the dorsal part of the foregut extending from the IInd to the Vth segment surrounded by the pharyngeal glands.

Stomach : Dilatation of the digestive tube behind the oesophagus.

Nephridium : Specialised convoluted tube having external opening for the purpose of excretion, a pair per segment beginning from the VIIth.

Clitellum : A protective band in the skin overlying the reproductive organ situated approximately in the segment Vth -VIIIth. containing glandular and supporting cells.

Testes : Lie attached to the posterior phase of the septum 4/5 on each side of the ventral nerve cord.

Ovaries : Small structures similarly attached to the sides of the nerve cord and to the septum in front.

Pineal setae : These are newly formed structures in the immediate vicinity of the atrial duct and develop after the disappearance of the ventral setae of the atrial segment.

List of Freshwater oligochaeta from Tripura

Class OLIGOCHAETA

Order HAPLOTAXIDA

Family I NAIDIDAE

Sub-family A NAIDINAE

Genus 1. *Homochaeta* Bretscher, 1896

(1) *Homochaeta naidina* Bretscher, 1896

Genus 2. *Branchiodrilus* Michaelsen, 1900

- (2)
- Branchiodrilus semperi*
- (Bourne, 1890)

Genus 3. *Dero* Oken, 1815

- (3)
- Dero cooperi*
- Stephenson, 1932

- (4)
- Dero indica*
- Naidu, 1962

- (5)
- Dero zeylanica*
- Stephenson, 1913

Sub-family B PRISTININAE

Genus 4. *Pristina* Ehrenberg, 1828

- (6)
- Pristina menoni*
- (Aiyar, 1929)

Family II TUBIFICIDAE

Genus 5. *Limnodrilus* Claparede, 1862

- (7)
- Limnodrilus hoffmeisteri*
- Claparede, 1862

Key to the families

Size small, hair setae present in dorsal bundles; occurrence of asexual reproduction; testes in Vth or VIth and ovaries in VIth or VIIth segment NAIDIDAE

Size large; hair setae absent in dorsal bundles; absence of asexual reproduction; testes in Xth and ovaries in XIth segment TUBIFICIDAE

Family I. NAIDIDAE

Diagnosis : Prostomium usually present, sometimes forming a mobile proboscis; ventral setae beginning in IInd segment and composed of a variable number of double, sometimes single pointed crotchets; dorsal setae sometimes absent, when present beginning from IInd, IIIrd, IVth, Vth and VIth segment and consisting of a variable number of hair and needle setae of different shapes or needle setae only; nephridia Open; clitellum in the region of gonads; pineal setae often present; asexual reproduction by budding or fragmentation.

Distribution : Europe; Pakistan; Tibet; Ceylon; North and South America.

Remarks : It is the biggest family of aquatic oligochaeta having 12 genera in India, of them four are represented in Tripura.

Key to the sub-families

Dorsal setae beginning from IInd to VIth segment; hair setae sometimes absent; 5 segments formed at anterior end by budding NAIDIANE

Dorsal setae beginning from IInd segment only; hair setae always present; 7 segments formed at anterior end by budding PRISTININAE

Subfamily NAIDINAE

Diagnosis : Hair setae present or absent; dorsally needle setae of Various kinds; pharynx with dorsal diverticulum; pharyngeal, oesophageal or septal glands present; nephridia open; testes and spermathecae in Vth, and ovaries and atria in VIth segment.

Key to the genera

1. Dorsal setae beginning from IInd Segment; branchiae absent*Homochaeta* Bretscher
- Dorsal setae beginning from VIth segment; branchiae present 2

2. Branchiae in a hollow area at the hind end of the body; foliaceous*Dero/Oken*

Branchiae arranged serially along the dorsolateral sides of body, a pair in each segment beginning from the IInd.*Branchiodrilus* Michaelsen

Genus 1. *Homochaeta* Bretscher

1896. *Homochaeta* Bretscher Rev. Suisse Zool., 3 : 449

1879. *Homochaeta* : Brinkhurst & Cook, in Aquatic oligochaete Biology : 87.

Type species : *Homochaeta naidina* Bretscher.

Diagnosis : Eyes absent; dorsal setae start from II, consisting of crotchets of similar shape; ventral setae are similar to those of the dorsal ones; vascular commissures may be simple or in the form of network in the anterior segments; penial setae present.

(1) *Homochaeta naidina* Bretscher, 1896

1896. *Homochaeta naidina* Bretscher, *Rev. Suisse. Zool.*, 3 : 508.

1952. *Homochaeta naidina* : Sperber, *Zool. Bidr. Uppsala*, 29 : 57.

Material : 1 ex., Dakshin Pulipur, Off Teliamura, West Tripura, 27. iv. 1992, B. P. Halder.

Diagnosis : Prostomium elongated, pointed; anterior part of body pigmented; dorsal setae beginning in the IInd segment, segment II-V having 5-6 per bundle, longer and more slender than the rest, in other dorsal segments and all ventral segments 3-5 per bundle with equally long prongs; stomach in segment VIII ; transverse vessels in I + V form a capillary network.

Habitat : Freshwater lakes.

Distribution : India : Tripura-West Tripura district.

Elsewhere : Switzerland; Japan.

Genus 2. *Dero* Oken, 1815

1815. *Dero* Oken, *Lehrbuch der Naturgeschichte*, 3 Zoologie 1, Fleischlose Thiere, Leipzig.

(In press) *Dero* : Mukhopadhyay, In : *State Fauna Series*, 3 : *Fauna of West Bengal* : Part 11.

Type species : *Dero digitata* (Muller)

Diagnosis : Eyes absent; dorsal setae beginning from IVth, Vth or VIth segment, consisting of hairs and double pointed, pectinate or palmet needles; ventral setae of IInd to Vth segment different from the rest, having the distal teeth longer than the proximal but equally thick compared to equally long or short but thinner in the later; pharynx extend from IInd to VIth segment and have pharyngeal glands; tube dwellers.

Distribution : Africa; Europe; China; Palestine; Pakistan; Turkestan; India; Ceylon; North and South America; West Indies.

Subgenus *Dero* Oken, 1815

1815. *Dero* Oken, *Lehrbuch der Naturgeschichte* 3, Zoologie 1 : Fleischlose Thiere, Leipzig.

Subgeneric type : *Dero digitata* (Muller)

Diagnosis : Dorsal setae from IV or VI; ventral setae of II - V as a rule sharply differentiated from those following; no palp; no penial setae; budding occurs; usually in fixed tubes.

2. *Dero cooperi* Stephenson, 1932

1932. *Dero cooperi* Stephenson, *Proc. zool. Soc. London*, 1932 (1-2) : 231-233, fig. 1, 2-5.

(In press) *Dero cooperi* : Mukhopadhyay, In : *State Fauna Series*, 3 : *Fauna of West Bengal* : Part 11.

Material : 1 ex., Dakshin Nayapara, Dharamnagar, North Tripura, 15. iv. 1992, B. P. Halder.

Diagnosis : Size small, 10 mm; pale red in colour; prostomium bears sensory hairs; dorsal setae beginning from VI onwards having 1 hair and 1 needle per bundle; hairs bayonet shaped, needles bifid, teeth short; ventral setae 4 per bundle with distal nodulus and short teeth, proximal prong thicker and longer than distal; ventral setae from II -V, 3-5 per bundle, longer, nodulus median and distal tooth 1½ times longer than proximal; branchial fossa with posterior prolongation; gills 4 pairs, dorsal pair foremost and the smallest, the hindmost pair leaf-like, the second and the third pair thicker than the rest; clitellum covers Vth to VIIth segment; nephridium starts from VIIth segment.

Habitat : Live in tubes with mucus, sand and mud; swim with spiral movement.

Distribution : India : Tripura-North Tripura district; West Bengal, Andhra Pradesh; Karnataka; Uttar Pradesh.

Elsewhere : Abyssinia; Pakistan.

3. *Dero indica* Naidu, 1962

1962. *Dero indica* Naidu, *J. Bombay nat. Hist. Soc.*, 59 (1) : 533-536, fig. 14 (A-G).

(In press) *Dero indica* : Mukhopadhyay, In : *State Fauna Series*, 3 : *Fauna of West Bengal* : Part 11.

Material : 5 exs., Dakshin Pulipur, West of Teliamura, West Tripura, 27. iv. 1992, B.P. Halder.

Diagnosis : Size 15-20 mm; whitish red; prostomium bluntly triangular with sensory hairs; dorsal setae beginning from VIth with 2 hairs and 2 needles per bundle in anterior half segments while 1 of each in the remaining posterior segments; hairs bayonet and sickle shaped; needles bifid with distal nodulus and teeth unequal, the outer prong being longer; ventral setae 3-4 per bundle, bifid crotchets, teeth unequal having distal prong thicker and slightly longer, nodulus distal; ventral setae of IIInd to Vth segment longer, and straighter; branchial organ funnel shaped; gills 4 pairs, broad; nephridium starts in VIIth segment; budding zones clear.

Habitat : Live in soft mud with other species of *Dero*, *Branchiodrilus semperi* and *Limnodrilus hoffmeisteri*.

Distribution : India : Tripura—West Tripura and North Tripura Districts; Andhra Pradesh; Karnataka; West Bengal.

4. *Dero zeylanica* Stephenson, 1913

1913. *Dero zeylanica* Stephenson, *Spolia zeylan*, Colombo, 8 : 252-256.

(In press) *Dero seylanica* : Mukhopadhyay, In : *State Fauna Series*, 3 : *Fauna of West Bengal* : Part 11.

Material : 2 exs., Dakshin Nayapara, Dharmanagar, North Tripura, 15. iv. 1992, B. P. Haldar.

Diagnosis : Size small, 8-10 mm, light brown; prostomium rounded; dorsal setae beginning from VIth segment, having 2 hairs and 2 needles in each bundle or 3, 2 or 1 of each in anterior, middle and posterior segments respectively; hairs long bayonet shaped, needles bifid, with distal nodulus, ventral setae all bifid crotchets, 4-6 per bundle, thinner and straighter with median nodulus and teeth diverging; branchial organ having flat anterior and posterior margin and 4 pairs of foliate gills, dorsally and ventrally one pair each and 2 pairs laterally; nephridium begins from VIIth segments; clitellum covers Vth - VIIth segment.

Habitat : Soft mud of ponds and lakes, live with other Naid s; rarely in tubes; swim by slow spiral movement.

Distribution : India : Tripura—North Tripura district; West Bengal, Andhra Pradesh; Kerala; Karnataka.

Elsewhere : Ceylon.

Genus 3. *Branchiodrilus* Michaelsen, 1900

1890. *Chaetobranchnus* Bourne, *Quat. J. micro Sci.*, (N.S.), 31 : 83.

1900. *Branchiodrilus* Michaelsen, *Das Tierreich*, 10 : 24.

(In press) *Branchiodrilus* : Mukhopadhyay, In : *State Fauna Series*, 3 : *Fauna of West Bengal* : Part 11.

Diagnosis : Prostomium rounded; paired branchial process dorsolaterally placed on many or most of the body segments beginning immediately after anterior end of body; dorsal setae and gills begin from the same segment and consist of hairs and needles, ventral setae of bifid crotchets; no penial setae.

Distribution : Pakistan and India.

Type species : *Branchiodrilus semperi* (Bourne)

5. *Branchiodrilus semperi* (Bourne)

1890. *Chaetobranchnus semperi* Bourne, *Quat. J. micro. Sci.* (N.S.) : 31 : 83.

1900. *Branchidrilus semperi* Michaelsen, *Das Tierreich*, 10 : 24.

(In press) *Branchidrilus semperi* : Mukhopadhyay, In : *State Fauna Series*, 3 : *Fauna of West Bengal* : Part 11.

Material : 1 ex., Dakshin Nayapara, Dharmanagar, North Tripura 15. iv. 1992, B. P. Haldar; 1 ex., Shibpara, Dharmanagar, North Tripura, 26. iv. 1992, B. P. Haldar; 3 exs., Kalitilla, 4 km east of Teliamura, West Tripura, 26. iv. 1992, B. P. Haldar.

Distribution : Size moderate, 30-40 mm; segments 70-80; anterior part of body with transverse chocolate-brown pigmented bands; prostomium bluntly triangular, gills arranged dorsolaterally, one pair in each of the first 40-50 segments beginning from IIInd, first five or six pairs smaller, gradually increasing in length after the 20th segment, further back from 30th or so, again decreasing steadily till they are reduced to

mere warts only; largest gill measuring several times the diameter of the body; gills are hollow projections of body wall, having a loop of dorsal blood vessel; dorsal setae enclosed within the gills and beginning from IIInd segment, consisting of hairs and needles, two or three of each in a bundle; ventral setae starting from IIInd segment, 4-6 per bundle, bifid crotchets, outer prongs of which being twice the length of the inner while in hind segments the inner being twice the length of the outer; nephridium begins in XIIth segment; budding zones apparent.

Habitat : Live in mud, not swimming usually, found along with other species of the genus and the species of the genus *Dero*.

Distribution : *India* : Tripura—North Tripura district and West Tripura District; West Bengal; Andhra Pradesh and Tamil Nadu.

Subfamily B. PRISTININAE Lastockin, 1924

Diagnosis : Prostomium sometimes form a proboscis; eyes absent; dorsal setae usually beginning in IIInd; pharyngeal and septal glands present; testes and spermathecae in VII; ovaries and atria in VIII; seven segments formed at anterior end by budding.

Genus 4 *Pristina* Ehrenberg, 1828

1828. *Pristina* Ehrenberg, *Phytozoa*, Berlin : 112.

(In press) *Pristina* : Mukhopadhyay, In : *State Fauna Series*, 3 : *Fauna of West Bengal* : Part 11.

Type species : *Pristina longiseta longiseta* Ehrenberg, 1828

Diagnosis : Prostomium may form a proboscis; dorsal setae beginning from IIInd, IIIrd and IVth segment and consisting of hairs and needles with simple or bifid tip; ventral setae all bifid crotchets; septa well developed; nephridium beginning from Xth segment; budding zones present.

Distribution : South Africa; Europe; Pakistan; Russia; Turkistan; India; Japan; Sumatra; Australia; North and South America.

6. *Pristina menoni* (Aiyar) 1929

1029. *Naidum menoni* Aiyar, *Rec. Ind. Mus.*, 31 : 21-23.

1948. *Pristina menoni* : Sperber, *Zool. Bidr. Uppsala*, 28 : 213

Pristina menoni : Persia, In : *Aquatic Ologochaete biology*, Brinkhurst and Cook (Eds.) : 97.

Material : 2 exs., Kamalpur, 9 km NW of Pechar thal N, Tripura 22.iv 1992 B.P. Haldar.

Diagnosis : Size 6-8 mm; colour white, fairly opaque; prostomium smooth with rounded anterior margin and sensory hairs; no proboscis; dorsal setae consisting of one hair and one needle or two hairs and one needle per bundle; needles single pointed, distal half bayonet or sigmoid shaped; both needles and hairs of segments IIInd and IIIrd shorter; ventral setae 2-5 per bundle, beginning from IIInd segment, stout, crotchet shaped, those of anterior segments having the outer prongs longer than the inner but are of equal from segments X onwards; nodulus distal but median in segment II; nephridium begins from segment IX.

Habitat : Freshwater, live among water plants and algal masses.

Distribution : *India* : Triupra-North Tripura district; Kerala.

Elsewhere : South America.

Family II TUBIFICIDAE

Diagnosis : Moderate to large in size, length may extend up to 200 mm; pale to deep red in colour; muscular; both dorsal and ventral setae starting from segment II, dorsal setae either bifid or pectinate; setal number varying; asexual reproduction does not occur.

Distribution : Tibet; China; India; Japan; Malay; North and South America.

Genus 5. *Limnodrilus* Claparede, 1862

1862. *Limnodrilus* Claparede, *Men. Soc. Phys. Hist. nat. Geneve*, 16 : 248, pt. I. figs. 1-3, pl. II, fig. 2, pl. IV, fig. 6.

(In press) *Limnodrilus* : Mukhopadhyay, In : *State Fauna Series*, 3 : *Fauna of West Bengal* : Part 11.

Type species *Limnodrilus hoffmeisteri* Claparede

Diagnosis : Both dorsal and ventral bundle of setae consisting of bifid crotchets of same type ;

no hair setae; posterior part of body having a vascular plexus; testes in X and ovaries in XI segments.

Distribution : Pakistan; Tibet; Ceylon; India; Japan; North America.

7. *Limnodrilus hoffmeisteri* Claparede, 1862

1862. *Limnodrilus hoffmeisteri* Claparede, *Mem. Soc. Phys. Hist. nat. Geneve*, **16** : 248-252.

1912. *Limnodrilus socialis* stephenson, *Men. Asiat. Soc. Bengal*, **6** : 93 pl. IV, fig. 6-7.

(In press) *Limnodrilus hoffmeisteri* : Mukhopadhyay, In : *State Fauna Series*, **3** : *Fauna of West Bengal* : Part 11.

Material : 5 exs. Kolutila, 4 km. east of Teliamura, West Tripura, 26.iv.1992, B. P. Haldar.

Diagnosis : Size large, 80-100 mm; brown anteriorly, lighter back and tail end almost white; posterior part whip like, branchial in function; both dorsal and ventral setae start from IInd segment, bifid crotchets with equally long teeth; dorsal bundles having 5-7 in anterior 3-5 in the

middle and 1-2 in the hind segments, thinner and shorter than ventral ones; clitellum opaque white; nephridium starting between VIIth and IXth segments.

Habitat : Live generally in soft clay and mud with silt in clear, turbid even foul water along with *Branchiura sowerbyi* in huge aggregation waving the tail ends.

Distribution : *India* : Tripura—West Tripura district; West Bengal; Meghalaya; Andhra Pradesh; Karnataka.

Elsewhere : Europe; Pakistan; Turkey; China; Java; Japan; Malay; North and South America.

SUMMARY

The paper deals with diagnosis, distribution and key for identification of 6 species of freshwater oligochaeta collected from different localities of the state of Tripura. It also furnishes a list of freshwater oligochaeta hitherto known from the Indian sub-continent.

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OLIGOCHAETA : EARTHWORM

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INTRODUCTION

The earthworms are elongated, soft bodied, metamerically segmented, bilaterally symmetrical, coelomate invertebrates. They are popularly known as friends of the farmers as they play an important role in enhancing the fertility of the soil. At present the global earthworm fauna comprises about 3300 species. They live in all types of soil where there is sufficient food and moisture. They move with the help of setae present in all segments excepting the first and the last ones. Their respiration takes place by the gaseous exchange through their moist skin. They are hermaphrodite and the fertilisation of their ova is external in the cocoons formed by the materials secreted from their clitellum.

Systematic studies on the earthworms were initiated in the eighteenth century by Linnaeus who erected the genus *Lumbricus* in 1758. Taxonomy of earthworms was flourished mostly by the contributions of the renowned scientists like Bahl, Baird, Beddard, Benham, Brinkhurst, Cernosvitov, Chen, Cognetti de Martis, Easton, Eisen, Fedarb, Fletcher, Gates, Grube, Hatai, Horst, Jamieson, Julka, Kinberg, Kobayashi, Lee, Michaelsen, Ohfuchi, Omodeo, Orley, Perrier, Pickford, Rosa, Savigny, Schmarda, Sims, Stephenson, Templeton, Ude and Vaillant.

Templeton initiated the taxonomic studies on the earthworms of the Indian subcontinent in 1844 with the description of a new species, *Megascolex caeruleus* from Sri Lanka. *Moniligaster deshayesi* the first new species of earthworm of the Indian mainland was discovered by Perrier in 1872 from Kerala. Subsequently, our knowledge on the Indian earthworms was

enriched especially by the works of Michaelsen (1907, 1909), Stephenson (1914, 1921, 1923, 1924 a & b, 1925, 1926, 1931), Gates (1934, 1937 a & b, 1938 a & b, 1939 a & b, 1940 a & b, 1945 a, b & c, 1947, 1951, 1956, 1962, 1972), Julka (1975, 1976 a & b, 1977, 1978, 1981, 1983, 1988 a & b) and Soota and Julka (1970, 1972). At present 378 species under 65 genera and 10 families are so far known from India.

Extensive studies were made on the earthworms mainly from Arunachal Pradesh, Assam, Manipur, Meghalaya and Sikkim of north-east India by Stephenson (1914, 1921, 1923, 1924 a, 1925), Gates (1972), Julka (1976a, 1977, 1981, 1988 a & b), Julka and Halder (1975, 1977) and Soota and Halder (1977, 1981). But there is almost nothing to mention about the earthworm fauna of Tripura excepting the occurrence of an anonymous species of *Eutyphoeus* recorded by Chaudhuri and Nanda (1990).

In order to know the present state of earthworm fauna of Tripura, field surveys were undertaken by several parties of Zoological Survey of India in 1991 and 1992. The material collected during these surveys were worked out. As a result the earthworm fauna of Tripura is now known to be comprised 12 species placed in 9 genera and 6 families. All the species, 8 genera and 5 families are recorded for the first time from the state while out of them one species is new to India.

The keys for identification, the diagnostic characters and description of the families, genera and species of earthworms of this state have been provided. In addition, their statewide distribution in India has been summarised. Each of the genera and species has been provided with synonymy

along with type localities and repositories of types. Economic importance, habitats and castings of as many species as possible have also been included. A general account of morphology and terminology as well as the method of collection and preservation of earthworms has also been added. The classification proposed by Brinkhurst and Jamieson (1971) has been followed. For details of synonymy, origin, description and economic importance Stephenson (1923), Gates (1972), Julka and Senapati (1987) and Julka (1988b) may be consulted.

MORPHOLOGY AND TERMINOLOGY

A. External Characters

The elongated body of earthworm is divided into so many segments. The anterior most and the posterior most segments are called the *peristomium* and *periproct* respectively. The protuberance on the anterior and dorsal side of the peristomium is called the *prostomium*. In earthworms there are six types of prostomium, viz. *zygobous*, *prolobous*, *epilobous*, *proepilobous*, *tanylobous* and combined *pro-* and *epilobous*.

Dorsal pores are located in the intersegmental grooves along the mid-dorsal line of the body of most of the earthworms.

The setae are minute peg-like needles situated in each segment excepting the first and the last ones. There are two types of setal arrangement, viz. *lumbricine* and *perichaetine*. In the former eight setae are arranged in four pairs on the ventral surface of each segment while in the latter numerous setae are arranged in the form of ring around each segment.

Clitellum is an area consisting of some segments thickened and swollen by the tumescence of epidermal cells in the anterior portion of mature worms.

The genital apertures, viz. spermathecal pores, female pores, male pores and prostatic pores are located on the ventral side in the anterior part of the body. *Spermathecal pores*, the external openings of the spermathecae, are situated in

front of clitellum. The openings of the male ducts, female ducts and prostatic ducts are called the male pores, female pores and prostatic pores respectively. In *acanthodrilin* form the paired prostatic pores are present in XVII and XIX, and male pores in XVIII. In *balantin* form the prostatic and male pores are in XIX. In *microscolecina* form a pair of tubular prostates open to the exterior in XVII alone or combined with sperm ducts.

Genital markings, genital tumescences, tubercula pubertatis, etc. are formed by the modification of certain areas of the epidermis on the ventral surface of the body of some sexually mature worms. Their shape, number and location are variable.

The external openings of nephridial ducts are called the nephridiopores.

B. Internal Characters

Coelom is a large cavity extending from prostomium to periproct. It contains digestive, circulatory, excretory, sensory and reproductive organs. There are transverse partitions placed between successive segments in coelom and these are called *septa*.

(a) *Digestive System* : The alimentary canal which runs straight from mouth to anus is composed of buccal cavity, pharynx and oesophagus anteriorly, and intestine posteriorly.

The mouth leads into a small cavity called the *buccal cavity* which opens into a pear-shaped structure the *pharynx*. The pharynx opens into the *oesophagus* which may be modified at different levels to form *stomach*, *crop* and *gizzard*. In Megascolecidae the crop and the gizzard are situated in the anterior part of oesophagus just behind the pharynx while in Lumbricidae these are located in the anterior portion of intestine. In Moniligastridae there are mostly two to ten gizzards. Calciferous glands are the lateral or dorsal glandular swellings of posterior wall of oesophagus. The oesophagus leads to *intestine*. In most of earthworms there is a longitudinal fold called *typhlosole* which projects from mid-dorsal

wall of intestine. The pair of conical out-growths of intestine are known as *intestinal caeca*. *Rectum* the posterior portion of intestine opens outside through *anus*.

(b) *Circulatory system* : Three large *trunk vessels* run along the length of the body. One of them, the *dorsal vessel* is located along mid-dorsal line of the alimentary canal, other one the *ventral vessel* runs below the gut and third one the *subneural vessel* is placed beneath the nerve-cord. There are some short longitudinal vessels also. One of them the *supra-oesophageal vessel* runs towards anterior segments along the dorsal wall of gut. The other paired vessels, *extra-oesophageal vessels* and *latero-parietal vessel* are located anteriorly on the latero-ventral positions of the gut and laterally on the body wall respectively. Ventral vessel is connected with dorsal or supra-oesophageal or both by paired *commissural vessels* some of which are enlarged, contractile and provided with valves internally and are called the *hearts*. *Lateral hearts* open into dorsal vessels, *oesophageal hearts* into supra-oesophageal vessels and *latero-oesophageal hearts* into both dorsal and supra-oesophageal vessels.

(c) *Excretory system* : In earthworms excretory organs are known as nephridia. Nephridium is a long narrow tubule the middle portion of which is a tangled mass of ciliated tracts. The opening of the tubule into coelom dilates to form a ciliated funnel the *nephrostome*. The external opening of the nephridial duct is called *nephridiopore*. The nephridia occurring as a single pair in each segment are called *holonephridia* and in more than one pair in each segment are *meronephridia*. The nephridia may be either open (stomate) or closed (astomate). The ducts open to the exterior in *exonephric condition* and into the alimentary canal in *enteronephric condition*. The nephridia when enlarged are called *meganephridia* while *micronephridia* are small and occur in clusters.

In some anterior segments of some species there are *tufted nephridia* which may be of three types, viz. (1) the holonephridia which are

incompletely branched into a number of micronephridium-like lobes with single duct, with or without a funnel, (2) the nephridia in which the terminal canals run together in a sheaf and (3) similar to (2) but with terminal ducts secondarily united to form a single duct.

(d) *Reproductive system* : The earthworm is hermaphrodite because of the presence of both male and female reproductive organs in the same individual.

Testes, testis sacs in confluence with seminal vessicles, vasa deferentia, prostate glands, accessory glands and male genital apertures are the male reproductive organs. *Testes* are digitate or finger-like processes. *Seminal funnels* placed opposite the testes are rosette-shaped enlargement of ental end of vasa deferentia with central aperture through which sperms pass in to the sperm ducts. The median pouch is enlarged on either side to form sacs called *seminal vesicles*. Seminal vesicles are lacking in moniligastrid worms. There are paired testes in X and XI in *holandry*, in X only in *proandry* and in XI only in *metandry*. The ducts which carry sperms from seminal funnels to the exterior are called *vasa deferentia* or *sperm ducts*. In *holandric* form two sperm ducts of each side—one from the anterior pouch and the other from the posterior one, run side by side towards posterior direction to open into the *male genital aperture* or *male pore* of that side. In *proandric* and *metandric* forms the single sperm duct of each side opens into the male pore of the corresponding side. There are some glands commonly associated with sperm ducts of both sides. These are called the *prostate glands*. In Acanthodrilidae, Ocnerodrilidae and Octochaetidae prostates are tubular with a central canal and of ectodermal origin while in Megascolecidae prostates are racemose without a central canal and of mesodermal origin. In Moniligastridae the capsular prostate has an outer and an inner glandular layer and a middle muscular layer.

Spermathecae, ovaries, oviducts and female genital apertures are the female reproductive organs. *Spermathecae* are the pouches located in

antero-ventral region of the coelom. Sperms received from copulatory partner during matting are stored in these pouches for fertilisation of eggs. The external opening of the spermathecal duct is called spermathecal pore. There may be *diverticulum* an outgrowth of the spermathecal duct. Paired *ovaries* enclosed in paired *ovisacs* are generally situated posterior to testis segments. The duct that carries ova from ovary is called *oviduct*. Anteriorly the oviduct of each side forms a funnel called *oviductal funnel* which faces the ovary of the corresponding side. The oviduct of each side runs towards posterior direction to open into the female genital aperture or female pore. Occasionally two oviducts unite to form a *common oviduct* and open into a single female pore. There are paired ovaries, in XII and XIII in *hologyny*, in XII only in *progyny* and in XIII only in *metagyny*.

METHOD OF COLLECTION AND PRESERVATION

The best method for collection of earthworms is by digging the soil with some suitable equipments like shovel or spade. Care should be taken so that the specimens are not damaged. Collections should be made from various ecological niches, such as, different types of soil, grass lands, pastures, forests, agricultural fields, gardens, manure heaps, litter, kitchen drainage, margins of fresh-water bodies, etc.

The living worms are dropped in a vessel containing 70% alcohol. When the worms stop moving they are removed from alcohol and kept in straight position on a piece of blotting paper or any other absorbent paper. These straightened specimens along with the blotting paper are then transferred to a tray or any other flat bottomed container and covered with thin layer of cotton. Afterwards, 10-15% formalin is added slowly and the worms are kept soaked in it for a period of at least 24 hours. Then the worms are washed in fresh-water and preserved in 70% alcohol or 5-10% formalin. The specimens should be preserved in suitable-sized bottles along with labels containing all the collection data, such as, locality, altitude, habitat, name of collector and date of

collection. It may not be possible to follow this method in the fields due to lack of sufficient time. In that case, the worms may be directly preserved in 4-10% formalin depending upon their size.

ABBREVIATIONS

- a*, the first seta from mV on each side of a segment;
- A*, a meridian of longitude passing antero-posteriorly along *a* setal follicles;
- A A*, median space ventrally between the two *A* meridians;
- A B*, median space ventrally between *A* and *B* meridians;
- b*, the second seta from mV on each side of a segment;
- B*, a meridian of longitude passing antero-posteriorly along *b* setal follicles;
- B C*, median space ventrally between *B* and *C* meridians;
- c*, the third seta from mV on each side of a segment;
- C*, a meridian of longitude passing antero-posteriorly along *c* setal follicles;
- C*, circumference;
- C D*, median space ventrally between *C* and *D* meridians;
- d*, the fourth seta from mV on each side of a segment;
- D*, a meridian of longitude passing antero-posteriorly along *d* setal follicles;
- D D*, median space dorsally between the two *D* meridians;
- e,f,g*, etc., the fifth, sixth, seventh seta, etc., respectively from mV on each side of a segment;
- eg*, equatorial;
- I,II,III,IV*, etc., the first, second, third, fourth segment, etc., respectively;
- ibid.*; *ibidem*, in the same place.

m, mid. mB C, at the middle of B & C; mD, mid-dorsal;

mL, mid-lateral; mV, mid-ventral; mm, millimeters.

SYSTEMATIC ACCOUNT

I. Family GLOSSOSCOLECIDAE

1. Genus *Pontoscolex* Schmarda

- (1) *Pontoscolex corethrurus* (Müller)

II. Family MEGASCOLECIDAE

2. Genus *Kanchuria* Julka

- (2) *Kanchuria sumerianus* Julka

3. Genus *Lampito* Kinberg

- (3) *Lampito mauritii* Kinberg

4. Genus *Perionyx* Perrier

- (4) *Perionyx excavatus* Perrier

5. Genus *Polypheretima* Michaelsen

- (5) *Polypheretima elongata* (Perrier)

III. Family ALMIDAE

6. Genus *Glyphidrilus* Horst

- (6) *Glyphidrilus spelaeotes* Stephenson

- (7) *Glyphidrilus tuberosus* Stephenson

IV. Family MONILIGASTRIDAE

7. Genus *Drawida* Michaelsen

- (8) *Drawida nepalensis* Michaelsen

V. Family OCNERODRILIDAE

8. Genus *Gordiodrilus* Beddard

- (9) *Gordiodrilus elegans* morph *paski* Stephenson

VI. Family OCTOCHAETIDAE

9. Genus *Eutyphoeus* Michaelsen

- (10) *Eutyphoeus comillahnus* Michaelsen

- (11) *Eutyphoeus gammiei* (Beddard)

- (12) *Eutyphoeus orientalis* (Beddard)

Key to Families

1. Testes and male funnels intraseptal, male pores in 10/11 or 11/12 or 12/13 MONILIGASTRIDAE

Testes and male funnels interseptal, male pores posterior to 12/13 2

2. Prostates with muscular ducts generally present 3

Prostates with muscular ducts generally absent 5

3. Last pair of hearts in or in front of XI OCNERODRILIDAE

last pair of hearts behind XI 4

4. Prostates racemose MEGASCOLECIDAE

Prostates tubular OCTOCHAETIDAE

5. Extramural calciferous glands lacking ALMIDAE

Extramural calciferous glands present GLOSSOSCOLECIDAE

I. Family GLOSSOSCOLECIDAE

Diagnosis : Setae sigmoid, simply pointed. Dorsal pores lacking. Digestive system with one oesophageal gizzard in VI, paired extramural calciferous glands in some of VII XIV. Nephridia macroic, in intestinal region holoic. Spermathecae adiverticulate, testes and male funnels not intraseptal; male pores behind female pores; prostates absent.

Distribution : Central and South America, West Indies.

Remarks : This family is recorded here for the first time from Tripura and is represented by a single genus, *Pontoscolex*.

1. Genus *Pontoscolex* Schmarda

1861. *Pontoscolex* Schmarda, *Neue wirbellose Thiere, Leipzig*, 1 (2) : 11. (Type species, *Pontoscolex arenicola* Schmarda, 1861.)

1972. *Pontoscolex* : Gates, *Trans. Am. phil. Soc.*, 62 (7) : 53.

(In press) *Pontoscolex* : Halder, In : *State Fauna Series*, 3 : *Fauna of West Bengal*.

Diagnosis : Setae lumbricine. Male pores and tubercula pubertatis in clitellar region. Septa all present at least from 5/6. Digestive system with paired solid calciferous glands in VII-IX, a well developed typhlosole but without intestinal caeca and supra-intestinal glands. Metandric; seminal vesicles long, extending from XII back through several segments. Metagynous.

Distribution : Surinam, Guyana, Guatemala.

Remarks : The genus is represented in Tripura by a single species, *Pontoscolex corethrurus* which is widely distributed in the world.

(1) *Pontoscolex corethrurus* (Müller)

1856. *Lumbricus corethrurus* Müller, *Abhandl. Naturgesch. Ges. Halle*, 4 : 26. (Type loc.—Itajahy, Brazil; typus amissus.)

1897. *Pontoscolex corethrurus* : Michaelsen, *Mitt. Mus. Hamburg*, 14 : 247.

1982. *Pontoscolex corethrurus* : Julka, *Rec. zool. Surv. India*, 80 : 130.

(In press) *Pontoscolex corethrurus* : Halder, In : *State Fauna Series*, 3 : *Fauna of West Bengal*.

Material : 1 ex., Aglapur, 3 km from Dharmanagar, North Tripura, 13. iv. 1992; 1 ex., Panisagar, 14 km south of Dharmanagar, North Tripura, 15. iv. 1992; 37 exs., Nayapara, east of Dharmanagar, North Tripura, 16. iv. 1992; 1 ex., Jamaibari, 2 km from Teliamura town, West Tripura, 26. iv. 1992; 1 ex., Dakshin Pulipur, 4 km from Teliamura town, West Tripura, 27. iv. 1992; coll. B. P. Halder.

Diagnosis : Length 48-120 mm; diameter 2-6 mm. Segments 60-232. Prostomium lacking. Clitellum saddle-shaped, XV, XVI-XXI, XXII, XXIII; tubercula pubertatis between B C on XVIII, XIX-XX, XXI, XXII. Setae on I and II closely

paired, from III widely paired but with 'quincunx' arrangement at hinder end of body. Nephropores about at C. Spermathecal pores 3 pairs, minute at C on 6/7-8/9. Male pores paired, minute, probably on 20/21. Female pore minute, on left side at A B slightly in front of 14/15.

Gizzard in VI; intestinal origin in XIV or XV; typhlosole lamelliform. Last pair of hearts in XI. Seminal vesicles one pair in XII, rudimentary or small or large, extending back through 8-10 segments. Spermatheca club-shaped; duct, slender.

Habitats : Manure and compost heaps; humus and sandy soil; red and black soil; gardens; coconut plantations; under barks of trees; in rotting plantain trunks; under stones.

Economic Importance : This species was regarded as a pest when the friable and loose soil in plant benches of greenhouses in U.S.A. was found to become hard caused by their infestation. In Karnataka this species was reported to make the soil compact, hard and cloddy.

Distribution : INDIA : Tripura—North and West Tripura; Andaman and Nicobar Islands; Andhra Pradesh; Gujarat; Karnataka; Kerala; Maharashtra; Tamil Nadu; West Bengal.

Outside INDIA : Africa, Madagascar and its adjacent islands; Iran, Pakistan; Sri Lanka, Burma, Thailand, Kampuchia, some islands in the Pacific Ocean; U.S.A., Mexico; West Indies, South America.

Remarks : This species is most widely distributed throughout the world. Though the original home of this species is South America it has successfully colonized in the Indian peninsular region.

II. Family MEGASCOLECIDAE

Diagnosis : Body cylindrical. Dorsal pores present. Male pores behind female pores. Spermathecae diverticulate, in front of testes segments; prostates racemose without central canals. Last pair of hearts behind XI. Nephridia holoic or meroic.

Distribution : Eastern U.S.S.R., Korea, Japan, Southern China to Australasia.

Remarks : For nomenclature and taxonomy of pheretimoid earthworms Sims & Easton (1972) was followed.

Key to Genera

- 1 Nephridia stomate PERIONYX
Nephridia astomate, at least in some parts of body 2
2. Gizzard in front of 7/8 3
Gizzard behind 7/8 POLYPHERETIMA
3. Setae perichaetine LAMPITO
Setae lumbricine KANCHURIA

2. Genus *Kanchuria* Julka

1988. *Kanchuria* Julka, *Bulletin (Science) of the Punjab University*, **39** (I-II) : 85. (Type species, *Kanchuria turaensis* Julka, 1998.)

(In press) *Kanchuria* : Halder, In : *State Fauna Series*, **4** : *Fauna of Meghalaya*.

Diagnosis : Setae lumbricine. Male pores paired, on XVIII; female pore(s) on XIV; prostates racemose, strap-shaped. Digestive system with a single oesophageal gizzard in V, 2 pairs of discrete extramural calciferous glands in XII and XIII, simple and lamelliform typhlosole but without intestinal caeca and supra-intestinal glands. Meronephric; astomate and stomate exonephric micromeronephridia present, megameronephridia absent.

Distribution : INDIA : Meghalaya; Tripura (present record).

Remarks : The genus is recorded here for the first time from Tripura and is represented by a single species, *K. sumerianus*.

(2) *Kanchuria sumerianus* Julka

1988. *Kanchuria sumerianus* Julka, *Bulletin (Science) of the Punjab University*, **39** (I-II) : 89. (Type loc.-Sumer nr. Shillong, E. Khasi Hills, Meghalaya, India; types in Zoological Survey of India, Calcutta and Solan.)

(In press) *Kanchuria sumerianus* : Halder, In : *State Fauna Series*, **4** : *Fauna of Meghalaya*.

Material : 9 exs., Suba Lake, Jupoi Hills, North Tripura, 5. iv. 1991; 6 exs., Fuldensei, Jupoi Hills, North Tripura, 5. iv. 1991; 9 exs., Vangmun, Jupoi Hills, North Tripura, 5. iv. 1991; 12 exs., Moharchhora, West Tripura, 21. iv. 1991; coll. T. Roy. 4 exs., Aglapur, 4 km from Dharmanagar, North Tripura, 13. iv. 1992; 6 exs., Dakshin Nayapara, Dharmanagar, North Tripura, 15. iv. 1992; 4 exs., Asarambari, West Tripura, 22. iv. 1992; 9 exs., Dakshin Pulinpur, 4 km from Teliamura, West Tripura, 27. iv. 1992; coll. B. P. Haldar.

Diagnosis : Length 77–162 mm; diameter 2–3 mm. Segments 147–269. Prostomium prolobic. Clitellum XIV–XVII. First dorsal pore at 10/11 or 11/12. Genital marking discrete, single, median, transversely oval, in 18/19, at B B. Spermathecal pores 2 pairs, large longitudinal slits, on posterior margins of VII and VIII, at A A. Male field slightly depressed on XVIII; male pores minute, paired at or slightly lateral to A lines, on setal arc of XVIII, at the anterior ends of seminal grooves, paired, straight, diagonally placed with posterior ends convergent to the single aperture of the genital marking. Female pores minute, paired, anteromedian to A.

Intestinal origin in XV. Last pair of hearts in XIII. Metandric; seminal vesicles in XII. Prostates in XVIII–XIX, XXI. Quadrithecal; ampulla tubular to ovoid, duct short and barrel-shaped; unidiverticulate; diverticulum lateral, ental, short and club-shaped.

Distribution : INDIA : Tripura–West and North Tripura; Meghalaya.

3. Genus *Lampito* Kinberg

1933. *Lampito* Kinberg, *Ofvers. K. Vetens. Akad. Forhandl. Stockholm*, **23** : 103. (Type species, *Lampito mauritii* Kinberg, 1866.)

(In press) *Lampito* : Halder, In : *State Fauna Series*, **3** : *Fauna of West Bengal*.

Diagnosis : Setae perichaetine. Dorsal pores present. Clitellum annular. Male pores (combined with prostatic pores) paired on XVIII. Female

pores paired on XIV. Septa all present from 4/5. Digestive system with a single oesophageal gizzard in V, calciferous lamellae in X-XIII, an intestinal oringin in region of XV-XVI and a typhlosole but without intestinal caeca and supra-intestinal glands. Meronephric. Spermathecae bidiverticulate, diverticulum digitiform, arising from lateral and median face of duct.

Distribution : INDIA : Palni and Cardomom Hills, S. India. One species, *Lampito muritii* is widely distributed throughout India and also in different parts of the world probably due to transportation.

Remarks : The genus is recorded here for the first time from Tripura and is represented by a single species, *Lampito mauritii*.

(3) *Lampito mauritii* Kinberg

1866. *Lampito mauritii* Kinberg, *Ofvers. K. Vetens. Akad. Forhandl. Stockholm*, **23** : 103. (Type loc. - Mauritius ; types in Naturhistoriska Riksmuseet, Stockholm.)
1883. *Perichaeta armata* Beddard, *Ann. Mag. nat. Hist. (ser.5)*, **12** : 216. (Type loc.—Calcutta, West Bengal, India ; typus amissus.)
1887. *Perichaeta divaginata* Bourne, *Proc. zool. Soc. Lond.*, **1886** : 666. (Type loc.—Salem, Tamil Nadu, India ; typus amissus.)
1887. *Perichaeta sulettensis* Bourne, *ibid.*, **1886** : 669. (Type loc.—Salem, Tamil Nadu, India ; typus amissus.)
1891. *Perichaeta madagascariensis* Michaelsen, *Arch. Naturgesch.*, **57** (1) : 227. (Type loc.—Madagascar ; types in Brit. Mus. (Nat. Hist.), London.)
1899. *Megascolex mauritii* : Michaelsen, *Ofvers. K. Vetens. Akad. Forhandle. Stockholm*, **56** : 441.
1909. *Lampito mauritii* : Michaelsen, *Mem. Indian. Mus.*, **1** : 179.
1914. *Lampito trilobata* Stephenson, *Rec. Indian Mus.*, **10** : 34. (Type loc.—Baroda, Gujarat, India ; types in Zoological Survey of India, Calcutta.)
1938. *Lampito mauritii* : Gates, *ibid.*, **40** : 413.

(In press) *Lampito mauritii* : Halder, In : *State Fauna Series*, **3** : *Fauna of West Bengal*.

Material : 10 exs. ; Panisagar, 14 km S. of Dharmanagar, North Tripura ; 15. iv. 1992 ; coll. B. P. Haldar.

Diagnosis : Length 95-155 mm ; diameter 3-6 mm. Segments 157-201. Prostomium epilobic, tongue closed. Clitellum annular, XIII, 1/2 XIII-XVII. Setae 40-51 on VIII, 30-43 on XX, 10-16 between spermathecal pores and none between male pores. First dorsal pore at 10/11-12/13. Genital markings absent. Spermathecal pores 3 pairs, large, in 6/7-8/9. Female pores paired, presetal within A A.

Septa 7/8-12/13 muscular. Intestinal origin in XV ; typhlosole rudimentary. Last pair of hearts in XIII. Holandric ; seminal vesicles in XI and XII. Prostates in XVIII ; duct straight. Penial setae with horseshoe-shaped or scoop-shaped tips, ornamentation of closely set circles of traingular teeth. Sexthecal ; ampulla elongated ; duct barrel-shaped.

Habitats : Sandy loam, loam, laterite soil in gardens, grass lands, lawns, crop fields, forests. Manure and compost heaps. Abundant in soil with high organic matter.

Castings : Castings are deposited on the surface of soil in the form of small heaps of spheroidal or nearly globular pellets.

Economic Importance : These worms may be used as waste conditioners and as biological agents for controlling plant parasites.

Distribution : INDIA : Tripura-North Trpura ; Andaman and Nicobar Islands ; Andhra Pradesh ; Bihar ; Gujarat ; Karnataka ; Kerala ; Laccadive and Minicoy Islands ; Madhya Pradesh ; Maharashtra, Orissa ; Rajasthan ; Tamil Nadu ; Uttar Pradesh ; West Bengal.

Outside INDIA : Zanzibar, Comoro Is., Madagascar, Seychelles Is., Mauritius ; Pakistan, China ; Maldives, Sri Lanka, Bangla Desh, Burma, Thailand, Malay Peninsula, Indonesia, Philippines, Hong Kong, New Caledonia.

Remarks : Though the original home of this species is assumed to be peninsular India, it is widely distributed throughout India. This species is recorded here in Tripura from North Tripura only.

4. Genus *Perionyx* Perrier

1872. *Perionyx* Perrier, *Nouv. Arch. Mus. Hist. nat. Paris*. 8 : 126. (Type species, *Perionyx excavatus* Perrier, 1872.)

(In press) *Perionyx* : Halder, In : *State Fauna Series*, 3 : *Fauna of West Bengal*.

Diagnosis : Setae perichaetine. Clitellum annular, setae retained. Female pore single, intracitellar and median. Male pores (combined with prostatic pores) on XVIII. Oesophagus without or with a small gizzard in V or VI; discrete calciferous glands, typhlosole, intestinal caeca and supra-intestinal glands absent. Holonephric. Biprostatic.

Distribution : India, Sri Lanka (?), Burma, Malayasia, Vietnam.

Remarks : The genus is endemic in India and is recorded here for the first time from Tripura also. The genus is represented from Tripura by a single species, *Perionyx excavatus*.

(4) *Perionyx excavatus* Perrier

1872. *Perionyx excavatus* Perrier, *Nouv. Arch. Mus. Hist. nat. Paris*, 8, 126, (Type loc.—Saigon, Vietnam; types in Museum National d' Histoire Naturelle, Paris.)

(In press) *Perionyx excavatus* : Halder, In : *State Fauna Series*, 3 : *Fauna of West Bengal*.

Material : 2 exs. ; Ramnagar, 6 km N. of Panisagar, North Tripura ; 18.iv.1992 ; coll. B.P. Halder.

Diagnosis : Length 30-180 mm ; diameter 3-7 mm. Segments 123-178. Prostomium epilobic, tongue open. Clitellum XIII-XVII. First dorsal pore at 2/3-5/6. Spermathecal pores 2 pairs, near mid-ventral line, in 7/8 and 8/9. Male pores on small papillae within a common male field.

Septa all present from 4/5. Gizzard absent or rudimentary in V ; oesophagus widened and moniliform in XIII and there with calciferous ridges; intestinal origin in XV or XVI. Last pair of hearts in XII. Holandric ; seminal vesicles in XI and XII. Prostates in XVIII ; duct straight. Penial setae 0.60-0.69 mm long, 15-25 μ thick, ornamentation of 6-16 circles of triangular spines

ectally, tip bluntly rounded or finely pointed or flattened and truncate. Quadrithecal ; spermathecae large ; duct short and stout, often with intramural seminal chambers of various sizes located near ental end of duct.

Habitats : Manure and compost heaps. Under logs, bricks and stones at the edge of freshwater bodies. Under barks of standing or fallen trees. In between the petioles of water hyacinths. Soil saturated with water from bathrooms and cook-houses. Dhobi compounds.

Castings : Castings are deposited on the surface of soil in the form of short threads or rods.

Economic Importance : This species may be used as waste conditioner. The worms may be cultured for utilisation of animal protein as poultry and fish food. They are known to be very much harmful for the potted plants.

Distribution : INDIA : Tripura-North Tripura ; Andaman Islands ; Arunachal Pradesh ; Assam ; Himachal Pradesh ; Maharashtra ; Manipur ; Meghalaya ; Orissa ; Sikkim ; Tamil Nadu ; Uttar Pradesh ; West Bengal.

Outside INDIA : Madagascar and its adjacent islands ; Sri Lanka, Burma, Thailand, Vietnam, Malay Peninsula, Indonesia, Philippines, Taiwan; West Indies.

Remarks : Though this species was originated in the Himalayas, it is widely distributed throughout India.

5. Genus *Polypheretima* Michaelsen

1934. *Pheretima* (*Polypheretima*) (part) Michaelsen, *Quart. J. microsc. Sci.*, 77 : 15. (Type species, *Perichaeta stelleri* Michaelsen, 1892.)

1979. *Polypheretima* : Easton, *Bull. Br. Mus. nat. Hist. (Zool.)*, 35 (1) : 28.

(In press) *Polypheretima* : Halder, In : *State Fauna Series*, 3 : *Fauna of West Bengal*.

Diagnosis : Body cylindrical. Setae perichaetine, never excessively crowded ventrally. Creeping sole absent. Clitellum annular, in XIV-XVI. Crescentic genital markings absent. First dorsal pore between 4/5 and 12/13.

Spermathecal pores small. Male pores on circular porophores. Oesophageal gizzard single, in VIII, intestinal gizzards and caeca absent. Usually holandric, occasionally metandric; spermathecae diverticulate, diverticulum simple and usually ectal in origin; ovaries in XIII.

Distribution : Autochthonous species have been recorded throughout the pheretima group domain except from New Britain, the Solomon Islands, New Hebrides, Caroline Islands and Marianas.

Remarks : The genus is recorded here for the first time from Tripura and is represented by a single species, *P. elongata*.

(5) *Polypheretima elongata* (Perrier)

1872. *Perichaeta elongata* Perrier, *Nouv. Arch. Mus. Hist. nat. Paris*, **8** : 124. (Type loc.—Peru; types in Museum National d' Histoire Naturelle, Paris.)

1875. *Perichaeta biserialis* Perrier, *C. r. hebd. Seanc. Acad. Sci. Paris (D)*, **81** : 1044.

1976. *Metapheretma elongata* : Easton, *Bull. Br. Mus. nat. Hist. (Zool.)*, **30** : 40.

1979. *Polypheretima elongata* : Easton, *ibid.*, **35** : 53.

(In press) *Polypheretima* : Halder, *In : State Fauna Series, 3 : Fauna of West Bengal*.

Material : 1 ex., Shanichara, 13 km from Dharmanagar, North Tripura, 14.iv.1992; 5 exs., Dakshin Nayapara, Dharmanagar, North Tripura, 15.iv.1992; coll. B.P. Halder.

Diagnosis : Length 75-300 mm; diameter 3-6 mm. Segments 136-297. Prostomium rudimentary or lacking. Setae 67-104 on VIII, 55-75 on XX, 13-17 between spermathecal pores and 7-15 between male pores. Genital markings transversely elliptical, paired, presetal on XIX and successive segments in line with or slightly median to male pores, occasionally on VI, VII and XVII. First dorsal pore at 12/13. Spermathecal pores, when present, minute and superficial. Female pore single, midventral, on XIV. Male pores paired, on squat penes within shallow copulatory pouches, ca. 1/4 C apart on XVIII.

Septa 8/9-9/10 absent. Intestinal origin in XV. Last pair of hearts in XIII. Holandric, seminal vesicles in XI and XII. Prostates in XVI-XXI;

ducts 2-6 mm long and looped. Polythecal; small spermathecal batteries in 5/6 and 6/7 or in 5/6 or in 6/7 only or absent; unidiverticulate; diverticulum arises from ectal end of duct, with longer stalk and ovoidal to ellipsoidal seminal chamber.

Habitats : Under compost, manure heaps and rubbish. Soils : red, black cotton, black tero.

Castings : Castings are deposited on soil surface in the form of cords of about 2 mm thickness and 20-40 mm length or in erregular piles, 10-20 mm high and 20-35 mm wide.

Economic Importance : In Karnataka this species was found to make the soil compact, hard and cloddy.

Distribution : INDIA : Tripura—North Tripura; Andaman and Nicobar Islands; Andhra Pradesh; Karnataka; Madhya Pradesh; Maharashtra; Tamil Nadu; West Bengal.

Outside INDIA : Africa, Madagascar, Comoro Island; Pakistan; Sri Lanka, Bangla Desh, Burma, Thailand, Malay Peninsula, Indonesia, Philippines, Taiwan; Australia, Papua New Guinea, New Britain, New Caledonia, Caroline Islands, Ryukyu Islands; Hawaii, Tahiti, West Indies, South America.

Remarks : The original home of this species is Borneo.

III. Family ALIMIDAE

Diagnosis : Body quadrangular at least posterior to clitellum. Dorsal pores absent. Oesophageal gizzard (s) anterior to testicular segments. Extramural calciferous glands absent. Holonephric. Male pores inconspicuous, one pair between XV-XXX; spermathecal pores inconspicuous, multiple, usually posterior to testes. Prostates usually absent.

Distribution : Africa, India, Sri Lanka, Burma, Malayasia, Indonesia, Costa Rica, Colombia, Ecuador, eastern Brazil.

Remarks : The family is recorded here for the first time from Tripura and is represented by a single genus, *Glyphidrilus*.

6. Genus *Glyphidrilus* Horst

1889. *Glyphidrilus* Horst, *Tijdschr. Nedlandsche Dierk. Ver.* 2, 2 : LXXVI. (Type species, *Glyphidrilus weberi* Horst, 1889.)

(In press) *Glyphidrilus* : Halder, In : *State Fauna Series*, 3 : *Fauna of West Bengal*.

Diagnosis : Setae lumbricine, Prostomium zygotobitic. Spermathecal pores at three or more intersegmental furrows. Male pores ventral to lateral protuberant ridges or 'wings' in clitellar segments. Digestive system with an oesophageal gizzard in VII or VIII, an intestinal origin behind XIV and a simple, lamelliform typhlosole but without calciferous glands, intestinal caeca and supra-intestinal glands. Nephridiopores at *B* lines, nephridia lacking anterior to XII. Holandric, seminal vesicles 4 pairs, in IX-XII. Polythecal.

Distribution : Tanzania, India, Sri Lanka, Burma, Hainan, Malaysia, Sumatra, Java, Borneo, Celebes.

Remarks : The genus is represented in Tripura by 2 species, *G. spelaeotes* and *G. tuberosus*.

Key to species

Gizzard in VII or mainly so *G. tuberosus*

Gizzard in VIII or mainly so ... *G. spelaeotes*

(6) *Glyphidrilus spelaeotes* Stephenson

1924. *Glyphidrilus spelaeotes* Stephenson, *Rec. Indian Mus.*, 26 : 133. (Type loc.—Siju Cave, E. Garo Hills, Meghalaya ; types in Zoological Survey of India, Calcutta.)

1972. *Glyphidrilus spelaeotes* : Gates, *Trans. Am. phil. Soc.*, 62 (7) : 237.

(In press) *Glyphidrilus spelaeotes* : Halder, In : *State Fauna Series*, 4 : *Fauna of Meghalaya*.

Material : 7 exs. ; Baruakandi, 5 km N. of Dharmanagar, North Tripura ; 14.iv.1992 ; coll. B.P. Halder.

Diagnosis : Length ca. 175 mm ; diameter 2-3 mm. Segments ca. 310. Clitellum XVI-XXX ; 'wings' in XVIII-XXIV, 1/2XXV. Genital markings, postsetal ; unpaired and median, in XI, XVII-XVIII ; paired in A A, of XIX, XXVII-

XXVIII, lateral to *B* in XIV-XVII and XXV. Spermathecal pores at 13/14-15/16, at A, B, C, D and in B C.

Gizzard in VIII ; intestinal origin in XV. Last pair of hearts in XI.

Distribution : INDIA : Tripura—North Tripura ; Meghalaya.

Remarks : This rare endemic species was so far known to occur from Meghalaya. It is now recorded here for the first time from Tripura also.

(7) *Glyphidrilus tuberosus* Stephenson

1916. *Glyphidrilus tuberosus* Stephenson, *Rec. Indian Mus.*, 12 : 349. (Type loc.—Cuttack, Orissa, India ; types in Zoological Survey of India, Calcutta.)

1987. *Glyphidrilus tuberosus* : Julka and Senapati, *Rec. zool. Surv. India, Occ. Paper* no. 92 : 6.

(In press) *Glyphidrilus tuberosus* : Halder, In : *State Fauna Series*, 3 : *Fauna of West Bengal*.

Material : 7 exs. ; Machmara, 2 km S. E. of Pacherthal, North Tripura ; 21.iv.1992 ; coll. B.P. Halder.

Diagnosis : Length 60-118 mm ; diameter 2.5-3 mm. Segments, ca. 221. Clitellum annular, XIV, XV, XVI-XXVIII, XXIX ; 'wings' XX-XXIV. Genital markings small, circular to elliptical tubercles, post setal, usually arranged in a set of 6 transverse rows on a segment—two in A A, one in A B, one slightly lateral to B on X-XII, XIII ; one median to A, one in AB and one lateral to B on XVI, XVII, XVIII-XIX, XXIV-XXVIII, XXX. Spermathecal pores minute, at 13/14-14/15. Female pores paired, minute, presetal, slightly lateral to B lines, on XIV.

Gizzard apparently in VII ; intestinal origin in XV. Last pair of hearts in XI. Holandric ; seminal vesicles 4 pairs in IX-XII. Spermathecae adiverticulate small spherical sacs, 2-4 on each side, in XIV and XV.

Habitats : Submerged soil with high organic matter. Clay soil at the edge of freshwater bodies and in low land crop fields.

Castings : Castings are deposited on soil

surface in the form of elongated threads of small tower-like structure.

Distribution : INDIA : Tripura–North Tripura ; Orissa ; Tamil Nadu ; West Bengal.

IV. Family MONILIGASTRIDAE

Diagnosis : Dorsal pores absent. Male pores at or close to 10/11 or 11/12 or 12/13. Spermathecal pores anterior to male pores. Digestive system with gizzards behind ovarian segment, an intestinal origin behind XVII but without calciferous glands, typhlosole and supra-intestinal glands. Holonephric.

Distribution : Southeast and eastern Asia, from South India to Manchuria, Korea, Japan, Philippines, Borneo, Sumatra.

Remarks : The family is recorded here for the first time from Tripura and is represented by the single genus, *Drawida*.

7. Genus *Drawida* Michaelsen

1900. *Drawida* Michaelsen, *Das Tierreich*, **10** : 114. (Type species : *Moniligaster barwelli* Beddard, 1886.)

(In press) *Drawida* : Halder, In : *State Fauna Series*, **3** : *Fauna of West Bengal*.

(In press) *Drawida* : Halder, In : *State Fauna Series*, **4** : *Fauna of Meghalaya*.

Diagnosis : Setae lumbricine. Spermathecal pores paired, at or close to 7/8. Male pores paired at or close to 10/11. Female pores paired, at or posterior to 11/12. Digestive system with one to several gizzards, in XII-XXVII but without intestinal caeca. Holonephridia present from III. Capsular prostates paired, in X.

Distribution : Siberia, China, Korea, Japan; India, Nepal, Burma, Malay Peninsula, Indonesia, Philippines, Borneo, Thailand.

Remarks : The genus is represented in Tripura by a single species, *D. nepalensis*.

(8) *Drawida nepalensis* Michaelsen

1907. *Drawida nepalensis* Michaelsen, *Mitt. Naturhist. Mus. Hamburg*, **24** : 146. (Type loc.—Gowchar near Katmandu, Nepal ; type in Zoological Survey of India, Calcutta.)

1909. *Drawida burchardi* : Michaelsen, *Mem. Indian Mus.*, **1** : 149.

1916. *Drawida jalpaigurensis* Stephenson, *Rec. Indian Mus.*, **12** : 307. (Type loc.—Teesta River, Jalpaiguri Dist., West Bengal, India ; types in Zoological Survey of India, Calcutta.)

1924. *Drawida troglodytes* Stephenson, *ibid.*, **26** : 129. (Type loc.—Siju Cave, Garo Hills, Meghalaya, India ; type in Zoological Survey of India, Calcutta.)

1926. *Drawida cacharensis* Stephenson, *ibid.*, **28** : 251. (Type loc.—Katlichera, S. Cachar, Assam ; types in Zoological Survey of India, Calcutta.)

1929. *Drawida nepalensis* : Stephenson, *ibid.*, **31** : 229.

(In press) *Drawida nepalensis* : Halder, In : *State Fauna Series*, **3** : *Fauna of West Bengal*.

Material : 1 ex. ; Asarambari, West Tripura ; 22.iv.1991 ; coll. T. Roy. 25 exs., Aglapur, 3 km from Dharmanagar, North Tripura, 13. iv. 1992 ; 53 exs., Sanichara, 13 km from Dharmanagar, North Tripura, 14.iv.1992 ; 49 exs., Baruakandi, 5 km N. of Dharmanagar, North Tripura, 14.iv.1992 ; 9 exs., Dakshin Nayapara, Dharmanagar, North Tripura, 15. iv. 1992 ; 12 exs., Panisagar, 14 km S. of Dharmanagar, North Tripura, 15. iv. 1992 ; 32 exs., Nayapara, 3 km E. of Dharmanagar, North Tripura, 16. iv. 1992 ; 35 exs., Ramnagar, 6 km N. of Panisagar, North Tripura, 18. iv. 1992 ; 35 exs., Debcherra, North Tripura, 21. iv. 1992 ; 1 ex., Kamalpur, 9 km N. W. of Pachertal, North Tripura, 22. iv. 1992 ; 7 exs., Panitilla, 12 km N. of Pachertal, North Tripura, 23. iv. 1992 ; 15 exs., Kumarghat, 10 km S. of Pachertal, North Tripura, 23. iv. 1992 ; 44 exs., Jamaibari, 2 km from Teliamura town, West Tripura, 26. iv. 1992 ; 7 exs., Dakshin Pulipur, 4 km from Teliamura, West Tripura, 27. iv. 1992 ; 25 exs., Golabari, W. of Teliamura, West Tripura, 28. iv. 1992 ; coll. B. P. Haldar.

Diagnosis : Length 78-130 mm ; diameter 4-5 mm. Segments 129-180. Clitellum IX-XIV. Setae A A = or slightly > or < B C, D D ca. = or slightly > $\frac{1}{2}$ C. Genital markings : one small, circular, translucent area lateral or anterior to each male porophore, another similar one on VII, just anterior to each spermathecal pore. Nephropores at or close to D. Spermathecal pores, small transverse slits, just median to C. Male pores paired, at or

median to m *B C*, in 10/11. Female pores paired, at 11/12.

Gizzards, 2-4, in XII-XX. Prostates glandular ; prostatic capsule 2-4 mm long, slenderly club-shaped ; diverticulum sac-like, 2-4 mm long in VII. Genital marking glands spheroidal.

Habitats : Soil in gardens, lawns and forests. Compost pits. Soil at base of bamboo clumps. Mud under water cress.

Distribution : INDIA : Tripura-North and West Tripura; Andaman & Nicobar Islands; Arunachal Pradesh; Assam; Bihar; Himachal Pradesh; Meghalaya; Punjab; Sikkim; Uttar Pradesh; West Bengal.

Outside INDIA : Pakistan; Nepal, Bangla Desh, Burma, Indonesia.

Remarks : This species was originated from the Himalayas and successfully colonized in various parts of India.

V. Family OCNERODRILIDAE

Diagnosis : Body cylindrical. Clitellum multilayered. Dorsal pores rarely present. Spermathecal, female and male pores in anteroposterior order. Digestive system with a short oesophagus but without intestinal caeca. Last pair of hearts in XI. Spermathecae in front of testis segments. Prostates tubular with central canal. Holonephric ; nephridia avesculate.

Distribution : Tropical and southern Africa, some islands in the Indian Ocean; South India and nearby areas ; tropical America.

Remarks : This family is recorded here for the first time from Tripura and is represented by the single genus, *Gordiodrilus*.

8. Genus *Gordiodrilus* Beddard

1892. *Gordiodrilus* Beddard, *Ann Mag. nat. Hist.* (ser. 6) 10 : 93. (Type species, *Gordiodrilus elegans* Beddard, 1892.)

(In press) *Gordiodrilus* : Halder, In : *State Fauna Series*, 3 : *Fauna of West Bengal*.

Diagnosis : Setae lumbicine and closely paired. Dorsal pores absent. Septa all present from 5/6.

Digestive system with a ventromedian calciferous gland in IX and an intestinal origin in XII but without gizzard, typhlosole and supra-intestinal gland. Nephropores inconspicuous, in or close to *C D*. Spermatheae adiverticulate.

Distribution : Tropical Africa. One species is transported to India, Burma, Dominica and perhaps non-tropical portions of Africa.

Remarks : The genus is represented in Tripura by a single species, *G. elegans* morph *paski*.

(9) *Gordiodrilus elegans* morph *paski* Stephenson

1928. *Gordiodrilus paski* stephenson, *Ann. Mag. nat. Hist.*, ser. 10. 1 : 1. [Type loc. Kigoma Harbour, Lake Tanganyika, Central Africa ; types in Brit. Mus. (Nat. Hist.), London.]

1982. *Gordiodrilus elegans* morph *paski* : Julka, *Rec. zool. Surv. India*, 80 : 149.

(In press) *Gordiodrilus elegans* morph *paski* : Halder, In : *State Fauna Series*, 3 : *Fauna of West Bengal*.

Material : I ex. ; Shanichara, 13 km from Dharmanagar, North Tripura ; 14. iv. 1992 ; coll. B. P. Halder.

Diagnosis : Length 35-47 mm; diameter 1-1.5 mm. Segments 80-98. Prostomium epilobic. Clitellum annular, XIII-XIX, XX. Setae *AB* = *CD*, *AA* < *BC*, *DD* = $\frac{1}{2}$ *C*. Spermathecal pores 2 pairs, in or near *B*, in 7/8 and 8/9. Female pores paired, just lateral to *B*, on XIV. Prostatic pores 2 pairs, on setal circle of XVII and XVIII, in *AB*, at the anterior and posterior ends of seminal grooves. Male pores one pair, in seminal grooves, at 17/18.

Holandric ; testis sacs in X and XI ; seminal vesicles in XII, occasionally in XI also. Quadriprostatic. Quadrithecal ; spermathecal duct slightly spindle shaped, longer than ampulla.

Distribution : INDIA : Tripura-North Tripura : Andaman Islands ; Karnataka ; Sikkim ; West Bengal.

Outside INDIA : Africa ; Burma ; West Indies.

Remarks : The original home of the species is tropical Africa. This is a very rare species in India.

VI. Family OCTOCHAETIDAE

Diagnosis : Dorsal pores present. Intestinal origin behind XIII. Last pair of hearts behind XI. Meronephric, nephridia present in preclitellar segments. Prostates tubular with central canal. Spermathecae in pretesticular segments, diverticulate. Ovaries in XIII.

Distribution : Tropical Africa ; India, Burma ; Australasia ; tropical America.

Remarks : The family is represented in Tripura by a single genus, *Eutyphoeus*.

9. Genus *Eutyphoeus* Michaelsen

1900. *Eutyphoeus* Michaelsen, *Das Tierreich*, **10** : 322. (Type species, *Typhoeus orientalis* Beddard, 1883.)

1988. *Eutyphoeus* : Julka, *Fauna of India. Megadrile Oligochaeta*, **1** : 128.

(In press) *Eutyphoeus* : Halder, In : *State Fauna Series*, **3** : *Fauna of West Bengal*.

Diagnosis : Setae lumbricine. Clitellum annular extending beyond XIV and XVI. Spermathecal pores one pair, superficial, in 7/8. Female pore (s) on XIV. Male pores paired, just posterior to prostatic pores, on XVII ; seminal grooves absent. Digestive system with a single oesophageal gizzard between 5/6 and 8/9, one pair of discrete intramural calciferous glands in XII, an intestinal origin in XV, a simple and lamelliform typhlosole, one pair of intestinal caeca and one pair of supra-intestinal glands. Last pair of hearts in XIII. Bithecal, spermatheca diverticulate.

Habitats : Grass lands. Humus soil of forests.

Castings : Castings are deposited on soil surface in the form of small towers.

Distribution : Pakistan ; India, Nepal, Bangla Desh, Burma, Vietnam.

Remarks : The genus is represented in Tripura by 3 species, *E. comillahnus*, *E. gammiei* and *E. orientalis*.

Key to Species

1. Avestibulate *E. comillahnus*
- Vestibulate 2

2. Uninvestibulate *E. gammiei*
- Bivestibulate *E. orientalis*

(10) *Eutyphoeus comillahnus* Michaelsen

1907. *Eutyphoeus comillahnus* Michaelsen, *Jb. hamb. wiss. Anst.*, **24** : 187. (Type loc. Comillah, Chittagong Dist., Bangla Desh ; types in Zoological Survey of India, Calcutta and the Hamburg Mus.)

1988. *Eutyphoeus comillahnus* : Julka, *Megadrile Oligochaeta*, **1** : 137.

Material : 2 exs., Dakshin Nayapara, Dharmanagar, North Tripura, 15. iv. 1992 ; 11 exs., Panitilla, 12 km N. of Pacherthal, North Tripura, 23.iv.1992; coll. B. P. Halder.

Diagnosis : Length 65-90 mm ; diameter 3-4 mm. Segments ca. 240. Prostomium tanylobic. Clitellum XIV-XVII. First dorsal pore at 11/12. Genital markings unpaired, median, postsetal, on XII and XIII, at B B. Spermathecal pores at or slightly lateral to A. Avestibulate, male pores on small, paired porophores, at A B ; penes absent. Female pores paired, presetal, at ca. A.

Lateral intestinal caeca absent, supra-intestinal glands 4 pairs in XXXV-XXXVIII. Metandric ; seminal vesicles in XII, extending backward to XIV. Penial setae 2 mm long and 40µ thick, tip broadened and hollowed on one side ; ornamentation of irregular transverse rows or circles of triangular teeth. Spermathecal duct short, diverticula ental, one median and one lateral. Genital marking glands absent.

Distribution : INDIA : Tripura—North Tripura.

Outside INDIA : Bangla Desh.

Remarks : The species is recorded here for the first time in India from Tripura.

(11) *Eutyphoeus gammiei* (Beddard)

1888. *Typhoeus gammiei* Beddard, *Q. Jl. microsc. Sci.* **29** : 111. [Type loc. Darjeeling, West Bengal, India; types in Brit. Mus. (Nat. Hist.), London.]

1900. *Eutyphoeus gammiei* : Michaelsen, *Das Tierreich*, **10** : 323.

1907. *Eutyphoeus chittagongianus* Michaelsen, *Jb. hamb. wiss. Anst.*, **24** : 181. (Type loc. Comillah, Chittagong Dist., Bangla Desh ; types in Zoological Survey of India, Calcutta and the Hamburg Mus.)

1914. *Eutyphoeus koboensis* + *E. magnus* Stephenson, *Rec. Indian Mus.*, **8** : 404, 408. (Type loc. - of *E. koboensis*, kobo, Abor country, Arunachal Pradesh, India and of *E. magnus*, upper Rotung, Arunachal Pradesh, India ; types of both the species in Zoological Survey of India, Calcutta.)
1988. *Eutyphoeus gammiei* : Julka, *Fauna of India, Megadrile Oligochaeta*, **1** : 140.
- (In press) *Eutyphoeus gammiei* : Halder, *In : State Fauna Series*, **3** : *Fauna of West Bengal*.

Material : 1 ex., Aglapur, 3 km from Dharmanagar, North Tripura, 13. iv. 1992 ; 2 exs., Dakshin Nayapara, Dharmanagar, North Tripura, 15. iv. 1992 ; 1 ex., Ramnagar, 5 km N. of Panisagar, North Tripura, 18. iv. 1992 ; 9 exs., Kanchanpur, 28 km S. E. of Pachherthal, North Tripura, 22. iv. 1992 ; 3 exs., Golabari, 3 km W. of Teliamura, West Tripura, 28. iv. 1992 ; coll. B. P. Haldar.

Diagnosis : Length 182-405 mm ; diameter 5-10 mm. Segments 195-282. Prostomium prolobic. Clitellum 1/2 XIII-XVII. First dorsal pore at 11/12, occasionally at 10/11. Genital markings unpaired, median or closely paired with margins united, on 13/14, 19/20, 20/21, occasionally on 9/10-12/13, 21/22-23/24, at *B B*. Spermathecal pores small, transverse slits, at or slightly lateral to *B*. Male pores in an unpaired, median vestibulum opening on body surface through a transverse aperture ; penes annular. Female pore single, presetal, on left side at or just median to *A*.

Lateral intestinal caeca absent, median ventral intestinal caeca 32-75 in XXV-XCIX. Metandric ; seminal vesicles in XII, extending backward to XIV. Penial setae 2-5 mm long, 20-40 μ thick ; tip spoon-shaped ; ornamentation of closed circles of fine spines. Spermathecal duct short ; diverticula, one median and one lateral. Genital marking glands absent.

Distribution : INDIA : Tripura – West and North Tripura ; Arunachal Pradesh ; Assam ; Meghalaya ; West Bengal.

Outside INDIA : Bangala Desh.

Remarks : This species is recorded here for the first time from Tripura.

(12) *Eutyphoeus orientalis* (Beddard)

1883. *Typhoeus orientalis* Beddard, *Ann. Mag. nat. Hist. (ser. 5)*, **12** : 219. (Type loc. Calcutta, West Bengal, India ; typus amissus.)
1899. *Typhoeus masoni* Bourne, *J. Asiat. Soc. Beng.*, **58** : 112. (Type loc. Dehra Dun, Uttar Pradesh, India ; types in the Hamburg Mus.)
1907. *Eutyphoeus paivi* Michaelsen, *Jb. hamb. wiss. Anst.*, **24** : 178. (Type loc. Pusa, Bihar, India ; types in Zoological Survey of India, Calcutta.)
1907. *Eutyphoeus bastianus* Michaelsen, *ibid.*, **24** : 183. (Type loc. Katwari Bazar, Uttar Pradesh, India ; types in Zoological Survey of India, Calcutta and the Hamburg Mus.)
1907. *Eutyphoeus andersoni* Michaelsen, *ibid.*, **24** : 185. (Type loc. Rajshahi, Bangla Desh ; types in Zoological Survey of India, Calcutta.)
1988. *Eutyphoeus orientalis* : Julka, *Fauna of India, Megadrile Oligochaeta*, **1** : 161.

(In press) *Eutyphoeus orientalis* : Halder, *In : State Fauna Series*, **3** : *Fauna of West Bengal*.

Material : 1 ex., Ramnagar, 5 km N. of Panisagar, North Tripura, 18. iv. 1992 ; 4 exs., Jamaibari, 2 km from Teliamura, West Tripura, 26. iv. 1992 ; coll. B. P. Haldar.

Diagnosis : Length 130-250 mm ; diameter 4.5–10 mm. Segments 130-220. Prostomium protany lobic. Clitellum XIII-XVII. First dorsal pore at 11/12. Genital markings : paired, segmental, postsetal, on XV and XVI, occasionally on IX-X, XII-XIV, intersegmental on 18/19-20/21, occasionally on 21/22-26/27, at *A B*. Spermathecal pores paired, in *B C*. Bivestibulate and penile ; penes short and annular ; male pores discharge into vestibula through circular to oval or slit-like aperture at *A-m BC*. Female pore single, on left side, presetal at *A*.

Gizzard large, lateral intestinal caeca lacking, ventral intestinal caeca 31-34 in XXIV-LXVII, supra-intestinal glands 4-7 pairs in LXXXVI-XCVI. Metandric ; seminal vesicles in XII, long, extending back to XIV-XVI. Prostate large coiled tubes ; duct thinner. Penial setae 4-5 mm long and 32-36 μ thick ; shaft straight ; tip simple, rounded or bluntly rounded with spoon-shaped concavity ; ornamentation of closed circles of

spines. Spermathecal ampulla, an ovoidal sac ; duct short, stout and muscular ; diverticula ental, one median and one lateral. Genital marking glands sessile.

Distribution : INDIA : Tripura – West and North Tripura ; Bihar ; Uttar Pradesh ; West Bengal.

Outside INDIA : Bangla Desh.

Remarks : This species is recorded here for the first time from Tripura.

SUMMARY

A comprehensive account of the earthworm fauna of Tripura comprising 12 species belonging to 9 genera and 6 families is represented. All the species have been keyed and described for easy identification. Diagnostic characters are provided

for all the families as well as genera occurring in the state. In addition, their statewide distribution in India has been summarised in a table. A general account of morphology and terminology along with the method of collection and preservation is added and information on type locality and repositories of types are also provided. Eleven species, 8 genera and 5 families are new to the state, and one species is new to India.

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DIAPTOMIDAE (CRUSTACEA : COPEPODA)

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INTRODUCTION

The Copepods form an important constituent of the crustacean fauna. Among the plankton, they comprise 80% of the total population. They feed on diatoms, bacteria and minute particles of organic material in the water and are in turn serve as feed for many of the larger aquatic animals, chiefly fish. Thus, they play an important role in food chain and economy of the freshwaters.

In spite of much attention, our knowledge on Copepoda specially on Calanoida from North-Eastern region, is still inadequate. With this end in view, the present work of second in series (after Meghalaya state) was undertaken by the author as per approved research programme, to fill atleast a part of wide lacuna in our knowledge of the Suborder Calanoida which is exclusively planktonic free living forms, found in freshwaters of the Tripura. Family Diaptomidae of the Order Eucopopoda under Class Crustacea in the Phylum Arthropoda includes five species belonging to four genera, reported as new records of the state.

MATERIAL AND METHODS

Samples of the surface water Zooplankton were collected by the staff of the Zoological Survey of India, Calcutta during faunistic survey in the state of Tripura in March-April, 1991 and in March, 1992. Samples of the surface zooplankton were collected from ponds, Lakes and rivers with the help of 29 cm diameter conical plankton tow net (0.5 mm to 1.0 mm mesh size) for about 15-20 minutes in each haul. All the specimens were preserved in 85% Ethylalcohol (C₂H₅OH) including 2-3 drops of Glycerine.

SYSTEMATIC ACCOUNTS

Class	CRUSTACEA
Sub-Class	COPEPODA
Order	EUCOPEPODA
Sub-Order	CALANOIDA
Family	DIAPTOMIDAE

Description : The family Diaptomidae is mainly characterized by structure of fifth leg in both sexes, presence of well defined cervical depression across centre of dorsal surface of head, wings of last pedigerous segment of prosome more or less expanded in female, urosome short for 2-3 segments in female and five segments in male. Anterior antennae in female consisting of 25 segments. Right anterior antennae of male distinctly geniculate. Fifth leg in female not natatory and distinctly biramous. Fifth leg in male greatly asymmetrical. Right leg much longer and carrying at tip a slender claw. Ovisac present in female. This family represents four genera viz., *Tropodiaptomus* Kiefer, *Neodiaptomus* Kiefer, *Heliodiaptomus* Kiefer and *Paradiaptomus* Sars in the state of Tripura. Altogether, following five species belonging to mentioned four genera are recorded first time from this state. Such as :

1. *Tropodiaptomus chauhani* Roy
2. *Neodiaptomus sewelli* Roy
3. *Heliodiaptomus contortus* (Gurney)
4. *Heliodiaptomus viduus* (Gurney)
5. *Paradiaptomus greeni* (Gurney)

Key to genera of family DIAPTOMIDAE

1. Lack of hyaline process of antepenultimate segment of right anterior antennae of male *Paradiaptomus* Sars
 Presence of hyaline process of antepenultimate segment of right anterior antennae of male 2.
2. Terminal portion of endopod segment of female fifth leg provides with two equal setae *Neodiaptomus* Kiefer
 Terminal portion of endopod segment of female fifth leg provides with two unequal setae 3.
3. Anterior antennae longer than total length of body *Tropodiaptomus* Kiefer
 Anterior antennae smaller than total length of body *Heliodiaptomus* Kiefer.

Genus Tropodiaptomus Kiefer

1932. *Tropodiaptomus* Kiefer. *Zool. Jahrb. Jena (Syst.)* 63 : 451-520.

Type species : *Tropodiaptomus orientalis* (Brady-Sars)

Diagnosis : Body moderately long and wide and tapers slowly towards anterior end. Wings of last thoracic segment of female asymmetrical. Urosome 2-3 segmented in female and 5 segmented in male. Genital segment largest in female and bearing a small sensilla on each side and sometimes devoid of any sensilla. Anterior antennae long, elongated and little longer than total length of body. Terminal portion of endopod of female fifth leg provides with two unequal setae. Claw of right male fifth leg strong and tapers distally to a pointed end. Endopod short and fringed with a row of minute hairs on its tip. This genus represents single species from the state of Tripura.

1. Tropodiaptomus chauhani Roy

1980. *Tropodiaptomus chauhani* Roy. *Studies on Indian Copepods, PhD Thesis. Calcutta University*, pp. 287, pls. 38. (Unpublished)

1984. *Tropodiaptomus chauhani* Roy. *Bull. Zool. Surv. India*, 5 (2 & 3) : 53-58.

Material examined : Govindapur (West), Kailasahar, North Tripura, Coll. T. Roy & Party, 8.4.'91 ; Katoldighi, R. K. Compound, Kailasahar, North Tripura, Coll. T. Roy & Party, 8.4.'91 ; Vill. Kanakpur, Kailasahar, North Tripura, Coll. T. Roy & Party, 10.4. '91 & Santir Bazar, Udaipur, South Tripura, Coll. T. Roy & Party, 27.3.'92.

Diagnosis : Adult female : Body robust, moderately long & wide. Last metasomal segment with two asymmetrical lateral wings. Left of which bears two strong hyaline spines and right with two small spines and all spines of both lobes, pointing downwards. Urosome three segmented. Caudal rami symmetrical. Anterior antennae consists of 25 segments. Fifth leg well developed and symmetrical. Right fifth leg consists of one basipod, three exopods and one endopod segments. Third exopod segment originates from terminal portion of second exopod segment and forms a claw. 2/3rd of its inner margin finely serrated. Endopod one segmented and cylindrical, originates from distal lateral corner of first exopod segment and is tipped with two unequal setae. Left fifth leg nearly identical in shape and structure of right fifth leg except for difference in size of second exopod segment.

Adult male : Wings of last metasomal segment symmetrical and bear two small spines posterolaterally. Spines of left lobe closer than right lobe. Urosome five segmented. Caudal rami longer than fifth urosomal segment and symmetrical. Anterior antennae consists of 22 segments. Terminal process of antepenultimate segment reaches beyond distal end of 21st segment and little recurved distally. Fifth leg asymmetrical. Right fifth leg consists of two basipods, three exopods and one endopod segments. Third exopod segment froms claw which bends inside. Endopod very short and does not reach beyond distal end of first exopod segment and originates from dorso-lateral region of inner margin of second basipod segment. Left fifth leg consists of two basipods, one exopod and one endopod segments. First basipod segment smaller than its counterpart of right leg. First exopod with rounded lobe on

posterior aspect. Endopod single-segmented with a bluntly rounded extremity.

Distribution : In India—Meghalaya, Tripura.

Elsewhere : Nil.

Genus *Neodiaptomus* Kiefer, 1932

1932. *Neodiaptomus* Kiefer. *Zool. Jahrb. Jena (Syst.)*. 63 : 451-520

Type species : *Neodiaptomus schmackeri* (Poppe & Richard)

Diagnosis : Body slender in form and narrowed both anteriorly and posteriorly. Urosome three segmented in female and five segmented in male. Caudal setae comparatively short and present in normal number. Anterior antennae long, elongated and smaller than total length of body. Third exopod segment forms a pickle-shaped smoothly curved claw with base little angular and endopod well developed, large conical flask shaped of right male fifth leg. Terminal segment of female fifth leg forms a prominent large conical or leaf like process. This genus represents single species from the state of Tripura.

2. *Neodiaptomus sewelli* Roy

1980. *Neodiaptomus sewelli* Roy. *Studies on Indian Copepods, PhD Thesis, Calcutta University*, pp. 287, pls. 38 (Unpublished).

1984. *Neodiaptomus sewelli* Roy. *Bull. Zool. Surv. India*, 5 (283) : 133-138.

Material examined : Vill. Iaxmipur, Dasda, Kanchanpur, North Tripura, Coll. T. Roy & Party, 5.4.'92 ; Kamalcherra R., Dullubari, north Tripura, Coll. T. Roy & Party, 15.3.'92; Rima Surma Lake, Gondacherra, South Tripura, Coll. T. Roy & Party, 20. 3. '92 ; Bisramgunj, Udaipur, South Tripura, Coll. T. Roy & Party, 25. 3. '92 ; Belonia South Tripura, Coll. T. Roy & Party, 28. 3. '92.

Diagnosis : *Adult female* : Body well built and rounded in anterior end of cephalic region. Wings of last metasomal segment asymmetrical. Cephalosome nearly four times longer than urosome. Urosome three segmented. Anterior

antennae consists of 25 segments. fifth leg somewhat symmetrical. Right fifth leg consists of two basipod, two exopod and one endopod segments. Third exopod segment forms claw, inner margin of which set with seven highly chitinised conical denticles. Endopod cylindrical and its tip reaching almost distal end of first exopod segment. Left fifth leg similar to that of right but differs only in size and ornamentation of claw and size of endopod. Second exopod segment (claw) set with eight highly chitinised and conical denticles on inner margin and three on its outer. Endopod little smaller than its counter part of right leg.

Adult male : Body smaller than female. Body with five imperfect divisions of prosome. Wings of last pedigerous segment symmetrical. Cephalosome more than two times longer than urosome. Urosome five segmented. Caudal rami symmetrical. Each ramus bears six setae. Anterior antennae consists of 21 segments. Terminal process of antepenultimate segment finger like shaped with blunt end. Fifth leg asymmetrical. Right fifth leg consists of two basipod, three exopod and one endopod segments. Third exopod segment long, stout and recurved claw bearing fine hairs of 2/3rd of inner margin from distal end and unornamented on outer margin of it. Endopod large and broad based. Left fifth leg consists of two basipod, three exopod and one endopod. Third exopod segment represented by a small thick and recurved spine and a seta which set with fine hairs. Endopod smaller than its counterpart but margins more wavy.

Distribution : In India—Nilgiri District (Tamil Nadu) ; Tripura.

Elsewhere : Nil

Genus *Heliodyptomus* Kiefer, 1932

1932. *Heliodyptomus* Kiefer, *Zool. Jahrb. Jena (Syst.)* 63 : 451-520.

Type species : *Heliodyptomus viduus* (Gurney)

Diagnosis : Body more or less cylindrical. Cephalosome narrowed anteriorly or in some cases

tip rounded. Wings of last thoracic segment symmetrical. Urosome three segmented in female and five segmented in male. Caudal rami short in both sexes. Anterior antennae slender, elongated and smaller than total length of body. Third exopod segment forms claw which tapers to end with base angular in shape. This genus represents two species from the state of Tripura.

Key to the genus Heliodiaptomus Kiefer

1. Sinuate claw in fifth leg of female bearing 6-8 teeth of inner margin.
.....*H. viduus* (Gurney)
2. Sinuate claw in fifth leg of female bearing fine hairs of inner margin
.....*H. contortus* (Gurney)

3. *Heliodiaptomus contortus* (Gurney)

1907. *Diaptomus contortus* Gurney, *Rec. Indian Mus.*, 1 (1) : 21-33.
1980. *Heliodiaptomus contortus* Roy, Studies on Indian Copepoda. Ph.D Thesis, Calcutta University, pp. 287, pls. 38 (Unpublished).

Material examined : Vill Joysri, Ghataitla, Kanchanpur, North Tripura Coll. T. Roy & Party, 4. 4. '91 ; Vill. Subhasnagar, Kanchanpur, North Tripura, Coll. T. Roy & Party, 5. 4. '91 ; Rimasurma Lake, Gondacherra, South Tripura, Coll. T. Roy & Party, 20. 3. '92 ; Dhanyasagar, Udaipur, South Tripura, Coll. T. Roy & Party, 26. 3. '92.

Diagnosis : Adult female : Body moderately slender in form with anterior proximity rounded off at tip. Cephalothorax more than three times longer than urosomal segment. Urosome consists of three segments. Genital segment largest. Caudal rami one half times longer than third segment of urosome and symmetrical. Anterior antennae consists of 25 segments. Third exopod segment forms claw which knobbed at its base and has a notch externally from which two unequal setae arise. Inner margin of claw set with fine hairs.

Adult male : Cephalothorax more than two times longer than abdomen Posterior corners of

last thoracic segment being rounded off and are armed with two strong spines. Caudal rami symmetrical. Right anterior antennae prehensile, modified with grasping organ. It consists of 25 segments. Terminal process of antepenultimate segment straight and slightly recurved distally. Fifth leg asymmetrical. Right fifth leg consists of two basipod, three exopod and one endopod segments as in left fifth leg. Third exopod segment forms long, stout and recurved claw. Half of inner face of twisted claw striated. Third exopod segment of left fifth leg forms a chela like structure and a strong and long spine at its base.

Distribution : In India—West Bengal (Hooghly R. at Nawabgunj ; near Palta water works, near Howrah Bridge, Chingrighata canal ; Lock-gates at Dhapa near Calcutta); Chilka Lake; Chakradharpur; Goa; Chandwar; Kaushalyaganga; Linghipur and Jaipur ; Tripura.

Elsewhere : Nil.

4. *Heliodiaptomus viduus* (Gurney)

1916. *Diaptomus viduus* Gurney. *Proc. Zool. Sec. Lend.*, 49 : 333-343.
1980. *Heliodiaptomus viduus* Roy, Studies on Indian Copepods, ph. D thesis, Calcutta University, pp. 287, pls. 38 (Unpublished).

Material examined : Vill Churaibari, Dharmanagar, North Tripura, Coll. T. Roy & Party, 30. 3. '91 ; vill. Kashirampur, Dharmangar, North Tripura, Coll. T. Roy & Party, 3. 4. '91 ; Katoldighi, R. K. I. Compound, Kailasahar, North, Tripura. Coll. Roy & Party, 8. 4. '91 ; Rima-Surma Lake, Gendacherra, South Tripura, Coll. T. Roy & Party 20. 3. '92.

Diagnosis : Adult female : Body moderately long and slender with anterior proximity being rounded off at tip. Cephalothorax three and half times longer than urosome. Genital segment largest, Caudal rami nearly 1/3rd of genital segment of urosome and symmetrical. Right fifth leg consists of one basipod, three exopod and one endopod segments as in left fifth leg. Third exopod segment forms claw with a set of fine hairs on inner half of margin.

Adult male : Shape of body like a female. Cephalothorax nearly three and half times longer than urosomal segment. Urosomal segment consists of five segments. Caudal rami symmetrical. Right anterior antennae modified as a grasping organ. It consists of 25 segments. Terminal process of antepenultimate segment little curved distally. Right fifth leg consists of two basipod, three exopod and one endopod segment as in left fifth leg. Third exopod segment forms long and curved claw. More than half of inner margin of claw starting from distal end, striated. Third exopod segment represented by a small, thick spine and a seta originated from terminal end of second exopod segment.

Distribution : In India—Calcutta, Chilka Lake, Balasore, Berhampore, Cuttack, Puri, Mysore, Chandwar, Narshingpur, Jenapore, Jaipur, Linghipur, Maharastra.

Elsewhere : Nil

Genus *Paradiaptomus* Sars, 1895

1895. *Paradiaptomus* Sars. An account of the Crustacea of Norway. P. 4. Copepoda Calanoida.

Type species : *Paradiaptomus falcifer* (Loven)

Diagnosis : Body more or less cylindrical, A finger or hook like process present on its tip of anterior antennae. A hyaline process of antepenultimate segment of right anterior antennae of male completely lacking. Urosome 2-3 segmented in female and 5 segmented in male. Exopod lamellate bearing two stout process of left fifth leg of male. This genus represents single species from the state of Tripura.

5. *Paradiaptomus greeni* (Gurney)

1906. *Diaptomus greeni* Gurney. *Proc. Asiat. Soc. Bengal* (New series) 2 : Calcutta.

1980. *Paradiaptomus greeni* Roy, studies on Indian Copepods. Ph. D. Thesis, Calcutta University, pp. 287, pl. 38 (Unpublished).

Material examined : Fuldungsei (Jumpoi Hills), North Tripura, Coll. T. Roy & Party, 5. 4. '91 ;

Subal Lake, Fuldungsei, (Jumpoi Hills), North Tripura, Coll. T. Roy & Party, 5. 4. '91 ; Rima-Surma Lake, Gondacherra South Tripura, Coll. T. Roy & Party, 20. 3. '92.

Diagnosis : **Adult male** : Body more slender in form with a well defined cervical depression across centre of dorsal surface of body. Five segmented urosome nearly half in length of cephalothorax region. Caudal rami little longer than last urosomal segment and symmetrical. Fifth leg well developed and asymmetrical. Left fifth leg shorter than right. Right fifth leg consists of two basipod, three exopod and one endopod segments. Third exopod segment forms claw. Distal portion of it little curved and bearing serrations on 2/3rd proximal of inner margin. Left fifth leg consists of two basipod with fine saw type serrations on inner margin. On its outer margin two unequal setae arises, the smaller one has a weak knee at its base.

Adult female : Unknown.

Distribution : In India—Madurai (Tamil Nadu) ; Tripura.

Elsewhere : Nil.

DISCUSSION

Five species belonging to four genera viz., *Tropodiaptomus chauhani* Roy, *Neodiaptomus sewelli* Roy, *Heliodiaptomus contortus* (Gurney) *Neodiaptomus viduus* (Gurney) & *Paradiaptomus greeni* (Gurney) are reported first time from the state of Tripura. On the basis of geographical distribution of five species, it is fairly obvious that all the species reported upon are restricted to India only and specially in the state of Tripura, Meghalaya, Rajasthan & Madhya Pradesh.

SUMMARY

All the five species of the genera *Tropodiaptomus* Kiefer, *Neodiaptomus* Kiefer, *Heliodiaptomus* Kiefer & *Paradiaptomus* Sars reported by author occurring in freshwaters in the state of Tripura first time. An exhaustive systematic account, Material & Methods,

Synonymy, Type species of the concern species, Material examined, Diagnostic characters of each species and information of geographical distribution is brought together for easy identification of the species so far recorded from the state of Tripura. It is interesting to note that all the five species reported upon first time in the state of Tripura, were creditable for new records only.

ACKNOWLEDGEMENT

I am indeed grateful to the Director, Zoological Survey of India, Calcutta for providing me all sorts of facilities for conducting this work. Further, author is also express his sincere thanks to Sri H. C. Ghosh, Sri S. S. Ghatak, Sri S. Ghosh & Sri B. K. Sarder of the Crustacea Section for tendering sincere efforts for collecting specimens, labelling etc. in the field.

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CRUSTACEA : DECAPODA (Shrimps)

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INTRODUCTION

Present paper deals with the shrimp collections made from Tripura during 1978-1989 by the staff of Eastern Regional Station Shillong. Dr. J. R. B. Alfred, Scientist-SF kindly handed over the collections to the present author for study.

The collections comprises two genera and five species as follows :-

Class	CRUSTACEA
Order	DECAPODA
Family	ATYIDAE <i>Caridina</i> sp-16 exs.
Family	PALAEMONIDAE

Macrobrachium assamensis assamensis Tiwari
37 exs.

Macrobrachium dayanum (Henderson)-27 exs.

Macrobrachium lamarrei lamarrei (Edw.)-29 exs.

Macrobrachium rosenbergii (De Man)-4 exs.

Caridina sp.

Material examined : 16 exs. form Agartala, dt. 23-viii-1978.

Diagnosis : Small narrow, length 15 mm-20 mm. Supra orbital or antennal spine on either side of base of rostrum present. Rostrum short almost straight and serrated with more than 15 teeth on upper edge and 4-5 teeth on lower edge like most confusing *C. Weberi* group. Fingers of chelae with tufts of hairs, carpus short, stout wide distally and excavated anteriorly. A doubtful dried sample.

Genus *Macrobrachium* Bate

Key to the species

1. Very long narrow horizontal or upturned apically *rosenbergii*.
— Rostrum short or medium, straight or upturned apically 2
2. Short triangular evenly dentate rostrum, formula 7-10/2-5 teeth, upper edge of rostrum straight. *assamensis*
— Medium or upturned long narrow rostrum....
..... 3.
3. A long smooth interspace on upper distal half of rostrum and with a subapical spinule
..... *lamarrei*.
— Straight or upturned medium rostrum
..... *dayanum*.

Macrobrachium assamensis assamensis Tiwari
1955 *Palaemon assamensis assamensis* Tiwari, *Rec. Indian Mus.*, 53 : 298.

Material examined : 7 exs. Maharani, S. Tripura ; 24-ji-1989, V. T. Darlong ; 1 ex. Sindukupara (Gynamachara) Tripura, 3-viii-1979 K. P. Singh ; 7 exs. 3.viii.1979 ; Subal Singh, Tripura, 3 exs. Chelia Khola, 4.vi.1989 ; 5 exs. Khatal Bazar, N. of Santir Bazar, 9.viii.79 ; 3 exs. Kuki chera, N. Tripura, 13.vi.88 ; V. T. Darlong 2 exs. Maramasamara, Stream, 19.viii.86, V. T. Darlong ; 7 exs. Pecharthal, 17.vi.88 ; 2 exs. Kancnanchera, 11.vi.88, V. T. Darlong.

Small stout shrimp with broadly triangular rostrum in profile ; upper edge of rostrum horizontal, apex acute, longer than antennular

peduncle, often extend as far as the apex of the antennal scale. Rostral formula 7-11/2-5 with usually three teeth on the carapace behind the orbital border. Carapace with minute pickles in mature specimens only. Second pair of pereopods subequal, subcylindrical, merus always longer than carpus, short carpus broader distally. Palm little broader than carpus, a little compressed, longer than carpus, more than double in adult males but less in females and young. Fingers slightly longer than palm, with grooves and soft hairs, tips fluted, mainly in adult males, cutting edge toothed, non gapping.

Distribution : Tripura, Eastern Himalayan region, Bengal, Bihar, Nepal Tarai, Satpura and in Burma.

Remarks : Short, straight, triangular rostrum, short stout body peculiar details of second pereopod of adult males, presence of pickles on the carapace of adults are specific and cannot be mistaken for other species.

***Macrobrachium dayanum* (Henderson)**

1893. *Palaemon dayanus* Henderson, *Trans. Linn. Soc. London*(2) V : 443
 1947. *Palaemon dayanus* Chopra & Tiwari, *Rec. Ind. Mus. XLV* : 215.
 1950. *Macrobrachium dayanum* Holthuis, *Siboga Exped. pl. X, 39* : 197

Material examined : 2 exs. Julybari, S. of Santirbazar, 7.viii.1979 ; 1 ex. Belonia Cherra, 10.viii.1979 ; K. P. Singh ; 6 exs. Kanchan Cherra, 11.vi.1988 ; 6 exs. Nalkata, 14.vi.1988 ; 1 ex. Bagbasa, 17.vi.1988 ; 3 exs. Chawmanu, 20.vi.1988 ; Coll. V. T. Darlong ; 4 exs. Tikar Ma, 25.5.1989 ; 4 exs. R. H. Sepahijala, 30.v.1989 ; 4 exs. Kamal Ghat, 1.vi.1989. Coll. R. H. Kamble.

Diagnosis : Shrimp small stout, rostrum shorter than the antennal scale, straight, slightly upturned at its distal end. In most young specimen shape of rostrum vary variable, presence of its teeth show considerable variation in their numbers. Rostral formula 5-7-11/4-7. There are 2 or 3 teeth on the carapace and third tooth placed just above the orbital border. Carapace smooth, hepatic spine small and behind it there is a sulcus. Second cheliped stout, long in mature male. Chela equal

or longer than carpus. Fingers two thirds the length of palm in mature specimens, densely hairy, in adult male fingers with grooves and hairs. Palm slightly compressed laterally.

Distribution : Most common Indian species of tanks, lakes, rivers hill streams of entire India ; Bangladesh and Pakistan,

Remarks : Slightly upturned distal end of rostrum, variable rostral formula and in young rostral shape is extremely variable

***Macrobrachium lamarrei lamarrei* (Edwards)**

1837. *Palaemon lamarrei* H. Milne Edwards, *Hist. nat. Crustacea*, 2 : 397
 1933. *Palaemon lamarrei* Hora, *Curr. Sci.*, 1 : 4, 5
 1950. *Macrobrachium lamarrei* Holthuis, *Siboga Exped. Pt. X, 39* : 119.

Material examined : 2 exs. Agartala, 23.viii.1978-Coll. S. K. Chanda ; 5 exs. Julybari, Santir Bazar, 7.viii.1979 ; 8 exs. Kathal Bazar, 9.viii.1979 ; 3 exs. Belonia cherra, 10.viii.1979, Coll. K. P. Singh ; 1 ex. Bangbasa, 17.vi.1988, Coll. V. T. Darlong ; 1 exs. Pathalia Ghat, 30.v.1998, Coll. R. H. Kamble ; 9 exs., Santir Bazar, 25.ii.1989, V. T. Darlong.

Diagnosis : Small slender shrimp, rostrum narrow, long, slightly upturned distally, exceeds the antennal scale by 1/3 of its length in adults and by 1/4 in younger ones. Rostral formula 7-9/8-9. Upper proximal teeth 6-8 or 9, apical tooth one, separated by a long smooth interspace. Lower edge with 7-9 teeth. First pair of legs as long as antennal scale, second pair of leg pereopod longer than antennal scale Carpus thicker at distal end, almost twice-as long the chela and three times as long as the palm. Palm little longer than the fingers. Telson tapers to a pointed extremity and with two pairs of spinules on its upper surface.

Remarks : Rostrum is higher at the base, two teeth present on the carapace, one tooth at tip and in between these teeth long smooth interspace on upper distal and easily separates the species and shows considerable age variations in number of its rostral teeth and other characters. Length ratio of leg joints.

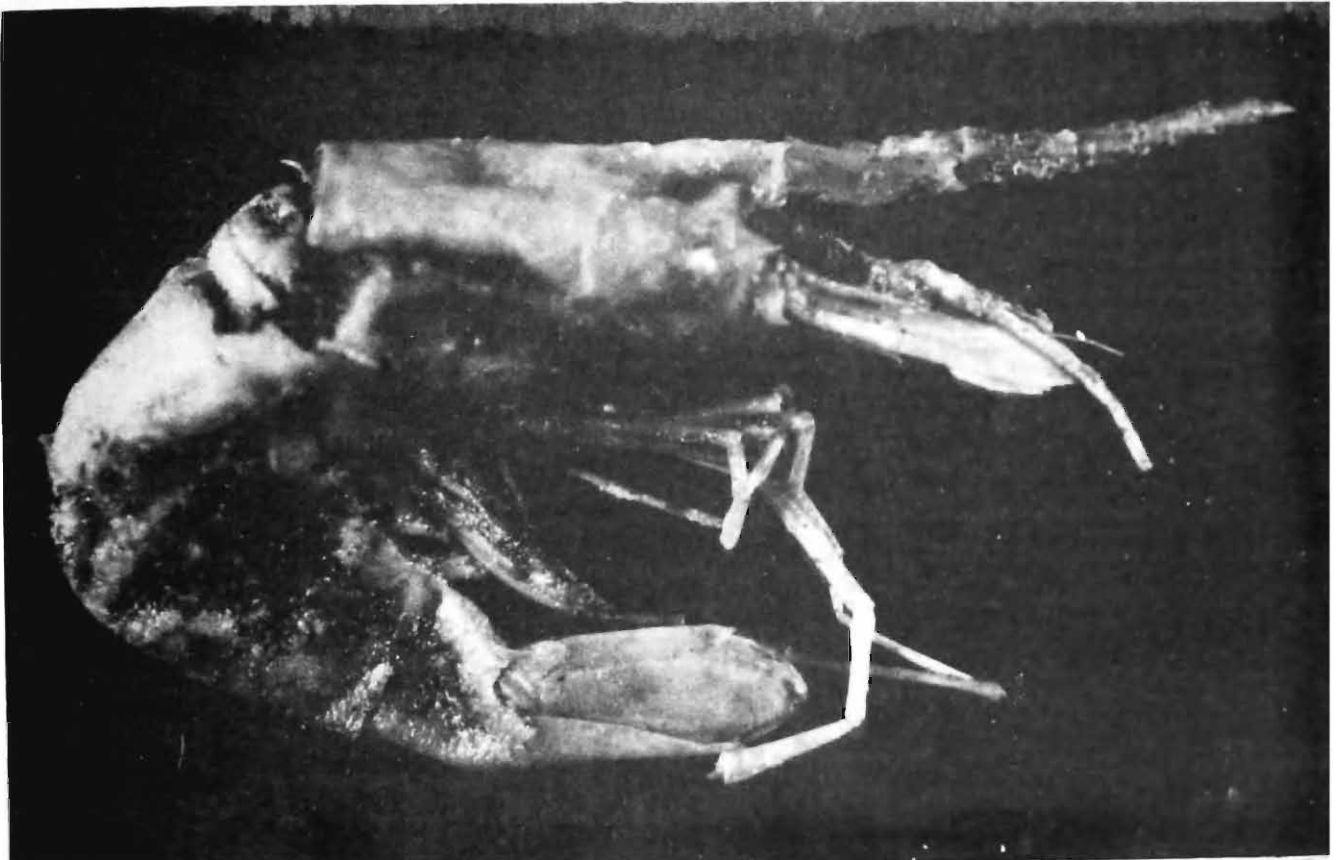


Fig. 1. *Macrobrachium* sp. *Macrobrachium rosenbergii* (De Man)

Distribution : Widely distributed in fresh and batchkish water bodies of whole India, Terai of Bengal, Bihar and U. P ; Bangladesh and Pakistan.

***Macrobrachium rosenbergii* (De Man)**

1798. *Palaemon carcinus* Fabricius, 402
 1879. *Palaemon rosenbergii* De Man, 167 : Holthuis 1950 : 111
 1888a. *Palaemon carcinus* De Man *J. Linn. Soc. London, zool.* 22 : 280 : 1908, *Rec. Indian Mus.*, 2 : 224
 1910. Henderson & Mathai *Rec. Indian Mus.*, 5
 1918a Kemp, S. *Mem. Asiat. Soc. Bengal*, 6 : 255
 1943a. Chopra *Curr. Sci.* 12 : 71
 1950 Holthuis *Siboga Exped.* 39 A-9 : iii

Material examined : 3 exs., Agartala, Tripura, 23-viii-1978. Coll. S. K. Chanda

Diagnosis : Long 4"-5" shrimps with very long narrow horizontal proximally and slightly upturned distally, exceeds apex of antennal scale by 1/3 of its length. Rostral formula 10-13/9-8, with two teeth on the carapace behind the orbital border. First pair of pereopods long narrow cylindrical, merus little shorter than distally broad carpus. Palm narrow smooth as the head, slightly shorter than the fingers which do not gape when closed. Second pereopods almost similar to the

first pair Dorsal spinules of telson very small. Posterior median spine of telson longer than two inner spines and in between these spines four pairs of plumose setae present.

Remarks : Rostrum very long narrow almost straight proximally and directed little upward distally, exceeds antennal scale by 1/3 of its length. Curvature and length of rostrum is very variable. Rostrum is less curved in older large males than in females and young ones. Very confusing hence both *M. carcinus* and *M. rosenbergii* are treated as same or separate species from the very beginning.

Distribution : Tripura, Meghalaya, Cachar, West Bengal, Orissa, Andhra Pradesh, Tamil Nadu, Karnataka ; Myanmar ; Singapore ; Mergui and Malay.

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PALAEMONIDAE (CRUSTACEA : DECAPODA)

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INTRODUCTION

It is infact true that the taxonomic and Zoogeographical knowledge of the palaemonid prawns of Tripura State is still in adequate. Inspite of the present State of information on the freshwater palaomonid Prawns of Tripura, it is possible to assign the boundaries, although previsionally, the geographic distribution of the principal known species to date and to establish the biogeographical region to which they belong. It is quite true that the prawns are usually absent from certain very shallow especially temporary waters and from highly polluted waters in Tripura. The collections on which the present report is based, were made during the exploration of the faunistic collections in and around Dharmanagar, Kailasahar, Ambassa, Kamalpur, Unokoti, Kanchanpur of North Tripura, Belonia of South Tripura and Khowai of West Tripura. As a result of this investigation and consultation of the concern literature, we are now familiat with eight species of prawns from Tripura state belonging to the genus *Macrobrachim* Bate under family palaemonidae. As the common four species which were already reported upon in the State of Meghalaya, a short descriptive account is provided and the remaining four species Viz. *M. Javancium* (Heller) ; *M. lamarrei lamarrei* (H. M. Edw.) ; *M. lamarrei lamarroides* (Tiwari) & *M. rosenbergii*, (de Man).

MATERIAL AND METHODS

While preparing this paper, first dealing with systematic account of prawns then followed by generic synonymy with original reference

including type species and also correct scientific name of species with original references and type locality are embedied. Besides information on diagnostic characters of all species, distribution in India and World and also material examined are given. Keys are provided in this study for identification of the palaemonid prawns after consulting various literature.

SYSTEMATIC ACCOUNT

Class CRUSTACEA

Order DECAPODA

Family PALAEMONIDAE

The family is characterised by carpus of second pair of pereopods entire chela on third pereopods and epipods on legs are absent, upper antennular flagellum bifid and third maxillipede normal.

Genus *Macrobrachium* Bate, 1868

1868. *Macrobrachium* Bate, *Proc. Zool. Soc. Lond.* : 363.

Type species : *Macrobrachium americanum* Bate, 1868.

Diagnosis : Prawns with rostrum well developed, compressed and toothod. Carapace armed with antennal and hepatic spines ; branchiostigal spine absent, dactylus of last three legs simple. Following eight species belonging too genus *Macrobrachium* Bate under family Palaemonidae represent from the Tripura state.

1. *Macrobrachium javanicum* (Heller)
2. *M. lamarrei lamarrei* (H. M. Edw.)
3. *M. rosenbergii* (de Man)
4. *M. lamarrei lamarroides* (Tiwari)

5. *M. assamensis assamensis* (Tiwari)
6. *M. Choprai* (Tiwari)
7. *M. hendersoni platyrostris* (Tiwari)
8. *M. dayanum* (Henderson)

*A key to the identification of species
of genus **Macrobrachium** Bate*

1. Carpus of second pereopod longer than merus 2
— Carpus of second pereopod shorter than merus 7
2. Palm (2nd. pereopod) longer than carpus
.....*M. Javanicum* (Heller).
— Palm shorter than carpus.....3
3. Chela (2nd pereopod) longer then carpus
.....*M. dayanum* (Handerson)
— Chela shorter than carpus 4
4. Fingers (2nd pereopod) same length as palm :
.....*M. resenbergii* (De man).
— Fingers shorter than palm.....5
5. Mobile finger (2nd pereopod) with densely
pubescent.....*M. choprai* (Tiwari).
— Fingers without any pubescence. 6
6. Carapace subequal to rostrum
.....*M. lamarrei lamarrei* (H. M. Esdwards)
— Carapace distincly longer than rostrum
.....*M. lamarrei lamarroides* (Tiwari)
7. Rostrum longer than carapace and antennular
peduncle
.....*M. assamensis assamensis* (Tiwari)
— Rostrum equal to or shorter than carapace and
antennular peduncle
.....*M. hendersoni platyrostris* (Tiwari)

1. *Macrobrachium javanicum* (Heller)

1865. *Palaemon javanicus* Heller, *Reise Novara Zool.*, 2 : 116, pt 3
1993. *Macrobrachium javanium* Kurian & Sebastian, *Prawns and Prawn Fisheries of India* : 77.

Type locality : Mergui Archipelago.

Material examined : 1 ex. from Champaknagar, North Tripura District, Coll. T. Roy, 18. 4. 91.

Diagnosis : Rostrum usually slender extends upto tip of antennular peduncle, upper edge with 10 to 13, seldom 9 teeth and lower edge bears generally three, seldom 4 teeth, Chela of second pereopod of adult male equal or subequal, distinctly tuberculate, large and without longitudinal groove. Upper margin of rostrum 2-3 teeth behind orbit. Adult male 1-2 large teeth on cutting edge of fingers of second pereopod, chelae distinctly tuberculate in adult male. Carpus elongated, fingers of smaller leg usually shorter than palm. Fifth legs nearly same length as fourth.

Distribution : In India : Deltaic Bengal.

Elsewhere : Burma ; Penang ; Malay peninsula, Siam ; Sumatra ; Java ; Central borneo ; Central Celebes.

2. *Macrobrachium lamarrei lamarrei* (H. M. Edw.)

1837. *Palaemon lamarrei* H. M. Edwards, *Hist. nat. Crust.*, 2 : 397.
1988. *Macrobrachium lamarrei lamarrei* Jalihal, Shenoy & Sankolli *Rec. zool. Surv. India. Occ. paper* No. 112 : 2.

Type locality : Karnataka State.

Material examined : 17 exs. from Unokoti, Kailasahar, Coll. Y. P. Sinha, 6. 12. 89 ; 27 exs. from Panisagar, Coll., Y. P. Sinha, 7. 12. 89 ; 2 exs. from Ambassa, Coll. Y. P. Sinha, 8. 12. 89 ; 10 exs. from Churraibari, Coll. Y. P. Sinha, 19. 12. 89 ; 4 exs. from Algapur, Coll. T. Roy 29. 3. 91 ; 11 exs. from Birjanagar, Coll. T. Roy, 31. 3. 91 ; 23 exs. from Baruakandi, Coll. T. Roy, 29. 3. 91 ; 26 exs. from Bagan, Coll. T. Roy, 30. 3. 91 ; 9 exs. from Barchara & 6 exs. from Kashirampur, Coll. T. Roy, 3. 4. 91 ; 1 ex. from Joysri, Coll. T. Roy, 4. 4. 91 ; 61 exs. from Subhanagar, Coll. T. Roy, 5. 4. 91 ; 1 ex. from Manu R., Coll. T. Roy, 8. 4. 91 ; 1 ex. from Unokoti, Coll. T. Roy, 10. 4. 91 ; 2 exs. from Garjantilla, Coll. T. Roy, 11. 4. 91 ; 9 exs. from

Kamalpur, Coll. T. Roy 13. 4. 91 ; 8 exs. from Khusdinpara, Coll. T. Roy, 15. 4. 91 ; 5 exs. from Bormura, Coll. T. Roy, 17. 4. 91 ; 4 exs. from Gerania, Coll. T. Roy 18. 4. 91 ; 7 exs. from Khowai town, Coll. T. Roy, 23. 4. 91 ; 3 exs. from Dullubari Gate, Coll. T. Roy, 16. 3. 92 ; 20 exs. from Bisramgunj, Coll. T. Roy, 25. 3. 92.

Diagnosis : Rostrum equal or longer than antennal scale and distally slightly upturned upper edge of rostrum with a gap between proximal series of 5-9 teeth and distal of 1-2 subapical teeth, sometimes the gap between proximal and distal series being filled up by 1—2 teeth, lower margin with 4-9 teeth. Second pereopods smooths, slender, equal and shorter than body length. Fingers of same pereopod in adult male with 1—2 teeth in its cutting edge. Last three pereopods nearly equal in length.

Distribution : In India : Coast of Chilka Lake ; West Bengal : Calcutta, Salt Lake, Port Canning, Uttarbhat ; Madras.

Elsewhere : Pakistan : Upper Burma.

3. *Macrobrachium rosenbergii* (de Man)

1879. *Palaemon rosenbergii* de Man, *Notes Leyden Mus.*, 1 : 167.

1993. *Macrobrachium rosenbergii* Kurian & Sebastian, *Prawns and prawn Fisheries of India* : 77, Fig. 4.22.

Type locality : Andai, N. W. New Guinea.

Material examined : 1 ex. from Garjantilla, Coll. T. Roy. 11. 4. 91.

Diagnosis : Rostrum long and distally curved upwards. extends upto tip of antennal scale or little longer. Upper edge of rostrum 10-16 and lower edge 8—14 teeth. Upper margin with a distinct elevated basal crest with a distinct naked portion in distal half. Last three pereopods slender of which fifth much more slender than third. Tip of telson some what rounded and extends beyond tip of longer posterior spines. All joints of pereopods naked or provided with a few small and scattered spinules or hairs.

Distribution : In India : Punjab, Surat ; Bombay ; Malabar District ; Cochin, Travancore ;

Madras ; Godavari District ; Ganjam ; Garia near Calcutta ; Sundarbans.

Elsewhere : Ceylon ; Burma ; Tavoy, Mergui Archipelgo ; penang. Singapore ; Bangkok ; Siam, Malay States ; Hongkong ; Japan ; Manila ; Java ; Sumatra.

4. *Macrobrachium lamarrei lamarroides* (Tiwari)

1952. *Palaemon lamarrei lamarroides* Tiwari, *Ann. Mag. Nat. hist.* (12) 5 : 28.

1988. *Macrobrachium lamarrei lamarroides* Jaliha! Shenoy & Sankolli, *Rec. zool. Surv. India. Occ. paper No.* 112 : 10.

Type locality : Loktak Lake, Manipur.

Material examined : 26 exs. from Dullubari, Coll. T. Roy, 15. 3. 92 ; 7 exs. from Belonia, Coll. T. Roy, 28. 3. 92.

Diagnosis : Rostrum slender, equal to or slightly longer than antennal scale. Upper edge of rostrum with 4-6 teeth in proximal half of which 1 or rarely 2 teeth on carapace behind orbital border and usually 1 teeth on apex ; gap between proximal and distal series generally unarmed ; lower edge with 4-5 teeth. Other characters same as in *M. lamarrei lamarrei* (H. M. Edw.)

Distribution : In India : Assam.

Elsewhere : Nil.

5. *Macrobrachium assamensis assamensis* (Tiwari)

1958. *Palaemon assamensis* Tiwari, *Rec. Indian. Mus.* 53 (1 & 2) : 297.

1988. *Macrobrachium assamensis assamensis* Jaliha!, Shenoy & Sankolli, *Rec. zool. Surv. India Occ. paper No.* 112 : 43.

Type locality : Garo Hills, Meghalaya.

Material examined : 1 exs. from Ambassa and around Kamalpur, Coll. Y. P. Sinha, 8. 12. 89 ; 1 ex. from Churaibari and around Dharmanagar, Coll. Y. P. Sinha, 19. 12. 89 ; 11 exs. from zuri R. Dharmanagar, Coll. T. Roy. 29. 3. 91 ; 6 exs. from Subal lake, Jumpoi Hills, Coll. T. Roy, 5. 4. 91 ; 12 exs. from manu R. Kailasahar, Coll. T.

Roy, 8. 4. 91 ; 9 exs. from Kumarghat, Coll. T. Roy 9. 4. 91 ; 3 exs. from Dullubari Gate, Ambassa, Coll. T. Roy, 16. 3. 92.

Diagnosis : Rostrum extends upto midway between tips of antennular peduncle and antennal scale, upper and lower edge of rostrum with 7-10 and 2-5 teeth respectively. Carpus of second pereopod gradually thickened distally. Palm slightly broader and longer than carpus in male, sometimes subequal or shorter in young male and female. Fingers with velvety pubescence arranged along grooves and slightly longer than palm. Cutting edge non-gaping with teething.

Distribution : In India : Chotanagpur ; Kharagpur Hills, Bengal Duars and Terai ; Eastern Assam.

Elsewhere : Arakhan Yomas ; Burma ; Eastern Nepal ; Pegu Yomas.

6. *Macrobrachium Choprai* (Tiwari)

1949. *Palaemon choprai* Tiwari, *Rec. Indian Mus.*, 45 (4) : 333.

1950. *Macrobrachium choprai* Holthuis, *Siboga Exped. Monogr.* 39a(9) : 261.

Type locality : Banaras, U. P.

Material examined : 5 exs. from Rudrasagar, Melaghar, Coll. T. Roy, 24. 3. 92.

Diagnosis : Rostrum shorter than carapace, extends upto end of antennular peduncle, sometimes end of antennal scale. Proximal two-third of upper edge forms a highly convex keel bears 8-11 teeth and distal one-third narrow, upturned sharp apex bears 1-3 teeth. Lower edge bears 4-6 teeth. Chela of second pereopod shorter than palm, carpus and palm cylindrical, palm shorter than merus. Second pereopod always longer than whole body. Cornea broader than eye stalks. Rostrum proportionately longer and dorsal keel not so deep as in male.

Distribution : In India : Uttarpradesh ; Bihar ; Assam.

Elsewhere : Hill ranges of North Burma.

7. *Macrobrachium hendersoni platyrostris* (Tiwari)

1952. *Palaemon hendersoni platyrostris* Tiwari, *Anna. Mag. Nat. Hist. Ser.* 12. 5. 32.

1993. *Macrobrachium hendersoni platyrostris* Kurian & Sebastian, *Prawns and prawn fisheries of India*, p. 76.

Type locality : Eastern Himalayan region.

Material examined : 1 ex. from Kanchanpur, Coll. V. T. Darlong, 17. 6. '88 ; 2 exs. from Ambassa, Coll. Y. P. Sinha, 8. 12. '89 ; 1 ex. from Kumarghat, Coll. T. Roy, 9. 4. '91 ; 1 ex. from Champaknagar, Coll. T. Roy, 18. 4. '91 ; 2 exs. from Dullubari Gate, Coll. T. Roy, 16. 3. '92 ; 1 ex. from Rudrasagar, Coll. T. Roy, 24. 3. '92.

Diagnosis : Rostrum extends upto tip of antennular peduncle, upper edge convex and bears 7-10 teeth, lower edge drawn back from apex and bears 0-4 teeth. Carpus short and conical, palm much longer than carpus, fingers with dense pubescence and generally longer than palm. Hill stream species is generally found not above 1500 feet. Both dactylus and fixed finger with 1 or 2 large teeth on cutting edge.

Distribution : In India : Darjeeling ; Chota Nagpur Hills.

Elsewhere : Burma.

8. *Macrobrachium dayanum* (Henderson)

1893. *Palaemon dayanus* Henderson, *Trans. Linn. Soc. Lond. ser.* 2. 5 : 443, pl. 40. figs 7-13.

1988. *Macrobrachium dayanum* Jaliha ; Shenoy & Sankolli, *Rec. zool. Surv. India*, Occ. paper No. 112 : 43.

Type locality : Northern India.

Material examined : 4 exs. from Anand Bazar gram, Coll. Y. P. Sinha, 5. 12. '89 ; 8 exs. from Unokoti and around Kailasahar, Coll. Y. P. Sinha, 6. 12. '89 ; 8 exs. from Ambassa, Coll. Y. P. Sinha, 8. 12. '89 ; 1 ex. from Kadamtola and around Dharmanagar, Coll. Y. P. Sinha, 15. 12. '89 ; 1 ex. from Ranibari, Coll. Y. P. Sinha, 16. 12. '89 ; 11 exs. from Boruakandi, Coll. T. Roy, 29. 3. '91 ; 5 exs. from Birjanagar, Coll. T. Roy,

31. 3. '91 ; 3 exs. from Kashirampur, Coll. T. Roy, 3. 4. '91 ; 7 exs. from Joysri, Coll. T. Roy, 4. 4. '91 ; 8 exs. from Unokoti, Coll. T. Roy, 10. 4. '91 ; 3 exs. from Garjantilla, Coll. T. Roy, 11. 4. '91 ; 52 exs. from Kamalpur, Coll. T. Roy, 13. 4. '91 ; 48 exs. from Manubari, Coll. T. Roy, 14. 4. '91 ; 35 exs. from Khusdinpara, Coll. T. Roy, 15. 4. '91 ; 13 exs. from Gerania, Coll. T. Roy, 18. 4. '91 ; 8 exs. from Moharchhora, Coll. T. Roy, 21. 4. '91 ; 9 exs. from Ramchandraghat, Coll. T. Roy, 23. 4. '91 ; 28 exs. from Khowai, Coll. T. Roy, 23. 4. '91 ; 11 exs. from Dullubari Gate, Coll. T. Roy, 16. 3. '92.

Diagnosis : Rostrum extends upto tip of antennal scale and its distal end distinctly upturned. Upper and lower edge of rostrum with 7-11 & 4-7 teeth respectively. Chela tuberculate and shorter than palm. Carpus subcylindrical. Second pereopod of female is shorter than male. Fingers about two-third length of palm and densely pubescent. Fixed finger has one teeth and mobile finger has two conical teeth. Cutting edge may be naked or with some short hairs.

Distribution : In India : West Bengal ; Orissa ; Assam ; Kerala ; Madhya Pradesh ; Punjab ; Uttar Pradesh.

Elsewhere : Pakistan.

DISCUSSION

It is known fact that due to overlapping characters, the genus *Macrobrachium* Bate tends to be very complicated group among the genera under family *Palaemonidae* and order *Decapoda*. Holthuis (1950) while determining the genus *Macrobrachium* comprising 71 species of which 18 are from Indian Peninsula, considers the presence of uropod accessory subapical spine. Holthuis (1950), Tiwari (1951) & Jaihal et al. (1988) used the second cheliped of male as the most important taxonomic character for determining the species of this genus. Tiwari (1955a) reported 34 species of which 29 species of the genus *Palaemon* are from India, Jaihal et al. (1988) described 3 new species out of 10 of the genus *Macrobrachium*, represented from

Karnataka, 8 species of this genus reported by us, occurring in freshwaters of the state of Tripura, form one compact group from the phylogenetic point of view. On the basis of the geographical distribution of 8 species, it is fairly obvious that Eastern Himalayan region and Assam hills, played an important role for facilitating smooth and rapid reproduction and dispersal of the species reported to other parts of India, Burma, Nepal, Pakistan, China, Thailand, Indonesia, Sri Lanka, Japan & Phillipines. It is obvious that the distribution of the species in the Indian region is concerned, the Eastern Himalayan zone might be the centre from where dispersal to other parts of India starts, It is, of course not new about all species of the genus *Macrobrachium* against the present set of distribution. Alcock (1910) reported about this type of distribution for the Indian freshwater crabs also. Hora (1944, 1949, 1952, 1953a, 1953b) very thoroughly worked out about the torrential fish fauna of India which lead to their particular type of distribution termed as 'Satpura Hypothesis' Dispersal of the Eastern Himalayan torrential fish fauna to the extreme south of Peninsular India routed through Garo Hills, the Chote Nagpur Hills, the Vindhya Satpura hill ranges and the Western Ghats are the existing small fraction claims under this hypothesis. The distribution of *M. assamensis assamensis* (Tiwari), *M. dayanum* (Henderson) and *M. hendersoni platyrostris* (Tiwari) can be satisfactorily explained on the basis of this Hypothesis. It is infact true that prawns are influenced by the total environmental rather than by any single factor in isolation. Therefore, if any suitable conditions prevail, a species may occur outside its normal range having any given factor. The reflection of barriers of dispersion of species imposed by torrents and water falls at lower levels lead to complete absence of prawns at altitudes above 4000 feet in the Tripura. While drawing conclusion, it is interesting to note that altogether 38 species of prawns were described from India out of which 20 species are new to science but no type locality in the state of Tripura was reported by any author till today but all the 8 species incorporated herein by us are tendering to new records.

SUMMARY

It is needless to mention that all the 8 species of the genus *Macrobrachium* Bate reported by the authors occurring in freshwaters in the state of Tripura first time. An exhaustive systematic account inclusive of Material and Methods, synonymy, material examined, Type locality of the species concerned, Diagnostic features of each species and information on geographical distribution is brought together for each species which can be satisfactorily explained on the basis of 'Satpura Hypothesis' was discussed in general in length. In addition to this, a detailed key has also been formulated for easy identification of

the species so far recorded from the state of Tripura. Further, all the 8 species reported upon in the state of Tripura first time, were creditable for the new record only.

ACKNOWLEDGEMENT

We are indeed grateful to the Director, Zoological Survey of India, Calcutta for providing us all kind of facilities including faunistic survey to the concern state. Further, authors are also express their sincere thanks to Sri Susanta Ghosh & B. K. Sarder of the Crustacea Section for tendering sincere efforts for collecting specimens, labelling, packing etc. in the field.

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CRUSTACEA : DECAPODA : POTAMONIDAE

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INTRODUCTION

A survey of available literature shows that only two species namely *Potamon* (*Acanthotelpusa*) *Wodmasoni* (= *Sartoriana soinigera*) of fresh water crabs have so far been reported from Tripura State. An examination of material of fresh water crabs collected by Zoological Survey of India survey parties in recent years have revealed three species belonging to equal number of genera from Tripura.

Of these two species were reported by Alcock as stated above and the third species-*Paratelpusa* (*Barytelpusa*) *luqubris* (= *Barytelpusa*) *Maydelliathelpusa lugubris lugubris* is reported here in from Tripura for the first time.

Though a total number of 102 adult Crabs belonging to only 3 species have been collected it cannot be taken to be exhaustive. More surveys covering all the seasons may reveal additional species.

Sartoriana spinigera is represented by maximum number of specimens followed by *Barytelpusa* (*Mydelliathelpusa*) *luqubris*. *Lobothelpusa wood maseni* is represented by a single male indicating its rarity in this state. Brief synonyms and zoo-geographical distribution for all the three species have been dealt with.

SYSTEMATIC ACCOUNT

Family POTAMONIDAE Rathbun 1904.

(A) Genus *Sartoriana* Bott 1969

(1) *Sartoriana spinigera* (Wood-Mason 1871)

1871. *Paratelpusa spinigera* Wood-Mason, *J. asiat. Soc. Bengal.* 40(2) : 194, T. 10. F. 14.

1910. *Paratelpusa* (*Paratelpusa*) *spinigera*. Alcock, *Cat. Ind. Decap. Crust. India Museum* 1(2) : 72, T. 11. F. 53.

1970. *Sartoriana spiniera*. Bott. *Abh. senckenb natur. Ges.* No. 526 : 39 Pl. 4. F. 35-37. pl. 26. F. 38

Material examined : 4M (Range : CL-17.0-14.2 mm, CW-22.5 19.0 mm) 15F (Range : CL-32.0-8.1 mm, CW-42.2-9.8 mm) Kamalcherra River, Dullubari, Tripura, T. Roy, 12. 3. 92. 1F (CL-32.6 mm CW-41 mm) Surmai River, South of Gondacherra, Tripura, T. Roy, 19. 3. 92. 5M (Range : CL-40.1-22.0 mm, CW-54.7-26.5 mm), 6F (Range : CL-42.0-20.7 mm, CW-53.0-36.5 mm) Dhanyasagar, Udaipur, South Tripura H. C. Ghosh, 25. 3. 97 1M (CL-16.1 CW-20.7 mm), Kadamtala, Dharmanagar Sub. Div, North Tripura, Y. P. Sinha, 15. 12. 89 1M (CL-10.0 mm, CW-12.5 mm), Kanchanpur, Dharmanagar Sub. Div, North Tripura, Y. P. Sinha, 12. 12. 89. 7M (Range : CL-38.5-22.5 mm, CW-50.7-29.1 mm), Birjanagar, Dharmanagar, North Tripura, T. Roy & Party 31. 3. 91, 1M (Range CL-36.6-9.5 mm, CW-48.0-11.7 mm) 1F (CL-10.9 mm, CW-12.8 mm), Y. P. Sinha, 16. 12. 89. 2M (Range : CL-31.3-26.7 mm, CW-42.1-35.0 mm), 2F (Range : CL 27.7-17.0 mm, CL-36.1-21.5 mm), T. Roy & Party, 13. 4. 91. 3M, (Range : CL-32.0-23.4 mm, CW-42.0-29.5 mm) 1F (CL-15.5 mm, CW-20.3 mm), Bormura, North Tripura, T. Roy & Party, 17. 4. 91. 3M (Range : CL-42.6-19.5 mm, CW-59.4-23.5 mm), 2F (Range : CL-32.0-28.7 mm, CW 40.0-36.5 mm), T. Roy and Party, 1M (CL-37.1 mm, CW-40.0 mm), 1F (CL-30.7 mm, CW-38.9 mm), Bagon, Dharmanagar, North Tripura, T. Roy & Party, 30. 3. 91. 2M (Range : CL-29.6-25.6 mm, CW-35.5-32.0 mm), 5F (Range : CL-30.2-23.5 mm, CW-39.5-30.4 mm), Khudsinpara

Chamanu Rd. North Tripura, T. Roy and Party, 15. 4. 91. 2M(Range CL-27.9-23.6 mm, CW-35.1-32.0 mm), 2F(Range : CL-42.0-33.0 mm, CW-51.5-43.0 mm), Manubari, North Tripura, T. Roy & Party, 14.1.91. 4M(Range : CL-43.5-26.0 mm, CW-49.2-32.6 mm), 1F(CL-33.6 mm, CW-43.4 mm), Asrambari, West Tripura T. Roy and party, 22. 4. 91. 5M(Range CL-35.8-19.5 mm, CW-48.5-25.6 mm), Gerania, North Tripura, T. Roy & Party, 18. 4. 91. 4M(Range : CL-28.2-21.5 mm, CW-37.5-27.1 mm) 4F(Range CL-30.2-16.9 mm, CW-39.1-23.3 mm), Champak Nagar, North Tripura, T. Roy & Party, 18. 4. 91. 2F(Range : CL-25.8-25.7 mm, CW-37.8-37.2 mm), Vill : Bagon, Dharmanagar, North Tripura, T. Roy & Party, 30. 3. 91.

Distribution : INDIA : Tripura : Dullubari, Gondacherra, Udaipur (S. Tripura), Dharmanagar, Kanchanpur, Birjendranagar, Salena, Bormura, Begon, Khusdinpara, Manubari, Gerania, Champaknagar, (North Tripura), Asrambari (W. Tripura), Uttarpradesh : Sharanpur, Hardwar, Punjab : Jullandar, Punjab Districts, Orissa : Puri District, West Bengal : Calcutta, Assam : Cachar, Bihar : Darbhanga, Kissen-Ganj, Meghalaya : Simsong River, Garo Hills.

Elsewhere : Jessore, Sylhet, Karachi.

Type Species : *Paratelphusa spinigera* Wood-Masen 1871.

Type locality : India, Jessore (Bangladesh) (Spinigera)—Sibsagar, Assam, Trilobate.

Remarks : *Sartoriana spinigera* is widely distributed and commonly available in the north East India. The largest specimen recorded here measures-CW-59.4 mm, CL-42.6 mm.

(B) Genus *Barytelphusa* Alcock 1909

(2) *Barytelphusa* (*Mydelliathelphusa*) *luqubris* (Wood-Mason 1871)

1871. *Telphusa lugubris* Wood-Mason *J. asiat. Soc. Bengal*, 40(2) : 197, T. 12F. 5-7.

1910. *Paratelphusa* (*Barytelphusa*) *luqubris*, Alcock, *Cat. Ind. Decap. Crust. Indian Museum*, 1(2) : 91, T. 12 F. 58.

1910. *Paratelphusa* (*Barytelphusa*) Harpax, Alcock, *Cat. Ind. decap. Crust. Indian Museum*, 1(2) : 95. T. 7. F. 25.

1970. *Barytelphusa* (*Maydelliathelphusa*) *lugubris* *luqubris*, Boët, *Abh. Senckenb. natur. Ges.* No. 526 : 34 ; pl. 3F 24-26 pl 26 f. 15.

Material examined : 3M (Range : CL-51.7-23.7 mm, CW : 67.7-29.6 mm), Fuldungsei, Jumpoi Hills, North Tripura, T. Roy and party, 5. 4. 91. 1M(CL-52.6 mm, CW-73.4 mm), 1F(CL-49.5 mm, CW-62.7 mm), Vangmun, Jumpoi Hills, North Tripura, T. Roy & Party, 5. 4. 91, 2F (Range : CL-46.0-42.7 mm, CW-58.7-53.1, MCL-45.4 mm, CW-59.5 mm), Subal Lake, Jumpoi Hills, North Tripura, T. Roy and party, 5. 4. 91. 1M(CL-46.4 mm, CW-60.5 mm), Salema, North Tripura, T. Roy 7 party, 13. 4. 91. 1F(CL-46.5 mm, CW-69.4 mm), Boruma, North Tripura, T. Roy & 17. 4. 91. 1M(CL-45.4 mm, CW-59.5 mm).

Distribution : INDIA : Tripura : Jumpoi Hills, Salema, Boruma (N. Tripura). West Bengal : Darjeeling Calcutta, Manipur : Manipur Hills, Assam ; Dafla Hills, Teesta Valley ; Sikkim : Sikkim Nagaland : Naga Hills. Meghalaya : Cherrapunje, Khasi Hills and Garo Hills (no specific locality).

Elsewhere : Nil.

Type species : *Telphusa lugubris* Wood-Mason 1871.

Type locality : Sikkim Pankabari, 200 feet.

Remark : *Telphusa* (*Maydelliathelphusa*) *luqubris* *luqubris* is reported here in for the first time from Tripura state.

(C) Genus *Lobothelphusa* Bouvier 1917

(3) *Lobothelphusa woodmasoni* (Rathbun 1905)

1905. *Potamon* (*Paratelphusa*) *Woodmasoni* Rathbun, *Nouv. Arch. Mus*, (4) 7 : 262T. 12 F. 12

1910. *Potamon* (*Acanthotelphusa*) *Woodmasoni* : Alock, *Cat. Ind. Decap. Crust. Ind. Mus*, 1(2) 63, T. 11. F. 50.

1970. *Lobothelphusa wood masoni* : Bot, *Abh. Senckenb natur. Ges.* No. 526 : 149 pl. 38 F. 26. p. ; 46. F. 24.

Material examined : IM(CL-44.1 mm, CW-54.1 mm), Vill : Kanakpur, Kailasahar, North Tripura, T. Roy and Party, 10. 4. 91.

Distribution : India : Tripura : Kanakpur Kailasahar (N. Tripura). Meghalaya : Garo Hills, Assam : Cachar, Sibsagar, Assam.

Elsewhere : Pegu, Moulmein Narail Jessore (Bangladesh) Nieder Burma.

Type species : *Potamon (Acanthotelohusa) wood masoni* Rathbun 1905.

Type locality : Nieder Burma, Pegu Yoma.

Remark : *Lobotelphusa wood masoni* is reported here in for the second time from Tripura by a single male.

SUMMARY

In the present report three species of Potamonid Crabs belonging to three genera are dealtwith. One species *Barytelphusa Maydelliathelphusa lugubris lugubris* (Wood-Mason 1871) is recorded for the first time from Tripura.

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CLADOCERA

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INTRODUCTION

The Freshwater Cladocera are among the most common microcrustaceans in the Freshwater Wetlands of India but they are not known taxonomically and ecologically compared to those in the surrounding countries such as Malaysia, Sri Lanka, Philippines and Indonesia. (Idris, 1983 ; Fernando, 1980). This is partly because of their limited and indirect economic importance. So far, no attempt has been made to study the Tripura State Freshwater Cladocera comprehensively. Hence, this study was initiated.

Tripura, one of the north-eastern States of India is surrounded mainly by Bangladesh, Assam and Mizoram, physiogeographically this state is situated in the eastern part of India lying between latitudes 22° 56' to 24° 32' N and longitude 91° 12' to 90° 21' E in the Sub-Himalayan region. Five major ranges of hills, viz., Jampai, Sakbantlang, Longtarai, Atharamura and Baramura running from north-west to south-east and alternating with marshy valleys are spread over the State. The State of Tripura (10,490 sq. km.) is at the southern most tip of at north-east India, and being lowlying, is most tropical in nature. The drainage systems of Tripura are Khowai, Dhalai, Manu, Juri and Longai rivers in the northern direction, Gumti and Howda rivers in the east ; in the south-east Fenny and Muhuri rivers which are tidal rivers. These tidal rivers mix with the Bay of Bengal flowing through Bangladesh. The Gumti is the largest river of this State flowing from the eastern side of the state towards the western side of Tripura. This river enters into the territory of Bangladesh in sub-division Sonamura. For the purpose of pisci culture various dams have been

constructed on this river. Several reservoirs have been connected with this river.

Collection localities :

(i) *Teliamura* : The wetlands visited by us are mainly man-made and temporary. Most of the waterbody is covered either with *Microcystis* sp. or *Eichornia* sp. and are being mainly used for fish culture.

(ii) *Manu* : In this town we made collections only from roadside ponds which are temporary in nature. A few ponds have more than two species of aquatic weeds.

(iii) *Sonamura* : Here, we made collections from a place called Melaghar or Rudra sagar lake with an area of 5.3 sq. km. and 3.5 to 4 metres depth. The littoral regions of this lake are completely filled with aquatic weeds *Najas* sp., *Hydrilla* sp. and Lily plants. This lake is visited by many migratory birds and is mainly used for recreational and pisciculture purposes. Other than this there are many wetlands available on the road sides of this town.

(iv) *Rajnagar* : Trishna wild life sanctuary is situated in this place. There are two big wetlands inside this sanctuary. The total area of the sanctuary is 173 sq. km. One of the wetlands which is situated inside the sanctuary has a variety of aquatic weeds and is visited by many local and migratory birds.

(v) *Amarpur* : We made collections from a lake called Phatick Sagar which is mainly used for fishing purpose. This is one of the largest lakes in Tripura having thick aquatic submerged weed growth which in turn harbours many species of zooplankton.

(vi) *Jothanbari* : This lies in between Amarpur and Thirthmukh sub-divisions. This town is located in the South Tripura district and is adjacent to the hilly Chittagong region (Bangladesh). Gumti reservoir is located here and is very large in size, covering an area of 500 sq. km. This wetland harbours many aquatic microphytes and is also visited by many migratory birds.

(vii) *Udaipur* : This is the Head Quarters of the South Tripura district and has many wetlands such as Suksagar, Dhanidsagar, Amarsagar and Jagannath dighy. Dhanisagar lake is a very promising wetland covered wholly by lotus and other macrophytes and is being visited by many migratory birds.

(viii) *Agartala* : In this place, we visited a sanctuary called Sipahijola which is a very interesting wetland. This wetland is being used mainly for recreational purpose. Many migratory birds were seen visiting this wetland.

MATERIAL AND METHODS

This study focuses on the taxonomy and distribution of Cladocera in Tripura State as a whole. In Tripura, the order Cladocera is represented by six families namely : Sididae, Daphniidae, Moinidae, Bosminidae, Macrothricidae and Chydoridae.

During our survey, 52 wetlands were visited and 153 samples were collected throughout Tripura State from various types of habitat namely, ricefields, marshes, ponds, reservoirs, lakes, dams, streams, rivers and miscellaneous water bodies. Tripura is a small state covering 10,490 sq. km. only. The normal annual rainfall is 3560 mm, mean maximum temperature is 32°C and the mean minimum temperature is 15°C. The mean relative humidity is 84%. The localities from where the samples were collected are shown in Fig. 1 and the list of wetlands surveyed is given in Appendix I.

Cladocera samples were collected using plankton nets with a circular mouth of 45 cm in diameter. The fauna were collected usually

in shallow water, among vegetation and in open water. The net was dragged close to the bottom to avoid excessive stirring of the mud. This sampling technique gave a qualitative sample of shallow water invertebrates living on the substratum, among vegetation and in the water column, a situation similar to ricefields or marshes. The samples were preserved in 5% formalin with sugar. Temporary slides were made using glycerine and important diagnostic characters were studied using a compound and wild microscopes.

MORPHOLOGY AND TERMINOLOGY

Most of the Cladocera range in size from 0.2 to 3.0 mm. The body is not clearly segmented, and in the great majority of the species, the thoracic and abdominal regions are covered by a single carapace. In lateral view, the carapace is variously shaped. There are often surface reticulations, or other types of markings. The head also shows variation in some taxa. Two light sensitive organs, the compound eye and the ocellus are present in the head. The antennule is usually situated in the ventral side of the head (Moinidae), or at the anterior margin (Macrothricidae) and sometimes reduced and immovable (Daphniidae). A biramous antennae are also present attached close to the posterior margin of the head. These antennae function as a main locomotion or swimming organ (Fig. 2).

The mouth parts of Cladocera are of little taxonomic value except the labral plate which varies in morphology in Macrothricidae and Chydoridae. The shape of the head shield and the middorsal head pores are of important taxonomic value in identification of chydorid cladocerans (Frey, 1959).

The carapace encloses 5-6 pairs of trunk limbs (thoracic legs). The posterior part of the body ends in a variously shaped postabdomen which bears anus, 2 long natatory setae, two terminal claws, basal spines and usually a series of anal denticles and lateral spinules (Fig. 2).

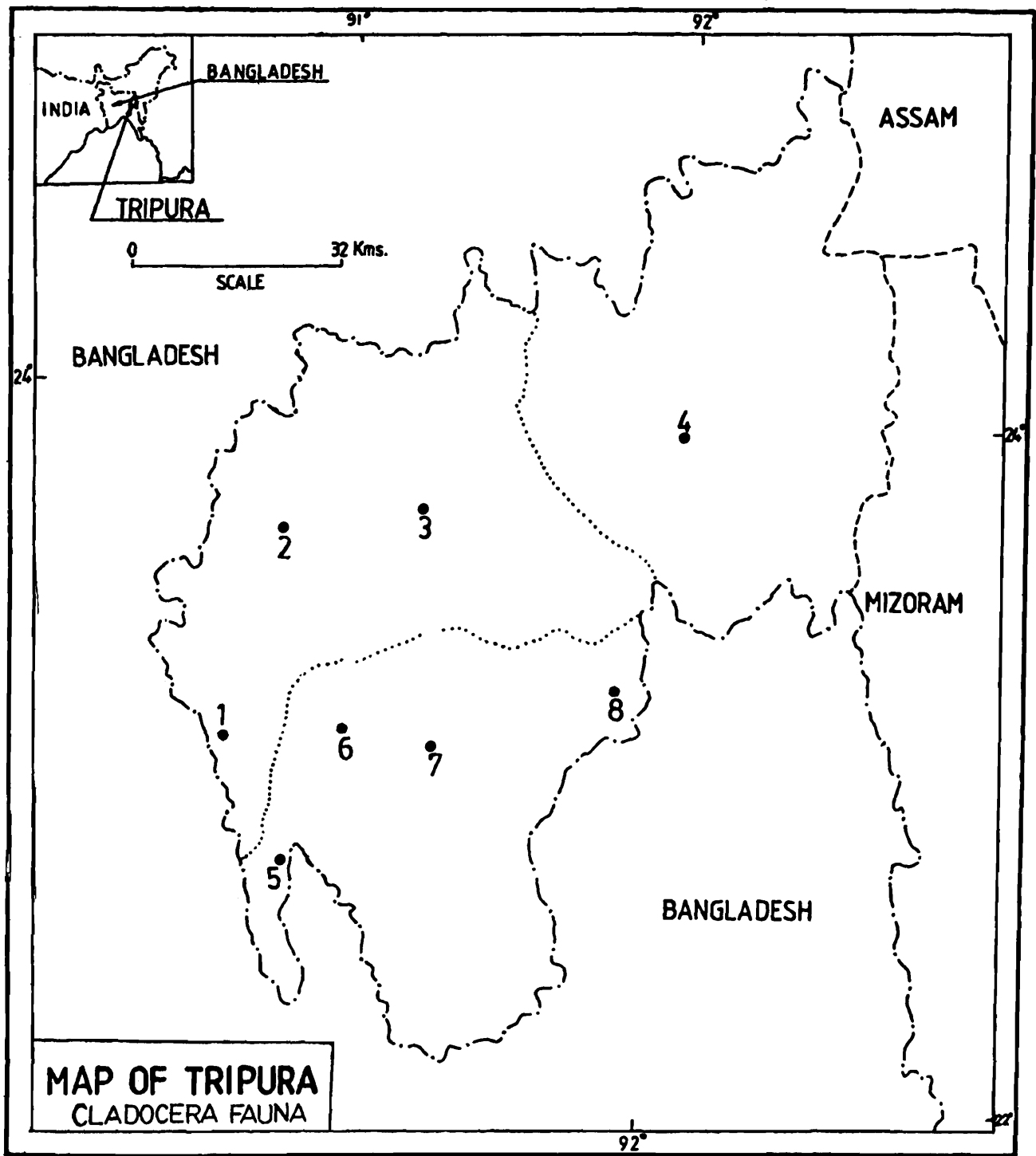


Fig. 1. Survery of Cladocera fauna from 1. Sonamura, 2. Sepahijolla, 3. Teliamura, 4. Manu, 5. Rajnagar, 6. Udaipur, 7. Amarpur and 8. Jothanbari.

SYSTEMATIC ACCOUNT

Phylum ARTHROPODA

Class CRUSTACEA

Subclass BRANCHIOPODA

Order CLADOCERA

Family I SIDIDAE Sars, 1865

Genus *Diaphanosoma* Fischer, 18501885. *Diaphanosoma excisum*, Sars.1895. *Diaphanosoma sarsi* Richard.Genus *Pseudosida* Herrick, 18841884. *Pseudosida bidentata* HerrickGenus *Latonopsis* Sars, 18881888. *Latonopsis australis* Sars.Genus *Sida* Straus, 18201820. *Sida crystallina* (O. F. Müller, 1776)Family II. DAPHNIIDAE Straus,
1820Genus *Ceriodaphnia* Dana, 18531885. *Ceriodaphnia cornuta* Sars.Genus *Scapholeberis* Schoedler, 18581853. *Simocephalus acutirostratus* (King)1841. *Simocephalus exspinosus* (Koch)1841. *Simocephalus serrulatus* (Koch)1776. *Simocephalus vetulus* (O. F. Müller)Genus *Daphnia* O. F. Muller, 17851885. *Daphnia lumholtzi* Sars.Family III MOINIDAE Goulden,
1967Genus *Moinodaphnia* Herrick, 18871853. *Moinodaphnia macleayi* (King)Genus *Moina* Baird, 18501874. *Moina micrura* Kurz.

Family IV. BOSMINIDAE Sars, 1865

Genus *Bosminopsis* Richard, 18951895. *Bosminopsis deitersi* RichardGenus *Bosmina* Baird, 18451776. *Bosmina longirostris* (O. F. Müller)Family V. MACROTHRICIDAE
Baird, 1843Genus *Macrothrix* Baird, 18431852. *Macrothrix spinosa* KingGenus *Echinisca* Lievin, 18481930. *Echinisca capensis monodi* Gauthier1886. *Echinisca triserialis* (Brady)Genus *Ilyocryptus* Sars, 18621882. *Ilyocryptus spinifer* HerrickFamily VI. CHYDORIDAE Stebbing,
1902

Sub-Family CHYDORINAE Frey. 1967

Genus *Pleuroxus* Baird, 18431879. *Pleuroxus denticulatus* BirgeGenus *Alonella* Sars, 18621854. *Alonella excisa* (Fischer)Genus *Disparalona* Freyer, 19681941. *Disparalona rostrata* (Koch)Genus *Chydorus* Leach, 18161776. *Chydorus sphaericus* (O. F. Müller)1898. *Chydorus ventricosus* Daday1894. *Chydorus barroisi* Richard1893. *Chydorus faviformis* Birge1893. *Chydorus reticulatus* Daday1901. *Chydorus pubescens* SarsGenus *Dunhevedia* King, 18531853. *Dunhevedia crassa* King1898. *Dunhevedia serrata* DadayGenus *Dadaya* Sars, 19011898. *Dadaya macrops* (Daday)Genus *Pseudochydorus* Freyer, 19681843. *Pseudochydorus globosus* (Baird)

Subfamily ALONINAE Frey 1967

Genus *Leydigia* Kurz, 18751854. *Leydigia acanthocercoides* (Fischer)Genus *Acroperus* Baird, 18431834. *Acroperus harpae* (Baird)Genus *Camptocercus* Baird, 18431896. *Camptocercus australis* SarsGenus *Euryalona* Sars, 19011898. *Euryalona orientalis* (Daday)Genus *Notoalona* Rajapaksa and Fernando, 19871893. *Notoalona globulosa* (Daday)Genus *Alona* Baird, 18431862. *Alona rectangula* Sars1862. *Alona guttata* Sars1853. *Alona pulchella* King1895. *Alona davidi* Richard1862. *Alona costata* Sars1901. *Alona monacantha* Sars1862. *Alona intermedia* Sars1853. *Alona karua* King1901. *Alona verrucosa* Sars1963. *Alona kwangsiensis* ChiangGenus *Oxyurella* Dybowski & Growchowski, 18941898. *Oxyurella sinhalensis* (Daday)

Key to the families of CLADOCERA

1. a. Six pairs of legs of similar structure
.....SIDIDAE Baird, 1850.
- b. Five pairs of legs of different structure
.....2.
2. a. Dorsal ramus of antennae 4 segmented
ventral ramus 3 segmented 5.
3. a. Antennules not mobile
.....DAPHNIIDAE Straus, 1820.
- b. Antennules mobile 4.

4. a. Antennules situated on anteroventral end of head ...MACROTHRICIDAE Baird, 1843.
- b. Antennules situated on the ventral margin of the head but not at anterior end
.....MOINIDAE Goulden, 1967.
5. a. Antennules fused with the rostrum, forming a proboscis like structure
.....BOSMINIDAE Sars 1895.
- b. Antennules are at base of ocellus covered by head shield of rostrum
.....CHYDORIDAE Stebbing, 1902.

Family I SIDIDAE

Key to the genera* and species of Sididae

(* Generic diagnosis of the genera with only one species are not given)

1. a. Dorsal ramus of antenna 3 segmented
.....*Sida crystallina* (O. F. Muller)
- b. Dorsal ramus of antenna 2 segmented ...2.
2. a. Postabdomen without anal spines
.....*Diaphanosoma* Fischer, 1850.
- b. Postabdomen with anal spines 3.
3. a. Rostrum present
.....*Pseudosida bidentata* Herrick, 1884.
- b. Rostrum absent
.....*Latonopsis australis* Sars, 1884.

Genus *Diaphanosoma* Fischer, 1850Key to the species of *Diaphanosoma*

1. a. Posteroventral corner of valve with 6-7 spines
.....*Diaphanosoma excisum* Sars, 1885.
- b. Posteroventral corner of valve with more than 10 spines
.....*Diaphanosoma sarsi* Richard, 1895.

Diaphanosoma excisum Sars, 1885 (Fig. 3)

1885. *Diaphanosoma excisum* Sars, Norske, vidensk Selsk. Forhandl. Christiania., 8 : 1-46.
1933. *Diaphanosoma paucispinosum* Brehm, Arch. Hydrobiol., Suppl. 11 : 631-771.

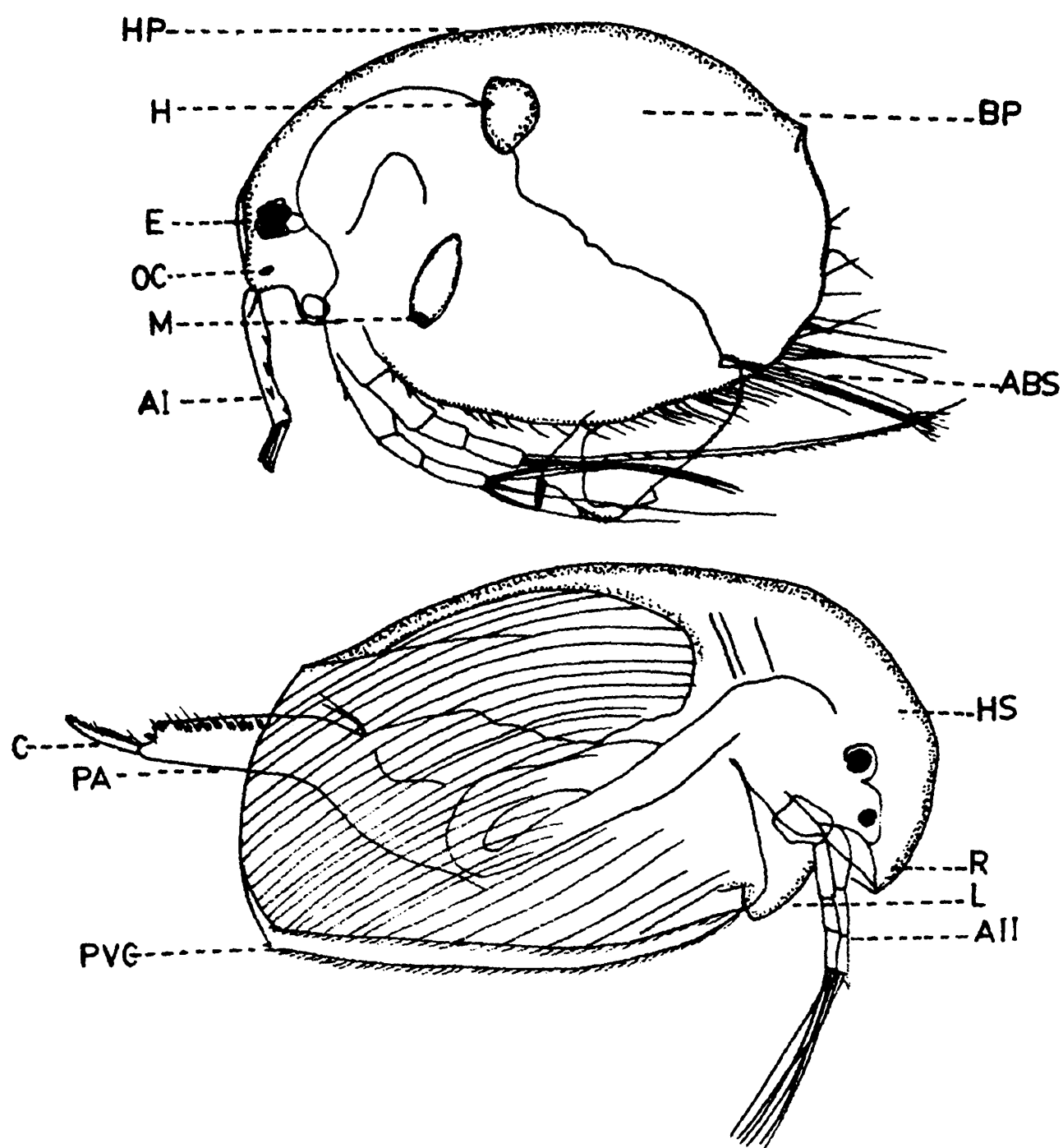


Fig. 2. Generalised structure of Tripura Cladocera : AI antennule (1st antenna) ; AII-antenna (2nd antenna) ; ABS - abdominal setae ; BP - brood chamber ; C - claw ; E - eyes ; HS - head shield; HP - head pore ; H - heart ; L - labral plate ; M - mandible ; OC - ocellus ; PA - postabdomen ; PVC - posteroventral corner ; R - rostrum.

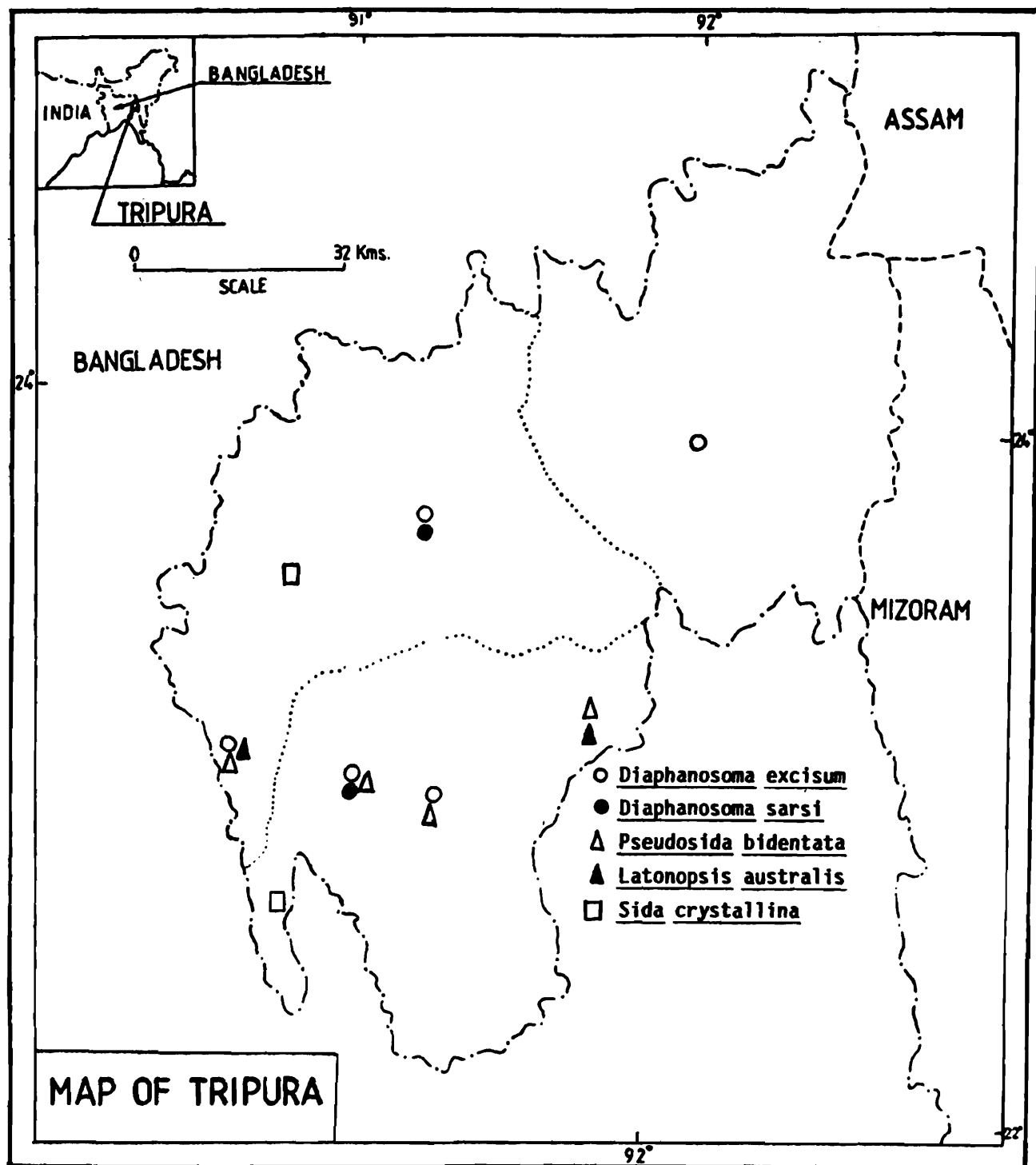


Fig. 3. Distribution of Cladocera fauna of Tripura - Sididae.

Material examined : Several females from Kollahati lake I, II and R. B. pond, North Gokul Nagar pond 1, 2, 3, Boranucholk ponds and Kowai River of Telliamura ; Forest pond, R. B. pond ; Fish pond Gagarachara pond and Road side stream pond of Manu ; Rudra Sagar lake, Gramtali pond, Pond with bund and Battali pond of Sonamura and Suk Sagar rice fields of Udaipur.

Female : Size 1.05 mm. large and rounded anteriorly. Eye small. Posteroventral corner broadly rounded with 5-9 marginal denticles followed by a series of fine setules. Claw serrated on the distal convex surface ; concave surface with three long basal spines.

Distribution : INDIA—Andaman and Nicobar islands, Rajasthan, Tamil Nadu and Tripura States.

Elsewhere : Common in tropical regions.

Remarks : Very common. Occurs in all types of habitat except in marshes.

***Diaphanosoma Sarsi* Richard, 1894 (Fig. 3)**

1894a. *Diaphanosoma sarsi* Richard, *Ann. Mus. Civico Stor. Nat. Genova.*, **14** ; 565-578.

1898. *Diaphanosoma singalense* Daday, *Terms. Fezetek*, **21** : 1-123.

Material examined : Several females from Rudra Sagar lake and Indiranagar pond of Sonamura ; Road side weed pond of Amarpur and Suk Sagar ricefields, Dhanisagar lake and Amarsagar lake of Udaipur.

Female : Body size 1.25 mm. Eye large, fills the head almost completely. Long setae on margin of ventral fold. Posteroventral corner with 17-23 spines. Postabdomen with characteristic setae on the lateral side.

Distribution : INDIA : Bihar, Meghalaya, Rajasthan, Tamil Nadu and Tripura.

Genus *Pseudosida* Herrick, 1884

***Pseudosida bidentata* Herrick, 1884**

1884. *Pseudosida bidentata* Herrick, *Geol & Nat. Hist. Survey Minnesota, Ann. Rep.*, **12** : 1-191.

1953. *Pseudosida szalayi* Brehm, *Ost. Zool. zeit.*, **4** : 241-345.

Material examined : Several females from Battali weedy pond of Sonamura ; Roadside ricefields of Amarpur ; Gumti reservoir and Gumti river at Karaichara of Jothanbari and Dhanisagar lake of Udaipur.

Female : Body size 1.20 mm. 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. Antenna not extending beyond the posterior margin of valves. Ventral margin with a series of long setae followed by a series of spinules on the posteroventral corner. Postabdomen with 10 groups of lateral spines. Claw long with 3 basal spines.

Distribution : INDIA : Andaman and Nicobar Islands, Rajasthan, Tripura and Tamil Nadu.

Elsewhere : South-East Asia, South Africa and South America.

Genus *Latonopsis* Sars, 1888

***Latonopsis australis* Sars, 1888 (Fig. 3)**

1888. *Latonopsis australis* Sars. *Fortn. Vidensk. Selsk. Christiania*, **8** : 1-46.

1892. *Latonopsis occidentalis* Birge, *Trans. Wis. Acad. Sci. Arts. and Letts.*, **4** : 77-109.

Material examined : Several females from Gramtali weedy pond of Sonamura and Gumti reservoir and Gumti river at Karaichara of Jothanbari.

Female : Body size. 170 mm. Head large with antennules on the ventral side. Eye large, situated very near to anterior margin of the head ; ocellus conspicuous ; setae on antenna : 4-7/0-1-4. Ventral margin ornamented with rows of long hairs at the anterior side, medium hairs at the middle and three long setae at the posteroventral corner. Postabdomen broad with two spines at the base of the claws, and denticles 10-12.

Distribution : INDIA : Rajasthan, Tripura and Tamil Nadu.

Genus *Sida* Straus, 1820*Sida crystallina* (O. F. Müller, 1776) (Figs. 3-4)

1895. *Sida crystallina* Richard, Ann. Sci. natur. Zool. 18 : 279-387.

Material examined : Several females from Trishna wild life Sanctuary Pond No.1 and Road-side ricefields of Rajnagar and the Sipahijolla wildlife Sanctuary lake.

Female : Body size 1.50 mm. Body oblong in shape. Head very large, separated by a cervical depression. Eye small, located ventrally. Rostrum present. Antennules short with flagellum. Posterior margin of valves straight with spines in groups. Ventral margin slightly convex with group of spines intercepted by a large spine throughout the posterior margin, Postabdomen with a row of 14-16 lateral spines. A single row of lateral setae present. Claw with four long basal spines increasing in size distally with a row of setae distal to the basal spines.

Distribution : INDIA : Assam and Kashmir.

Elsewhere : Holarctic and Neotropical.

Family II. DAPHNIIDAE Straus, 1820

Key to the genera and species of Daphniide

1. a. Valves with elongated posterodorsal spine 2.
b. Valves without posterodorsal spine 3.
2. a. Valves with only one posterior spine long in size.
.....*Daphnia lumholtzi* Sars, 1885.
b. Valves with more than one spine, short and less visible
.....*Ceriodaphnia cornuta* Sars, 1885.
3. a. Ventral margin straight ending a large spine at posteroventral corner
.....*Scapholeberis kingi* Sars, 1903.
b. Ventral margin curved ending smoothly at posteroventral corner
.....*Simocephalus* Schoedler, 1858.

Genus *Ceriodaphnia* Dana, 1852*Ceriodaphnia cornuta* Sars, 1885 (Fig. 5)

1885. *Ceriodaphnia cornuta* Sars, Norske. Vidensk. Selsk. Fornandl. Chirstiania 8 : 1-46.

1894b *Ceriodaphnia rigudi* Richard, Revue, Biol. Nord. France, 6 : 360-378.

Material examined : Several females from North Gokulnagar ponds of Telliamura ; Forest Dept. pond, Reddish brown pond and Roadside weed pond of Manu ; Rudrasagar lake and Battali weedy pond of Sonamaura ; Trishna wildlife sanctuary ricefields of Rajnagar ; Gumti river at Amarpur ; Gumti reservoir at Jothanbari ; Dhanisagar lake and Jagannath dighy of Udaipur and from Sipahijolla sanctuary lake.

Female : Body size 0.39 mm. Head depressed and separated from the carapace by a dorsal impression. Antennules short and broad, with a long seta and a group of sensory setate on the apex. Eye large, ocellus absent. Postabdomen with four or five curved denticles. Claw long, gently curved with a series of setules along the concave surface.

Distribution : INDIA : Andaman and Nicobar Islands, Meghalaya, Rajasthan, Tamil Nadu and Tripura states.

Elsewhere : South-East Asia, China and other torpical regions.

Remarks : Very common. Occurs in all types of habitat, especially in shallow ponds. Both horned and hornless individuals are found together with *D. excisum* and *M. micrura*.

Genus *Scapholeberis* Schoedler, 1853*Scapholeberis kingi* Sars, 1903 (Fig. 5)

1903. *Scapholeberis kingi* Sars, Arch. Math. Nat., 25 : 1-44.

1853. *Daphnia mucronata* King, Proc. R. Soc. van. Diemans Land. 2 : 243-263.

Material examined : Several females from North Gokul Nagar pond of Telliamura ; Rudra Sagar lake and Battali weed pond of Sonamura ;

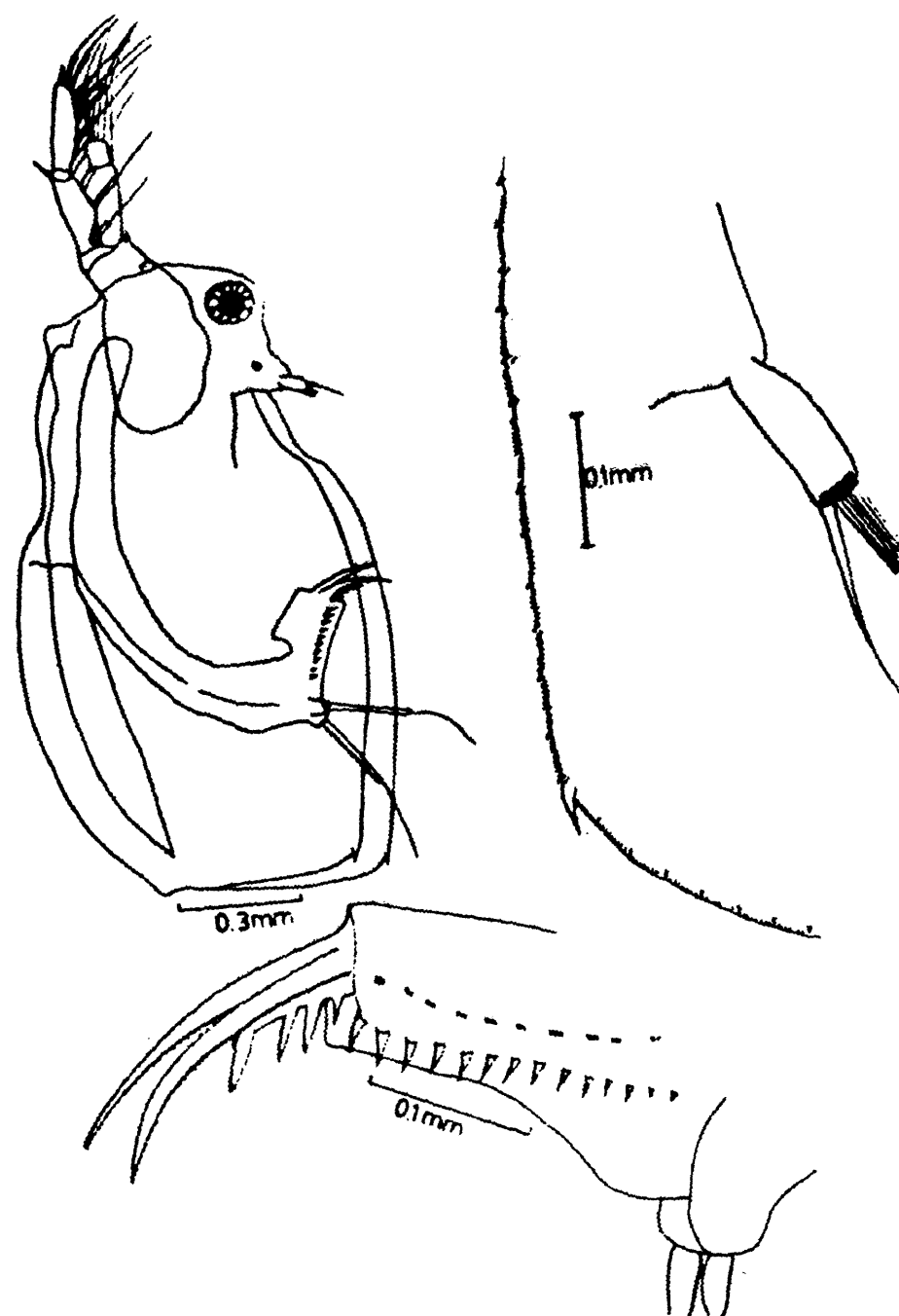


Fig. 4. *Sida crystallina* female.

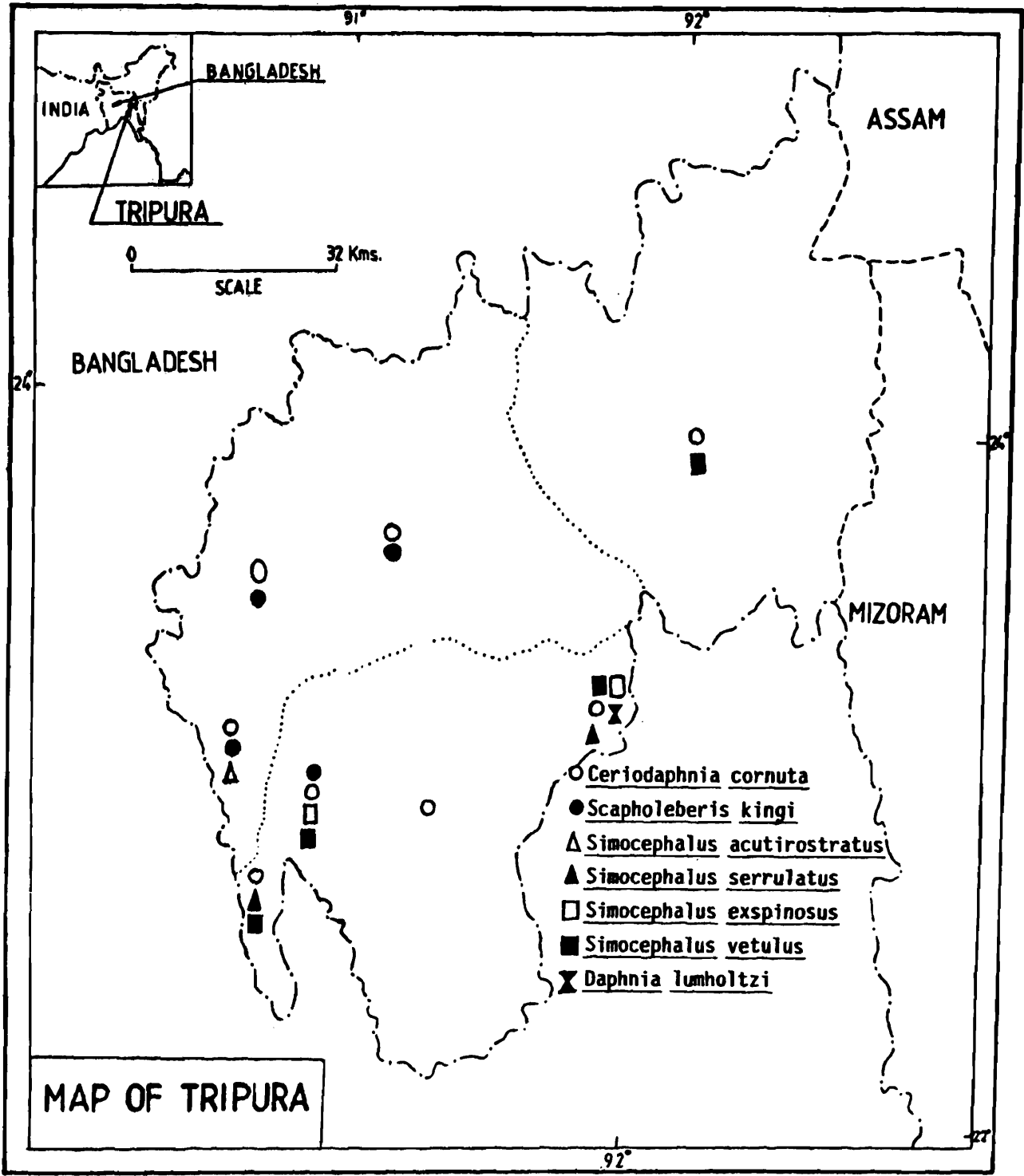


Fig. 5. Distribution of Cladocera fauna of Tripura - Daphniidae.

Dhanisagar lake, Jagannath dighy and Amarsagar ricefields of Udaipur and from Sipahijolla Sanctuary lake.

Female : Body size 0.59 mm. Body rounded dorsally. Head small and slightly depressed, rostrum rounded and projecting ventrally. Eye large, ocellus small situated closer to the rostrum than to the eye. Valves with lines and reticulations; posterior ventral margin has a long denticle. Postabdomen broad, dorsal margin with five or six denticles. Claw curved dorsally with spinules along the concave surface.

Distribution : INDIA : Andaman and Nicobar Islands, Assam, Kashmir, Meghalaya, Rajasthan and Tamil Nadu.

Elsewhere : Africa, North and South America, South-East Asia and China.

Remarks : Occurs in the surface of the water body.

Genus *Simocephalus* Schoedler, 1858

Key to the species of *Simocephalus*

1. a. Head with acute projection
.....*S. acutirostratus* (King, 1853)
- b. Head without acute projection 2.
2. a. Claw with large pectens
.....*S. exspinosus* (Koch, 1841)
- b. Claw with small pectens 3.
3. a. Vertex rounded, without spines. Ocellus elongated.....*S. ventulus* (O.F. Müller, 1776)
- b. Vertex angulate, spinous, Ocellus rhomboidal.....*S. serrulatus* (Koch, 1841)

***Simocephalus acutirostratus* (King, 1853)**
(Fig. 5)

1853. *Daphnia elizabethae* var., *acutirostrata* King, *Pap. proc. R. Soc. van Diemens Land.* 2 : 243-263.

1922. *Simocephalus acutirostratus* Henry, *Pro. Linn. Soc. New South Wales* ; 47 : 26-52.

Material examined : Several females from Rudrasagar lake at Sonamura.

Female : Body size 1.88 mm. Body oval in shape. Dorsal and ventral margin evenly arched with denticles on the posterior side. Posterior protuberance obtuse and pronounced. Head small with an acute projection. Rostrum pointed. Eye small and ocellus punctiform. Postabdomen broad with 7 anal spines increasing in size distally. Claw long and slender with 10-12 pecten and denticulate upto the tip.

Distribution : INDIA : Tamil Nadu.

Elsewhere : Australia, China, South-East Asia and Sri Lanka.

***Simocephalus serrulatus* (Koch, 1841)**
(Fig. 5)

1841. *Daphnia serrulatus* Koch, *Hefts.* 8 : 35-37.

1951. *Simosa serrulata* Gauthier, *Alger*, 1-169.

Material examined : Several females from Trishna wildlife sanctuary ricefields, Rajnagar and from Gumti reservoir at Jothanbari.

Female : Body size 1.35 mm. Body oval in shape with widened posterior region. Dorsal margin evenly arched and ventral margin bulging in middle. Posterior part of dorsal margin and the protuberance denticulated. Head small with large eye. Anterior most region of head with a number or minute denticles. Claw without pecten and setules on its concave margin.

Distribution : INDIA : Tamil Nadu.

Elsewhere : Australia, Africa, China, Europe and South East Asia.

***Simocephalus exspinosus* (Koch, 1841)**
(Fig. 5)

1841. *Daphnia exspinosa* Koch, *Rosenberg. Hefts*, 8, 35, 36, 37.

1916. *Simosa australiensis* Sars, *Ann. S. Afr. Mus.*, 15 : 303-451.

Material examined : Several females from Gumti river Karaichira of Jothanbari and from Dhanisagar lake and Amarsagar ricefields, Udaipur.

Female : Body size 1.8 mm. Shape subrhomboidal, expanded posteriorly Head projecting with curved anterior end. Ventral margin of carapace with denticles. Eye small and ocellus rhomboid in shape. Postabdomen with 10-12 ciliated denticles. Claw long with a distinct basal pecten at the base.

Distribution : INDIA : Meghalaya and Rajasthan.

Elsewhere : Cosmopolitan.

Simocephalus vetulus (O. F. Müller, 176)
(Fig. 5)

1776. *Daphnia vetula* O. F. Müller, *Havniae*, 1-282 pp.

1898. *Simocephalus vetuloides* Sars, *Zool. Mus. Imp. Acad. Sc.* 3.

1971. *Simocephalus elizabethae* (king) Biswas, *Rec. Zool. Soc. India.*, 16 : 92-98.

Material examined : Several females from roadside weedy pond, Manu ; Trishna wildlife sanctuary lake, Rajnagar ; Gumti reservoir, Jothanbari and from Dhanisagar lake Udaipur.

Female : Body size 2.2 mm. Shape broadly oval or rhomboid. Dorsal margin moderately to strongly arched ; posterior part of dorsal margin with distinct denticles. Head small with large eye and elongated ocellus. Postabdomen with 10 anal spines and a long, curved and denticulated claw.

Distribution : INDIA : Andaman and Nicobar Islands, Bihar, Kashmir, Karnataka, Punjab, Rajasthan and Tripura.

Elsewhere : Cosmopolitan.

Genus ***Daphnia*** O.F. Müller, 1785

Daphnia lumholtzi Sars, 1885 (Fig. 5)

1885. *Daphnia lumholtzi* Sars, *Norske. Vidensk. Selsk. Forhand Christiania*, 8 : 1-46.

Material examined : Several females from Gumti reservoir, Jothanbari.

Female : Body size 1.52 mm. Head with pointed helmet. Rostrum small, fornix well

developed. Body rounded. Dorsal and ventral margins with a series of spines. Postabdomen long and narrow with 9-11 denticles on the dorsal side.

Distribution : INDIA : Andhra Pradesh, Bihar, Orissa, Rajasthan and Tamil Nadu.

Elsewhere : Malaysia, Africa, Australia and Europe.

Family III. MONIDAE Goulden, 1967

Key to the genus and species of Moinidae

1. a. Ocellus present
.....*Moinodaphnia macleayi* (King, 1853)
- b. Ocellus absent
.....*Moina micrura* Kurz. 1874.

Genus ***Moinodaphnia*** Herrick, 1887

Moinodaphnia macleayi (King, 1853) (Fig. 6)

1853. *Moina macleayi* King, *Pap. Proc. R. Soc. Van Diemens. Land.* 2. : 243-263.

1901. *Monodaphnia macleayi* Sars, *Arch. Math. Nat.*, 23, 1-102.

Material examined : Several females from roadside weedy ponds at Manu; Battali weedy pond, Sonamura and from Dhanisagar lake Udaipur.

Female : Body size 0.81 mm. Head with distinct cervical depression. Eye large, ocellus small, situated closer to antennules than to eye. Antennules slender with long lateral seta and group of sensory setae on the apex. Ventral margin of valve rounded with series of short marginal spines. Postabdomen without anal denticles. Lateral surface with 8-10 ciliated spines. Claw long with a series of short setules along concave surface.

Distribution : INDIA : Andaman and Nicobar Islands, Rajasthan and Tamil Nadu.

Elsewhere : Tropicopolitan species.

Remarks : Not very common. Occurs only in the marshes.

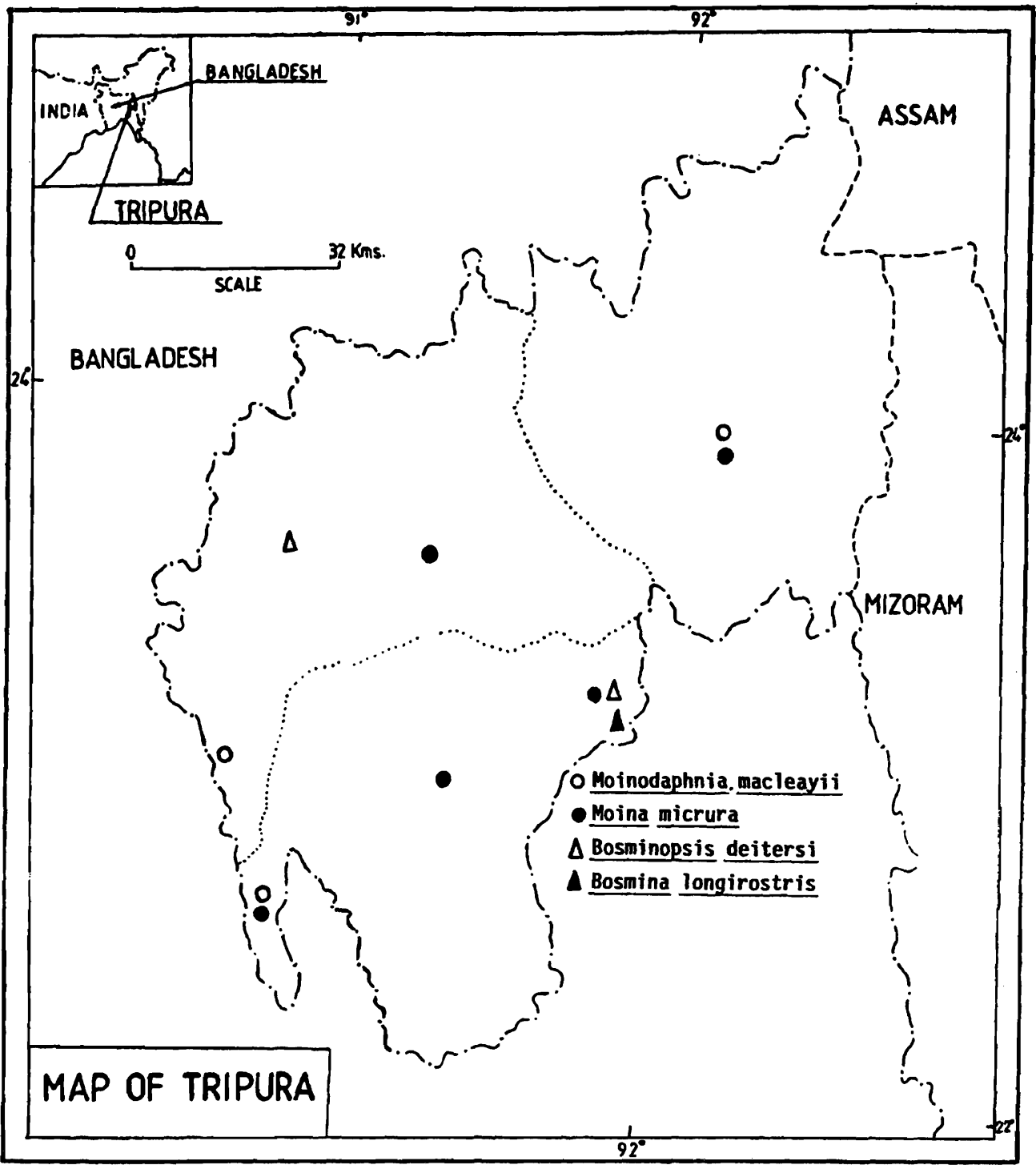


Fig. 6. Distribution of Cladocera fauna of Tripura - Moinidae and Bosminidae.

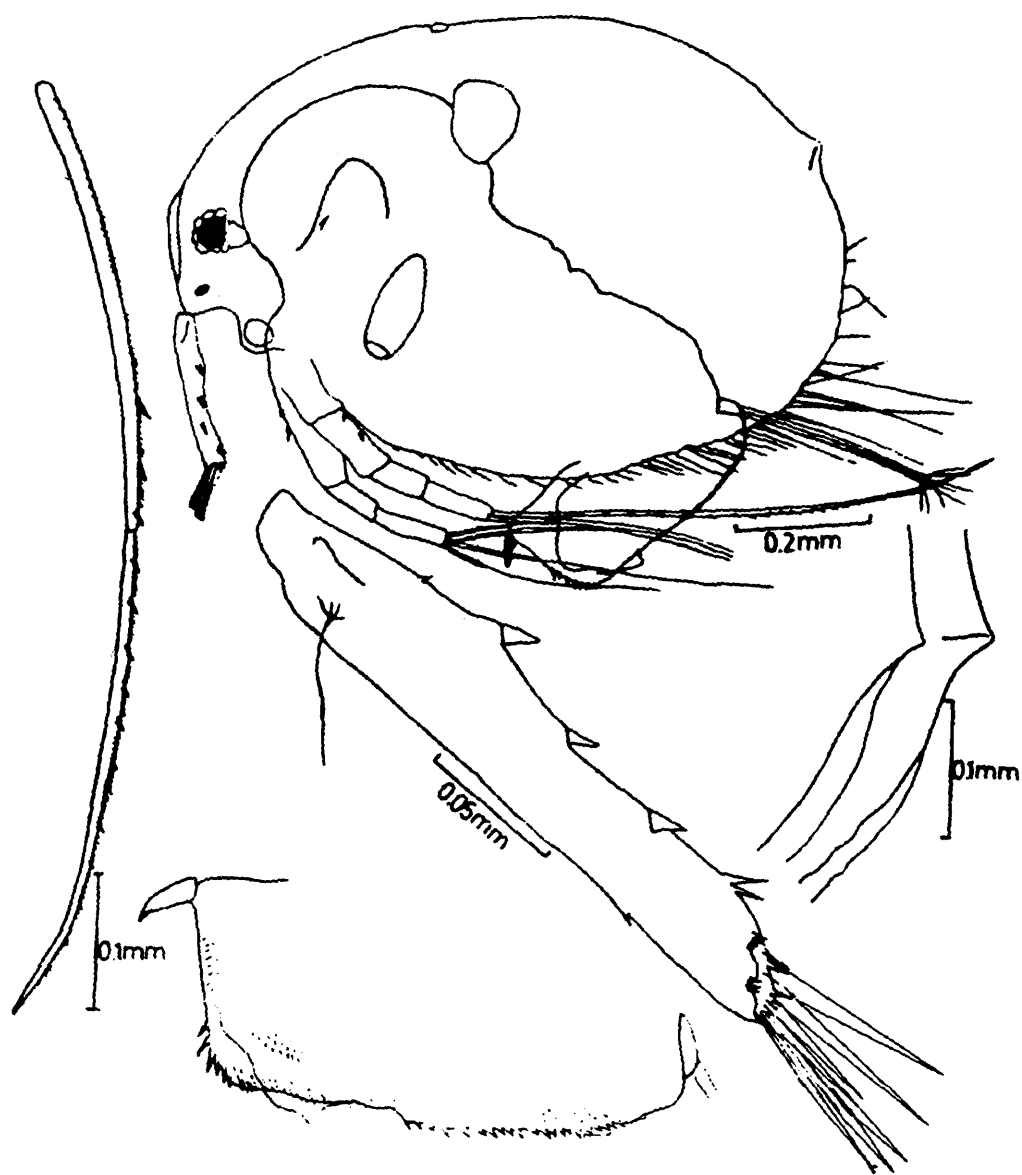


Fig. 7. *Echinisca capensis monodi* female.

Genus *Macrothrix* Baird, 1843*Macrothrix spinosa* King, 1852 (Fig. 9)

1853. *Macrothrix spinosa* King, *Pap. Proc. R. Soc. van. Diemens Land.* 2 : 243-263.
1915. *Macrothrix spinosa dentata* Phyfair, *Proc. Linnean Soc. N. S. Wales.*, 34 : 93-151.

Material examined : Several females from weedy pond and roadside stream pond at Manu, Indira Nagar Eichornia Pond, Gramtali Pond, Battali Pond at Sonamura ; Trishna wildlife sanctuary lake, Rajnagar ; Roadside weedy pond of Amarapur ; Gumti reservoir and Gumti river at Karaichara, Jothanbari ; Suksagar ricefields and Dhanisagar lake at Udaipur and from Sipahijolla wildlife sanctuary lake.

Female : Body size 0.41 mm. Body rounded oval; dorsal margin serrated. Head rounded, ventral margin slightly concave with slightly pointed anteroventral corner. Antennules short, with a long seta near its base. Eye large, ocellus small and situated much nearer to the base of antennules than to the eye. Postabdomen broadly rounded. Claw short and serrated on the concave surface.

Distribution : INDIA : Andaman and Nicobar Islands, Manipur, Rajasthan, Tripura and Tamilnadu.

Elsewhere : Cosmopolitan.

Remarks : Very common. Occurs in all types of habitats.

Genus *Echinisca* Liertin, 1848Key to the species of *Echinisca*

1. a. Posteroventral margin fringed with long seta*E. capensis monodi* Gauthier, 1930.
- b. Posteroventral margin with short seta
.....*E. triserialis* (Brady, 1886).

Echinisca capensis monodi Gauthier, 1930
(Fig. 8-9)

1930. *Macrothrix capensis* var. *monodi* Gauthier *Bull. Mus. Nat. Hist. Natur. Paris*, 11 : 92-116.

1969. *Guernella monodi* Rey and Saint-Jean, *Annales de Limnologie* : 177-182.

Material examined : Several females from Gumti reservoir, Jothanbari.

Female : Body size 0.92 mm. Shape oval ; dorsal margin broadly rounded, posterodorsal corner distinct with or without projection. Antennules typical of the genus, the longest setae armed with a series of fine setules and large spines in between, which decrease in size distally. Carapace convex dorsally, ventral margin evenly rounded with a series of long setae at the posteroventral corner. Postabdomen bilobed ; dorsal-distal margin rounded with 4-5 denticles and scattered groups of short spinules upto the anal groove.

Distribution : INDIA : New record.

Elsewhere : Srilanka, Malaysia and Africa.

Echinisca triserialis (Brady, 1886) (Fig. 9)

1886. *Macrothrix triserialis* Brady, *Intellectual Observer* ; 12 : 416-424.
1971. *Echinisca triserialis* Smirnov, *USSR. Acad. Sci. Zool. Institute Nova Ser. No. 101. Leningrad.* 539 pp.

Material examined : Several females from the roadside weedy ponds, Manu ; Rudrasagar lake, Indiranagar Eichornia pond, Gramtali weedy pond and Battali pond of Sonamura ; Trishna wildlife sanctuary lake, Rajnagar ; Phaticksagar lake, Amarapur and Dhanisagar lake, Udaipur.

Female : Body size 0.56 mm. Body oval. Dorsal margin with a slight cervical depression. Eye large, ocellus small and situated nearest to the apex of rostrum than to the eye. Antennules long with a long lateral seta. Antennae short with a longest seta having two or three longer spines in the middle. Postabdomen bilobed with rows of spines increasing in size proximally. Claw short and serrated without basal spines.

Distribution : INDIA : Andaman and Nicobar Islands, Rajasthan and Tamil Nadu.

Elsewhere : Cosmotropical.

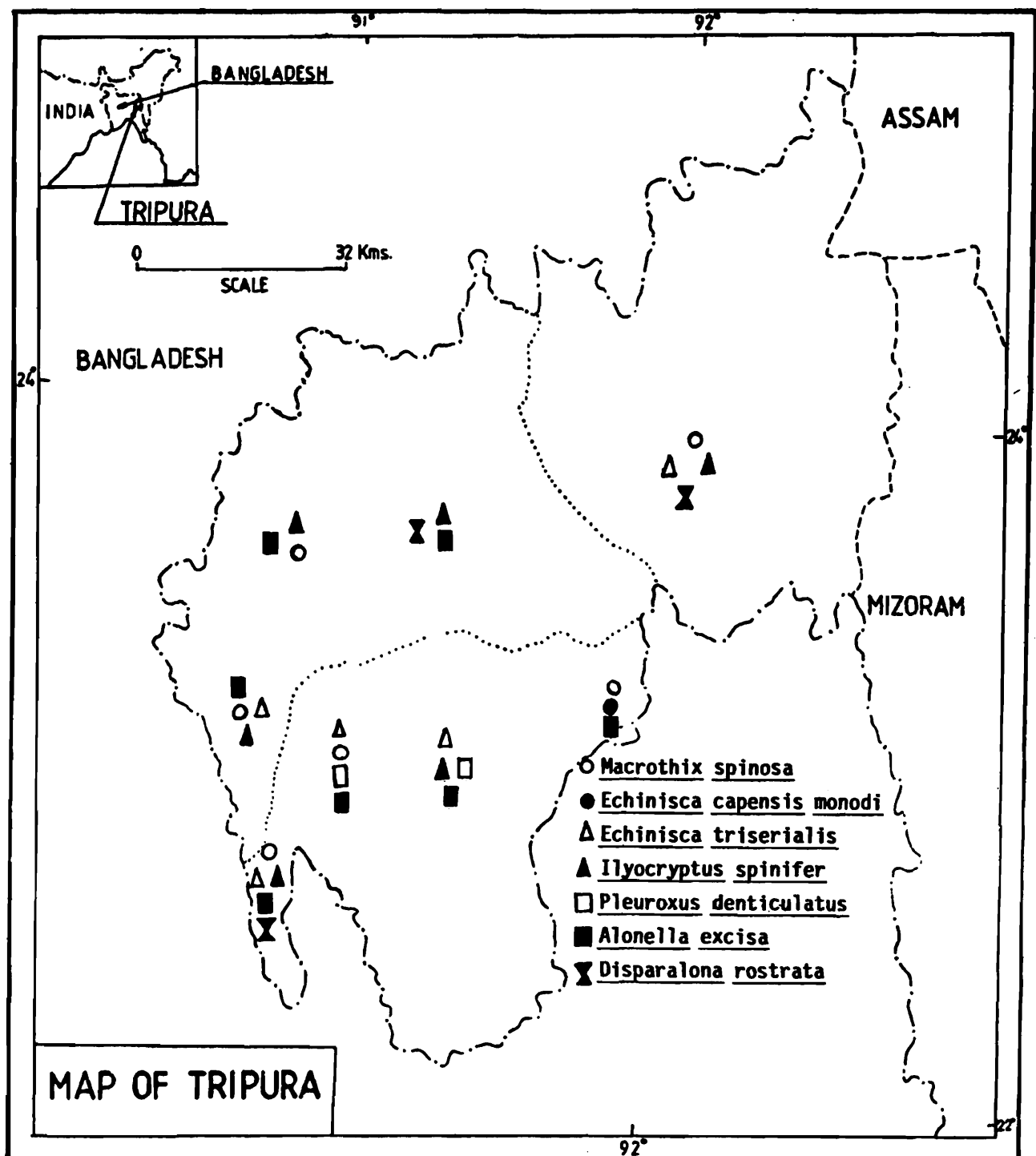


Fig. 8. Distribution of Cladocera fauna of Tripura - Macrothrocidae and Chydoridae.

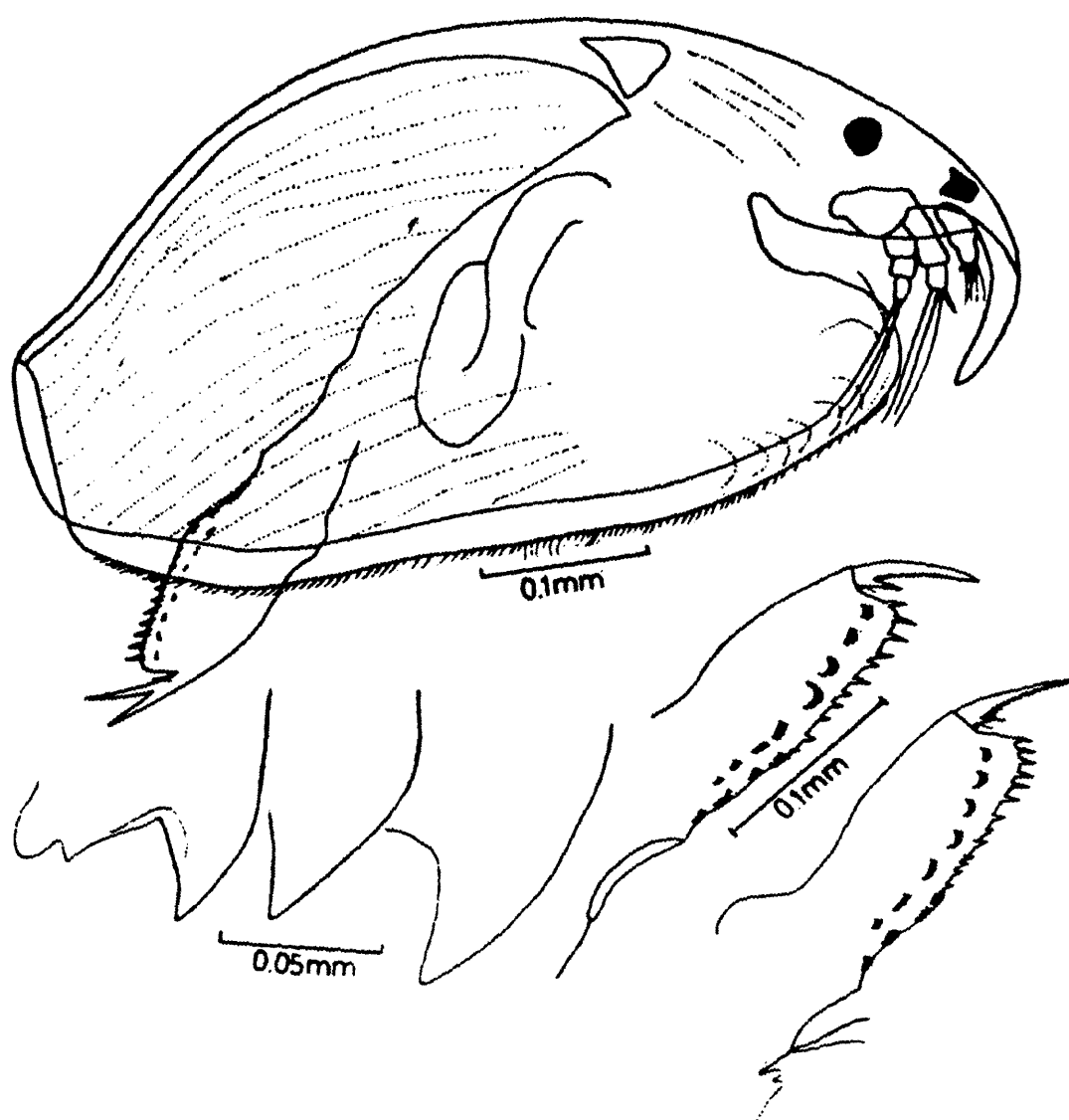


Fig. 9. *Disparolona rostrata* female.

Remarks : Very common. Occurs in the marshes.

Genus *Ilyocryptus* Sars, 1862

Ilyocryptus spinifer Herrick, 1882 (Fig. 9)

1882. *Ilyocryptus spinifer* Herrick, 10th Annual Rep. Geol & Nat. hist. Survey Minn., 235-252.

1914. *Ilyocryptus halyi* var *logniremis* Stingelin, Mem. neuchatel Sci. Nat., 5 : 600-638.

Material examined : Several females from North Gokul Nagar pond, Telliamura ; Roadside weedy pond, Manu ; Bathali pond Sonamura ; Trishna wildlife sanctuary lake and ricefields Rajnagar ; Roadside weedy pond Amarpur and Sipahijolla wildlife sanctuary lake.

Female : Body size 0.76 mm. Body oval. Head small. Eye large, ocellus small, situated about halfway between eye and base of antennules. Antennules long with group of sensory setae on distal end. Valves with a series of long feather-like setae on ventral side. Postabdomen with slight depression in the middle. Preanal margin with eight marginal denticles, postanal margin with 12 denticles upto anal groove and with five long and stout spines on the lateral surface.

Distribution : INDIA : Andaman and Nicobar Islands, Meghalaya, Rajasthan, Tamil Nadu and Tripura.

Elsewhere : South-East Asia, China, Australia and North and South America.

Remarks : Occur at the bottom debris.

Family VI CHYDORIDAE Stabbing, 1902

Key to the subfamilies of CHYDORIDAE

1. a. Two separate main head pores and two small pores situated between main pores..
.....CHYDORINAE Stebbing, 1902.
- b. Two or three main pores and two small pores situated lateral to main pores at a distance ALONINAE Frey, 1967.

Subfamily CHYDORINAE Frey, 1967

Key to the genera and species of *Chydorinae*

1. a. Valves with setae on the entire posteroventral margin 2.
- b. Valves with setae on inner side of posteroventral margin 3.
2. a. Rostrum Short
.....*Pleuroxus denticulatus* Birge, 1879.
- b. Rostrum short and blunt
.....*Alonella excisa* (Fischer, 1854)
3. a. Posteroventral corner with more than one spine*Dunhevedia* King, 1853.
- b. Posteroventral corner without spine 4.
4. a. Labrum without plate-shaped process
.....*Pseudochydorus globosus* (Baird, 1843)
- b. Labrum with plate-shaped process 5.
5. a. Antennule distinctly projecting beyond the rostrum
.....*Dadaya macrops* (Daday, 1898)
- b. Antennule not projecting beyond the rostrum 6.
6. a. Body elongate, size more than 0.40 mm.
.....*Chydorus* (Leach, 1816)
- b. Body elongated, size more than 0.40 mm
.....*Disparolona rostrata* (Koch, 1841)

Genus *Pleuroxus* Baird, 1843

Pleuroxus denticulatus Birge, 1879 (Fig. 8)

1879. *Pleuroxus denticulatus* Brige, Trans. Wis. Acad. Arts. and Letts., 4 : 77-109.

Material examined : Several females from roadside weedy pond and ricefields, Amarpur and Dhanisagar lake, Udaipur.

Female : Body size 0.42 mm. Shape broadly oval with striated carapace. Posteroventral corner with 2-4 denticles. Rostrum long and pointed. Ocellus situated nearer to the eye than to apex of rostrum. Postabdomen with 14-16 denticles with two basal spines on the claw.

Distribution : INDIA : Andaman and Nicobar Islands.

Elsewhere : North and South America, Africa, China and Europe.

Genus *Alonella* Sars, 1862

Alonella excisa (Fischer, 1854) (Fig. 8)

1853. *Lynceus nanus* Lilljeborg. *Lund.* 15,222

1854. *Lynceus excisus* Fischer, *Bull. Soc. Imp. Nat. Mosc.* 27 : 423-434.

1988. *Alonella excisa* (Fischer) Michael and Sharma, *Fauna of India, Cladocera*, 262 pp.

Material examined : Several females from north Gokulnagar, Telliamura ; Indiranagar Eichornia pond, Gramtali pond, Pond with bund and Battalipond, Sonamura ; Trishna wildlife sanctuary lake, Rajnagar, roadside Mimosa pudica pond, Amarapur; Gūmti reservoir, Jothanbari; Dhanisagar Lake, Udaipur and Sipahijolla wildlife sanctuary lake.

Female : Body size 0.48 mm. Dorsal margin of valve arched, posterior margin straight with a sharp end at the posteroventral corner. Valves with reticulation to form a honey comb pattern. Rostrum curved posteriorly. Postabdomen long with 7-8 group of anal denticles and 6-8 groups of lateral setules. Claw with two basal spines.

Distribution : INDIA : Kashmir, Madhya Pradesh and Tripura.

Elsewhere : Cosmopolitan

Genus *Disparalona* Freyer, 1968

Disparalona rostrata (Koch, 1841) (Fig. 8-9)

1841. *Lynceus rostratus* Koch, *Hefts.* 8 : 35, 36, 37.

1968. *Disparalona rostrata* Freyer, *Mar. Biol. Assoc. India. Proc. Symp. Crustacea.* 1 : 29-37.

Material examined : Several females from north Gokulnagar ponds, Telliamura ; Fish pond, Manu and Trishna wildlife sanctuary lake, Rajnagar.

Females : Body size 0.63 mm. Shape oblong. maximum height in the middle. Valves with distinct longitudinal lines. Ventral margin of valves convex with a series of setae. Rostrum long and curved ventrally. Ocellus slightly smaller than eye situated closer to the eye than to the apex of rostrum. Postabdomen relatively long and slender, dorsal distal margin gradually rounded, anal denticles attached submarginally, followed by groups of spinules along the anal groove ; lateral side with 6-8 groups of short setules. Claw long, setulated along the concave surface and with 2 basal spines.

Distribution : INDIA : New record.

Elsewhere : Malaysia.

Remarks : Michael and Frey (1984) reported that the drawings of *D. rostrata* by Idris and Fernando (1981) and Idris (1983) lack many details and further stated that the species available in Eastern Asia is different from the European forms. Further studies on this will prove the real status of the present species.

Genus *Chydorus* Leach, 1816.

Key to the species of genus *Chydorus*

1. a. Valves without deep polygons 2.
 b. Valves with deep polygons
 *Chydorus faviformis* Birge, 1893.
2. a. Plate of labrum with denticles
 *Chydorus barroisi* (Richard, 1894).
 b. Plate of labrum without denticles 3.
3. a. Plate of labrum pointed ventrally
 *Chydorus ventricosus* Daday, 1898.
 b. Plate of labrum broadly rounded 4.
4. a. Valves with short hair on the surface
 *Chydorus pubescens* Sars, 1901.
 b. Valves without hair on the surface 5.
5. a. Valves with strong reticulations and concentration of dots with in each cell
 *Chydorus reticulatus* Daday, 1898.

- b. Valves with pattern of polygons with stright borders or without polygons
 ...*Chydorus sphaericus* (O. F. Müller, 1776).

***Chydorus sphaericus* (O. F. Müller, 1776)**
 (Fig.10)

1776. *Chydorus sphaericus sphaericus* Smirnov, USSR. Acad. Sci. Zool. Institute Nova Ser. No. 101. Leningrad, 539.
 1988. *Chydorus sphaericus* (O. F. Müller) Michael and Sharma, *Fauna of India*, Cladocera, 262 pp.

Material examined : Several females from roadside weedy ponds I and II, Roadside stream pond and Reddish-brown pond, Manu.

Female : Body size 0.32 mm. Shape spherical with posterodorsal corner of the valve distinct. Valves with pentagonal reticulation. Ocellus nearer to the eye than the apex of rostrum. Postabdomen with 7-10 anal denticles and claw with two basal spines.

Distribution : INDIA : Jammu and Kashmir, Meghalaya and Tamil Nadu.

Elsewhere : Cosmopolitan.

***Chydorus ventricosus* Daday, 1898. (Fig. 10)**

1898. *Chydorus ventricosus* Daday, *Termes. Fuzetek.*, **21** : 1-123.
 1966. *Chydorus brehmi* Biswas, *Crustaceana*, **11** : 113-114.
 1971. *Chydorus eurynotus brehmi* comb. n. Smirnov, USSR Acad. Sci. No. 101. Leningrad. 539 pp.

Material examined : Several females from Rudrasagar lake, Sonamura ; Trishna wildlife Sanctuary lake, Rajnagar ; Phaticksagar, Amarpur and Sipahijolla wildlife Sanctuary lake, Agartala.

Female : Body size 0.74 mm. Body oval. Posteroventral corner rounded, with denticle. Valves with hexagonal markings. Rostrum long and pointed. Labrum long, curved anteriorly and slightly pointed. Postabdomen long with distinct preanal corner. Dorsal margin with 9-10 anal denticles. Claw setulated along concave surface with basal spines.

Distribution : INDIA : Andaman and Nicobar Islands, Gujarat, Rajasthan and Tamil Nadu.

Elsewhere : South-East Asia, Srilanka, China and Africa.

***Chydorus barroisi* Richard, 1894 (Fig. 10)**

1894. a. *Pleuroxus barroisi* Richard, *Revue. Biol. Nord. France*, **6** : 360-378.
 1895. *Chydorus barroisi* Sars, *Vidensk. Selesk. Skrifter I. math. naturv. Klassen* : 1-56.
 1982. *Ephenmeroporus barroisi* (Richard) Frey. *Hydrobiologia*, **86** : 31-261.

Material examined : Several females from Rudrasagar lake, Gramtali pond and pond with bund, Sonamura ; Trishna wildlife sanctuary lake No. 1 and II, temporary pond and Ricefield marshes, Rajnagar ; Floating Mimosa pudica pond and Roadside ricefields, Amarpur ; Gumti reservoir, Jothanbari ; Dhanisagar lake, Udaipur and Siphijolla wildlife sanctuary lake.

Female : Body size 0.32 mm. Body elliptical in shape with a spine in the posteroventral corner. Carapace ornameneted with striation. Labrum with 3-5 denticles. Postabdomen with 7-9 unequal spines and a long basal spine.

Distribution : INDIA : Andaman and Nicobar Islands, Gujarat, Rajasthan, Tamil Nadu and Tripura.

Elsewhere : Cosmopolitan.

***Chydorus faviformis* Birge, 1893 (Fig. 10)**

1901. *Chydorus eurynotus* Sars, *Arch. math, Nat.*, **23** : 1-102.
 1893. *Chydorus faviformis* Birge, *Trans. Wis. Acad. Sci. Arts and Letts.*, **4** : 77-109.

Material examined : Several females from Trishna wildlife sanctuary temporary pond and Ricefield marshes, Rajnagar ; roadside weedy pond, Amarpur and Gumti reservoir, Jothnabari.

Female : Body size 0.45 mm. Shape rounded or oval. Posteroventral and posterodorsal corners of valves not distinct. Valves and shield with deep hexagonal cells. Ocellus smaller than eye situated much closer to the eye than to the apex of rostrum. Labral plate with convex anterior

margin and blunt at the apex. Postabdomen with 8-10 anal spines. Claw with two basal spines.

Distribution : INDIA : Kashmir and Tripura.

Elsewhere : South-East Asia, Australia, China and North America.

***Chydorus reticulatus* Daday, 1898 (Fig. 10)**

1898. *Chydorus reticulatus* Daday, *Termes. Fuzetek.*, **21** : 1-123.

1979. *Chydorus reticulatus* Michael and Hann, *Hydrobiologia*, **65** : 225-232.

Material examined : Several Several females from Trishna wildlife sanctuary lake No. I, Rajnagar; Phaticksagar lake and Floating Mimosapudica pond, Amarpur.

Female : Body size 0.27 mm. Body spherical in shape. Valves strongly reticulated with hexagonal patterns and concentration of punctuations or dots inside the pattern. Rostrum long and curved posteriorly. Labral plate rounded oculus about half the size of the eye and situated closer to the eye than to the apex of rostrum. Postabdomen short with distinct preanal corner. Claw setulated on the concave surface.

Distribution : INDIA : Rajasthan.

Elsewhere : Srilanka, Java and Thailand.

***Chydorus pubescens* Sars, 1901 (Fig. 10)**

1901. *Chydorus pubescens* Sars, *Arch. math. nat.*, **23** : 1-102.

1955. *Chydorus kallipygos* Harding, *Trans. Linn. Soc. London*, **1** : 329-354.

Material examined : Several females from Battali weedy pond, Sonamura, Trishna wildlife sanctuary temporary pond, Rajnagar ; Paticksagar lake and Roadside ricefields, Amarpur ; Gumti reservoir, Jothanbari ; Suksagar ricefields, Dhanisagar lake and Jagannath dighy, Udaipur and Sipahijolla wildlife sanctuary lake.

Female : Body size 0.26 mm. Body rounded, dorsal and ventral margin bulge. Valves reticulated

with dots within the hexagonal cells. Surface of valves with short hairs. Postabdomen narrow, distally with 8-9 pointed denticles. Claw with 2 basal spines.

Distribution : INDIA : Assam

Elsewhere : South-East Asia.

Genus *Dunhevedia* King, 1853

Key to the species of genus Dunhevedia

1. a. Plate of labrum with denticles
.....*Dunhevedia serrata* Daday, 1898.
- b. Plate of labrum without denticles
.....*Dunhevedia crassa* King, 1853.

***Dunhevedia crassa* King 1853 (Fig. 10)**

1853. *Dunhevedia crassa* King, *Pap. R. Soc. van Diemens Land*, **2** : 243-263.

1971. *Dunhevedia crassa crassa* Smirnov, *USSR Acad. Sci. Zool. Institute Nova. ser 101*. Leningrad, 539 pp.

Material examined : Several females from Rudrasagar lake, Sonamura ; Phaticksagar lake, Amarpur.

Female : Body size 0.53 mm. Body curved dorsally. Posteroventral corner of valves with a bifurcated denticle. Rostrum blunt. Labrum rounded with pointed apex. Ocellus small and situated slightly closer to eye than to apex of rostrum. Postabdomen with groups of scattered spinules. Claw setulated with one basal spine.

Distribution : INDIA : Andaman and Nicobar Islands, Gujarat, Rajasthan, Tamil Nadu and Tripura.

Elsewhere : South-East Asia, Australia and USSR.

***Dunhevedia serrata* Daday, 1898 (Fig. 10)**

1898. *Dunhevedia serrata* Daday, *Termes. Fuzetek.*, **21** : 1-123.

Material examined : Several females from Battali weedy pond Sonamura ; Roadside seedy pond and ricefields, Amarpur and Sucksagar lake, Udaipur.

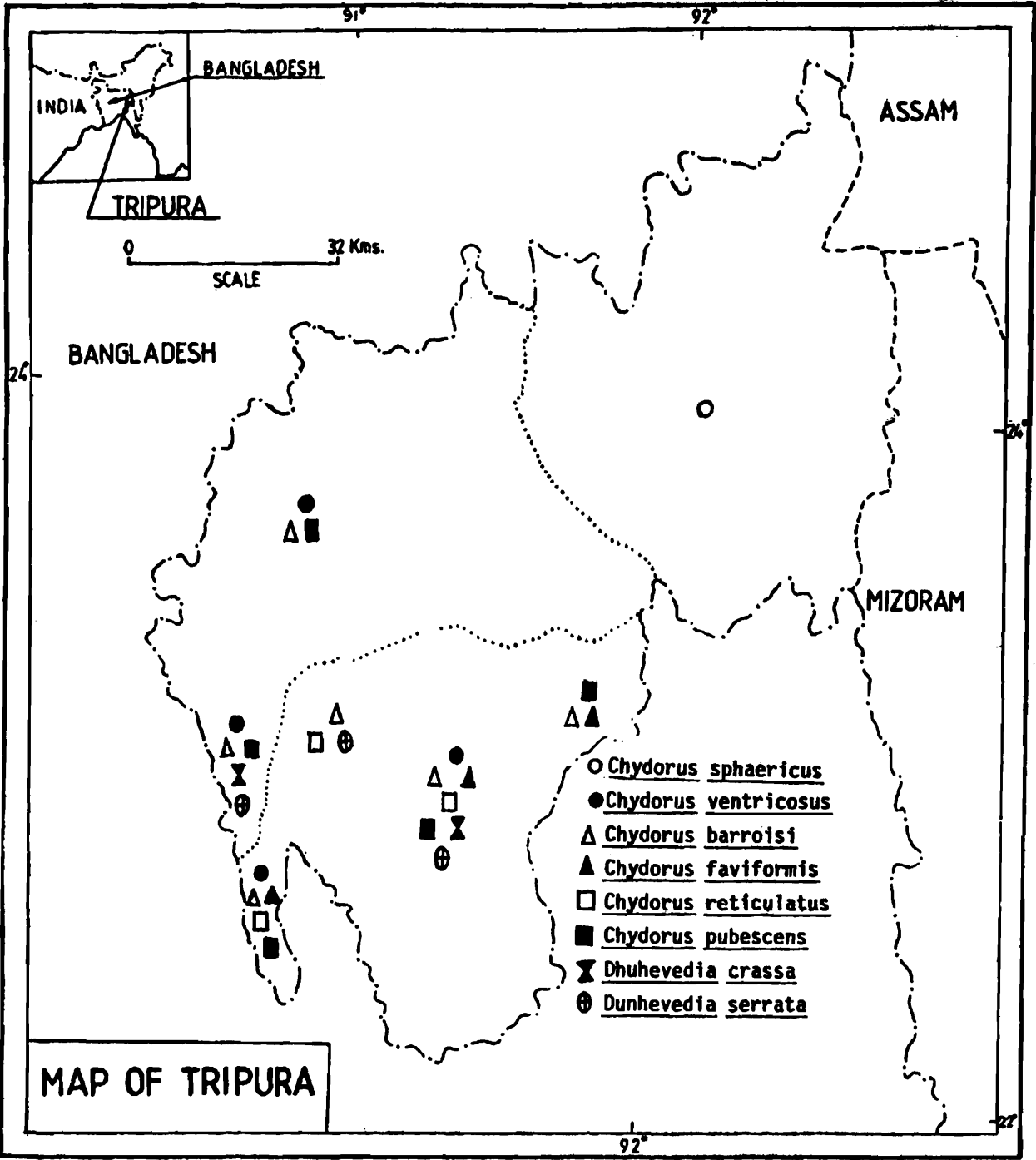


Fig. 10. Distribution of Cladocera fauna of Tripura - Chydoridae.

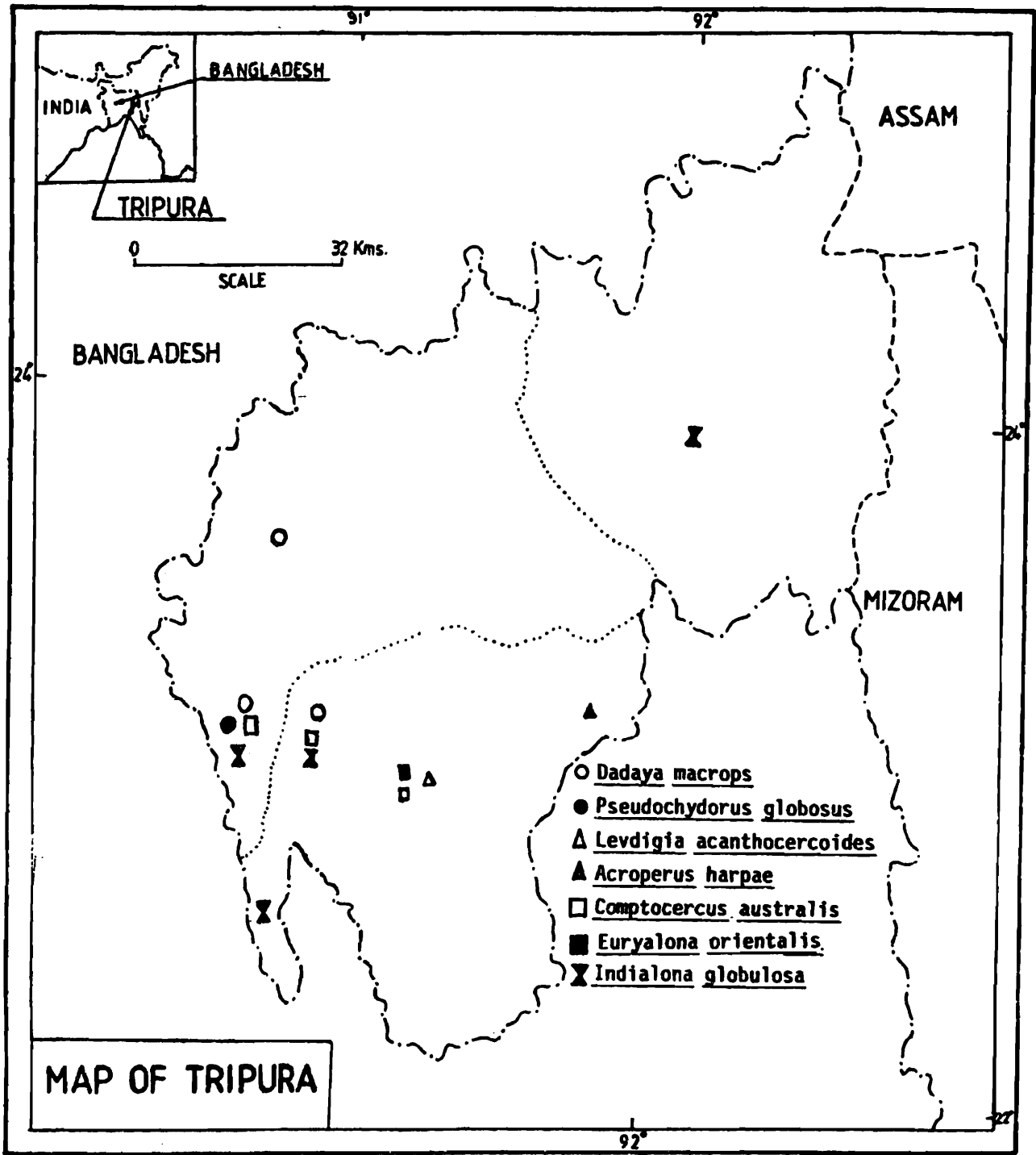


Fig. 11. Distribution of Cladocera fauna of Tripura - Chydoridae.

Female : Body size 0.63 mm. Body evenly curved dorsally, maximum height slightly before middle. Valves with distinct longitudinal lines. Rostrum blunt. Ocellus smaller than eye. Plate of labrum rounded and serrated on the anterior margin with pointed apex. Dorsal surface of postabdomen covered with groups of scattered spinules, denticles slightly increasing in size distally. Claw with one basal spine.

Distribution : INDIA : Andaman and Nicobar Islands, Rajasthan and Tamil Nadu.

Elsewhere : Africa, Sri Lanka, New Guinea and North America.

Genus *Dadaya* Sars, 1901

Dadaya macrops (Daday, 1898) (Fig. 11)

1898. *Alona macrops* Daday, *Termes. Fuzeték.*, 2 : 1-123.

1971. *Dadaya macrops* Smirnov. *USSR. Acad. Sci. Zool. Institute. Leningrad.* 539 pp.

Material examined : Several females from Battali pond Rudrasagar lake, Sonamura ; Dhanisagar lake, Udaipur and Sipahijolla wildlife sanctuary lake.

Female : Body size 0.38 mm. Head small, much depressed ; rostrum short. Antennules projecting for beyond the tip of rostrum. Valves with hexagonal pattern. Postabdomen with 14-18 marginal anal denticles ; one basal spine at the base of the claw.

Distribution : INDIA : Rajasthan, Tamil Nadu.

Elsewhere : Africa, Australia, Malaysia and Neotropical regions.

Genus *Pseudochydorus* Fryer, 1968

Pseudochydorus globosus (Baird, 1843) (Fig. 11)

1843. *Chydorus globosus* Baird, *Ann. Mag. Nat. Hist.* 68 : 81-95.

1968. *Pseudochydorus globosus* Fryer, *Phil. Trans. Roy. Soc.* 254 : 221-385.

Material examined : Several Females from Battali weedy pond and Rudrasagar lake, Sonamura.

Female : Body size 0.73 mm. Body spherical, Posteroventral corner of valves rounded, without denticles. Valves with a pattern of polygons. Rostrum pointed and ventrally directed. Ocellus smaller than eye and situated nearer to eye than to apex of rostrum. Postabdomen narrow with 20 anal spines decreasing in size proximally. Claw with two basal spines and row of setae on concave margin.

Distribution : INDIA : Calcutta, Meghalaya, Tamil Nadu.

Elsewhere : Africa, Australia, Europe and Malaysia.

Subfamily ALONINAE Frey, 1967.

Key to the genus and species of the subfamily ALONINAE

1. a. Lateral setae of postabdomen large
Leydigia acanthocercoides (Fischer, 1854).
- b. Lateral setae of postabdomen not large 2.
2. a. Postabdomen tapering distally and short 3.
- b. Postabdomen straight and long 4.
3. a. Two or three main head pores
Alona Baird 1843.
- b. One main head pore.....5.
4. a. Body much longer than height
Euryalona orientalis (Daday, 1898).
- b. Body rounded.....
Oxyurella singalensis (Daday, 1898).
5. a. Posteroventral corner with small inconspicuous spines on the margin 6.
- b. Posteroventral corner without spines 7.
6. a. Postabdomen long with 18-20 anal denticles
Camptocercus australis Sars, 1896.
- b. Postabdomen with 6-7 groups of small denticles
Acroperus harpae (Barid, 1834).

7. a. Carapace with strong rectangular reticulation
 ...***Graptoleberis testudinaria* (Fischer, 1848).
 b. Carapace without reticulations 8.
 8. a. Plate of labrum with serrated anteroventral margin.....
*Notoalona gobulosa* (Daday, 1898).
 b. Plate of labrum without serration
 ***Kurzia* Dybowski and Growchowski, 1898.
 (**Not found in the present study).

Genus *Leydigia* Kurz, 1875.

Leydigia acanthocercoides (Fischer, 1854)
 (Fig. 11)

1853. *Lyneus acanthocercoides* Fisher, *Bull. Soc. Imp. Nat. Mosc.*, 27 : 423-434.
 1875. *Leydigia acanthocercoides* Kurz, *Sitzber. ACAD. Wiss. Wein. Math. Nat.* 69 : 40-46.

Material examined : Three females from Phaticksagar lake, Amarpur.

Female : Body size 0.89 mm. Valves with longitudinal lines. Rostrum blunt, antennules not reaching apex of : trum. Ocellus smaller than eye, situated closer to the eye than to the apex of rostrum. Labrum rounded with fine setae. Postabdomen with about 18 groups of small denticles, each group consists of 3 or 4 denticles with the distal-most denticle being the longest of each group. Claw with a short basal spine.

Distribution : INDIA : Andaman and Nicobar Islands, Gujarat, Rajasthan and Tamil Nadu.

Elsewhere : South-East Asia, Ethiopia, Neotropic and USSR.

Remarks : Rare. Occurs in bottom debris.

Genus *Acroperus* Baird, 1843

Acroperus harpae (Baird, 1834) (Fig. 11-12).

1820. *Monoculus striatus* Jurine, *Paris* : 1-260.
 1900. *Acroperus harpae* Lilljeborg, *Nova. acta. Roy. Soc. Sci. Upsala*, III, 19, VI, 701, 87 pl.

Material examined : Several females from Gumti reservoir, Jothanbari.

Female : Body size 0.62 mm. Body evenly rounded dorsally, head keel present, maximum height in the middle. Valves with distinct longitudinal lines, ventral margin with a series of setae and groups of fine setules between setae. Posteroventral corner of the valves with 2-3 denticles followed by a series of setules along the posterior margin. Ocellus small and situated closer to the eye than to the apex of rostrum. Postabdomen long with very small spines and 13-15 groups of lateral setae which decrease in size proximally. Claw with 2 groups of setules. Basal spine short with spinules at the base.

Distribution : INDIA : Jammu and Kashmir, and West Bengal.

Elsewhere : Cosmopolitan.

Genus *Camptocercus* Baird, 1843

Camptocercus australis Sars, (Fig. 11)

1896. *Camptocercus australis* Sars, *Arch. math. Nat.* 18 : 1-81.

Material examined : Several females from Rudrasagar lake, Sonamura and Phaticksagar lake, Amarpur.

Females : Body size 0.87 mm. Valves with longitudinal lines. Head smoothly curved. Posteroventral margin slightly convex with 3-4 small denticles. Ocellus smaller than eye, situated closer to the eye than the tip of rostrum. Labrum wedge-shaped and slightly rounded at apex. Postabdomen long with 16-18 anal denticles. Claw long, curved dorsally.

Distribution : INDIA : West Bengal.

Elsewhere : South-East Asia.

Genus *Euryalona* Sars, 1901

Euryalona orientalis (Daday, 1898) (Fig. 11)

1898. *Alonopsis orientalis* Daday, *Termes. Fuzetek.* 21 : 1-123.
 1905. *Euryalona orientalis* Daday, *Zoologica Stuttgart.* 18 : 154-233.

Material examined : Several females from Dhanisagar lake, Udaipur and Roadside weedy pond, Amapur.

Females : Body size 0.99 mm. Valves with rectangular reticulations. Posteroventral margin of valves with series of setae. Rostrum blunt, antennules almost reaching apex of rostrum. Labrum rounded with a nipple-like structure on apex. Postabdomen long with 20 pointed denticles decreasing in size proximally. Claw with a very short basal spine.

Distribution : INDIA : Andaman and Nicobar Islands, Rajasthan, Tamil Nadu and Tripura.

Elsewhere : South-East Asia, Ethiopian and Neotropical regions.

Remarks : Common among weeds.

Genus *Notoalona* Rajapaksa and Fernando, 1987.

Notoalona globulosa (Daday, 1893) (Fig. 11)

1898. *Alona globulosa* Daday, *Termes. Fuzetek.*, **21** : 1-123.

1987. *Notoalona globulosa* Rajapaksa and Fernando, *Hydrobiologia*, **144** : 131-153.

Material examined : Several females from Fish pond, Manu ; Indiranagar Eichornia pond, Gramtali weedy pond, Buttali weedy pond, Sonamura ; Trishna wildlife sanctuary lake No. I, Rajnagar and Dhanisagar lake, Udaipur.

Female : Body size 0.36 mm. Valves with striations. Rostrum short and blunt, antennules not reaching the apex. Ocellus smaller than the 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.

Distribution : INDIA : Andaman and Nicobar Islands, Rajasthan and Tamil Nadu.

Elsewhere : South-East Asia, Neotropical and Neoarctic regions.

Genus *Alona* Baird, 1843

Key to the species of *Alona*

1. a. Average size usually more than 0.6 mm, postabdomen with more than 10 anal denticles 2.
- b. Average size less than 0.6 mm, postabdomen with less than 10 anal denticles 3.
2. a. Three connected median pores 4.
- b. Two connected median pores
.....*Alona affinis* Leyding, 1860.
3. a. Labral plate convex anteriorly without a denticle 4.
- b. Labral plate convex and with a denticle 5.
4. a. Valves with longitudinal and transverse line forming a rectangular pattern
.....*Alona rectangula* Sars, 1862.
- b. Valves with only longitudinal lines 6.
5. a. Postabdomen slightly tapering distally with long basal spine 6
- b. Postabdomen slightly tapering distally with long basal spine
.....*Alona monacantha* Sars, 1901.
6. a. Posterventral corner with 1-4 spines at the corner*Alona karua* (King, 1852).
- b. Posteroventral corner with 1-5 spines extending at the corner and slightly towards the posterodorsal region
.....*Alona kwangsiensis* Chiang, 1963.
7. a. Valves with longitudinal lines, ventral margin forming an angle
.....*Alona davidi* Richard, 1895.
- b. Valves without or faint longitudinal lines 8.
8. a. Distal end of postabdomen rounded 10.
- b. Distal end of postabdomen not rounded 9.
9. a. Anal groove of postabdomen bordered by groups of spines or setae, dorsal corner forming an angle of 60°
.....*Alona guttata* Sars, 1862.

- b. Valves with faint longitudinal lines and anal groove of postabdomen not bordered by groups of spines or setae
.....*Alona costata* Sars, 1862.
- 10.a. Plate of labrum setulated on posterior margin
.....*Alona intermedia* Sars, 1862.
- b. Plate of labrum not setulated on posterior margin.....11.
- 11.a. Head shield with 3 main pores
.....*Alona pulchella* King, 1853.
- b. Head shield with 2 main pores.....
.....*Alona verrucosa* Sars, 1901.

***Alona rectangula* Sars, 1862 (Fig. 13)**

1862. *Alona rectangula* Sars, *Forhandl. vidensk. selsk. Christiania*, 144-167.
1971. *Alona rectangula rectangula* Smirnov, *USSR Acad. Sci. Zool. Institute Nova ser. 101. Leningrad*, 539 pp.

Material examined : Several females from Trishna wildlife sanctuary lake no. I, Rajnagar.

Female : Body size 0.31 mm. Shape rectangular, maximum height slightly before middle. Posteroventral corner without denticle. Valves with striations forming a rectangular pattern. Antennules not reaching the apex of rostrum. Postabdomen with 7-8 groups of anal denticles and claw with long basal spine.

Distribution : INDIA : Gujarat, Kashmir, Meghalaya and Rajasthan.

Elsewhere : South-East Asia, Africa and USSR.

***Alona guttata* Sars, 1862 (Fig. 13)**

1862. *Alona guttata* Sars, *Forhandl. Vidensk. Selsk. Christiania*, 250-302.
1988. *Alona guttata* Michael and Sharma, *Fauna of India, ZSI*, 262 pp.

Material examined : Six females from a Fish pond at Manu.

Female : Body size 0.42 mm. Body oval in shape with rounded posterodorsal and posteroventral corners. Antennules not reaching the apex of rostrum. Plate of labrum rounded.

Ocellus smaller than eye, situated halfway between eye and apex or rostrum. Postabdomen with 9 anal spines and lateral groups of setae, Claws with basal spines.

Distribution : INDIA : Himachal Pradesh, Rajasthan, Tamil Nadu.

Elsewhere : Cosmopolitan.

***Alona pulchella* (King, 1853) (Fig. 13)**

1853. *Alona pulchella* King, *Pap. proc. R. Soc. van. Diemens Land.*, 2 : 243-263.
1933. *Alona arenaria* Brehm, *Arch. Hydrobiol., Suppl.* 11 : 631-771.

Material examined : Several females from North Gokulnagar pond, Telliamura ; Roadside weedy pond, many ; Trishna wildlife sanctuary lake no. I, Rajnagar ; Jagannath dighy, Udaipur and SipahijoHa wildlife sanctuary lake.

Female : Body size 0.52 mm. Shape oval, without spines on the posteroventral corner and reticulations on the carapace. Antennules not reaching apex of rostrum. Labrum with pointed apex. Postabdomen with straight dorsal margin and 7-9 anal denticles present. Claw with a medium size basal spine.

Distribution : INDIA : Gujarat, Rajasthan and Tamil Nadu.

Elsewhere : Cosmotropical.

***Alona davidi* Richard, 1895 (Fig. 13)**

1895. *Alona davidi* Richard, *Mem. Soc. zool. France*, 7 : 237-243.
1971. *Alona davidi davidi* Smirnov, *USSR Acad. Sci. Zool. Institute Nova, ser. 101. Leningrad*, 539 pp.

Material examined : Several females from Battali pond, Sonamura ; Trishna wildlife sanctuary lake no. I, Rajnagar and Dhanisagar lake, Udaipur.

Female : Body size 0.35 mm. Maximum height slightly before middle. Posterodorsal and posteroventral corners rounded. Rostrum blunt. Ocellus smaller than eye. Postabodomen with prominent preanal and postanal corners. Claw with short basal spine.

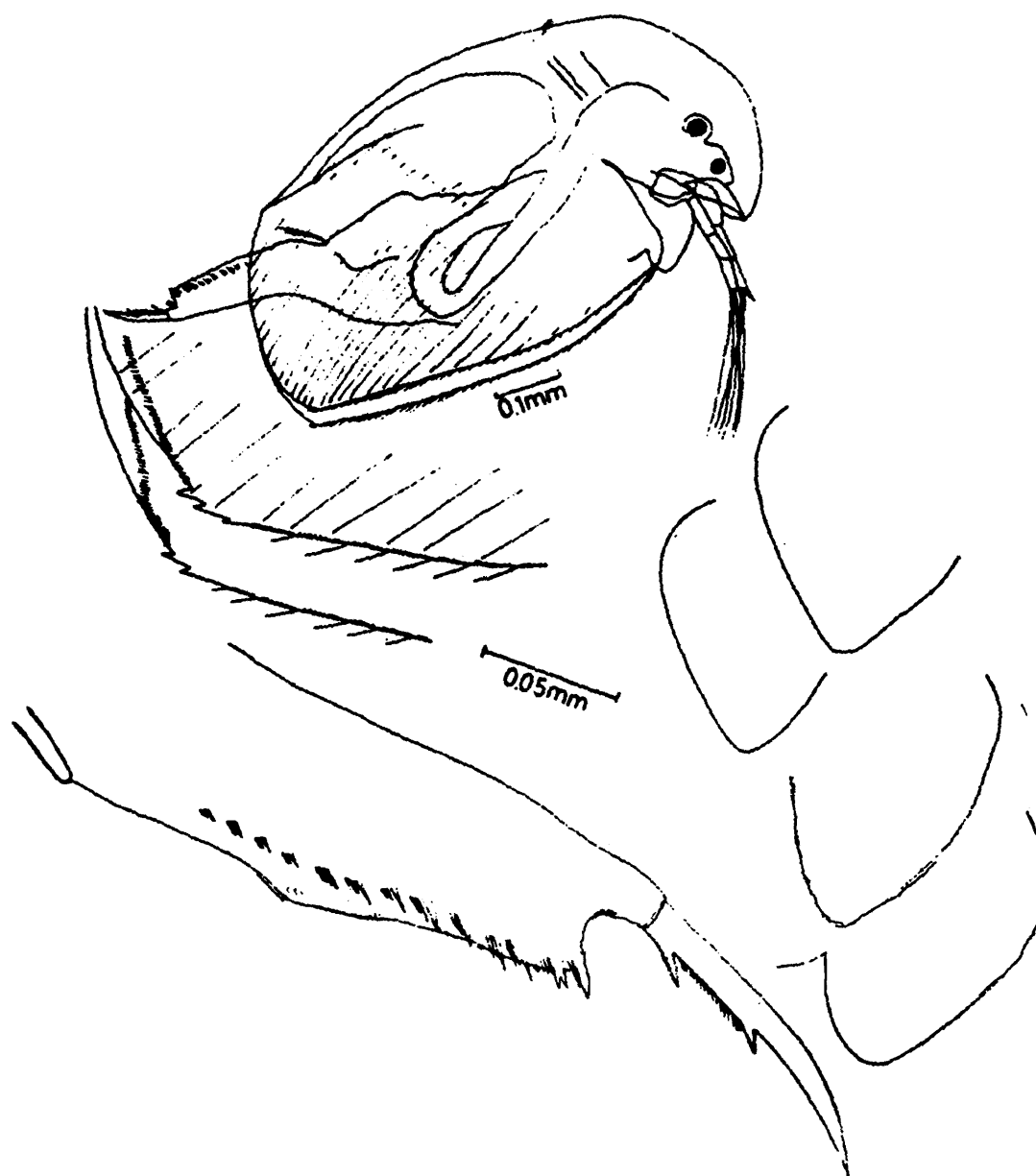


Fig. 12. *Acroperus harpae* female.

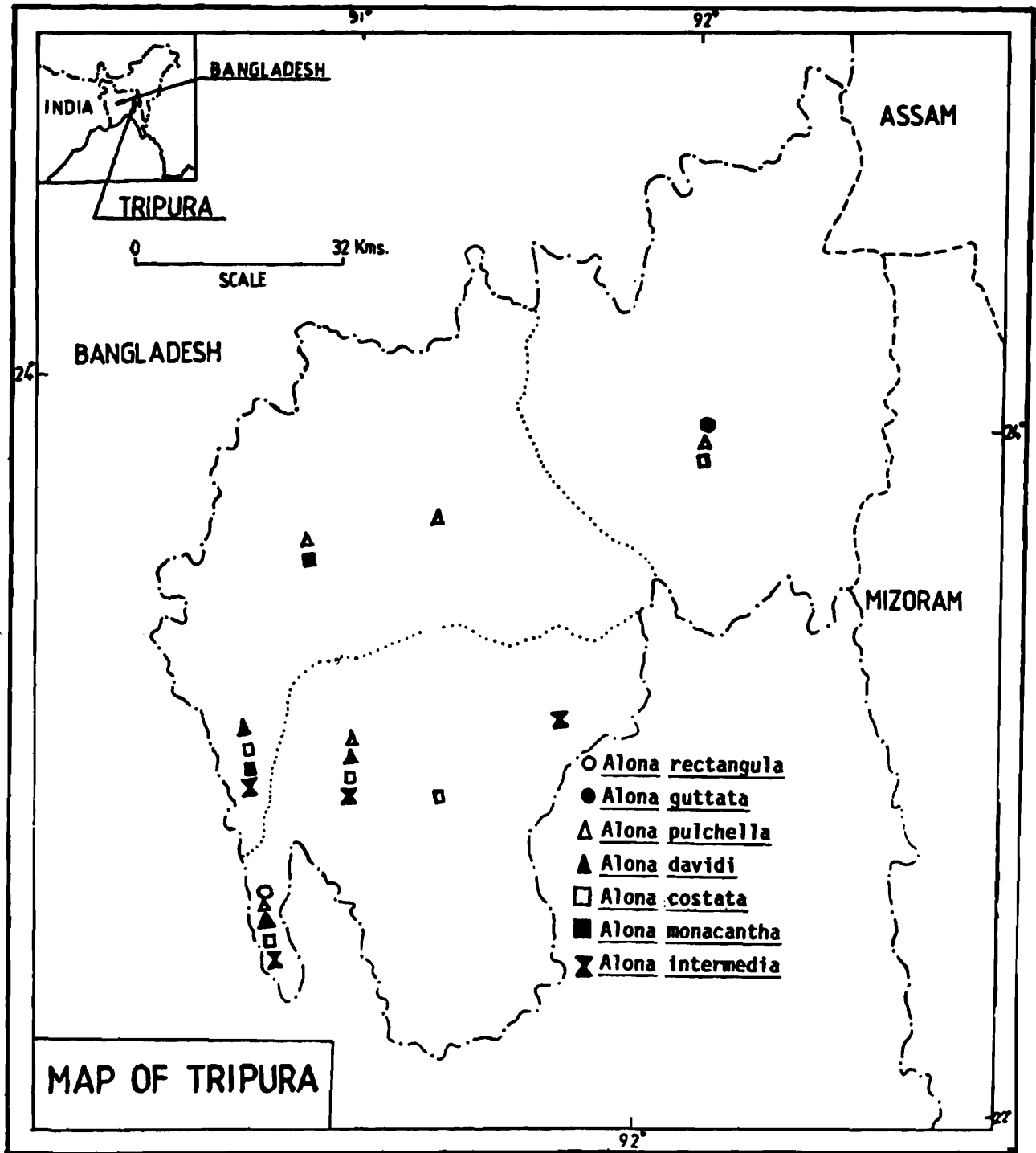


Fig. 13. Distribution of Cladocera fauna of Tripura - Chydoridae.

Distribution : INDIA : Andaman and Nicobar Islands, Rajasthan and Tamil Nadu.

Elsewhere : Africa, Malaysia, Sri Lanka and USSR.

***Alona costata* Sars, 1862 (Fig. 13)**

1862. *Alona costata* Sars, *Forhandl. Vidensk. Selsk. Christiania*, 250-302.

1900. *Lynceus costata* Lilljeborg, *Nova. Acta. Reg. Soc. Sci. Upsala ser. III. 19.* : 465-468.

Material examined : Several females from Roadside weedy pond, Manu ; Battali weedy pond, Sonamara ; Trishna wildlife sanctuary temporary pond, Rajnagar ; Floating Mimosa pudica pond, Amarpur.

Female : Body size 0.39 mm. Valves with longitudinal line, posterodorsal and posteroventral corners rounded. Antennules not reaching apex of rostrum. Ocellus smaller than eye, situated halfway between eye and apex of rostrum. Postabdomen with 9-11 anal denticles and 8-10 groups of lateral setae. Claw with a basal spine.

Distribution : INDIA : Manipur and Uttarpradesh.

Elsewhere : South-East Asia, South America and USSR.

***Alona monacantha* Sars, 1901 (Fig. 13)**

1904. *Alona acuticostata* var. *tridentata* Stingeloin, *zool. Jahrb. Syst.*, 21 : 327-367.

1917. *Alona monacantha tridentata* Smirnov, *USSR Acad. Sci. Zool. Institute, Nova. ser. 101. Leningrad*, 539 pp.

1983. *Alona monacantha* (Stingelin) Idris, *Penerbit universiti Pertanian Malaysia*, 153 pp.

Material examined : Several females from Battali pond, Sonamura ; Dhanisagar lake, Udaipur and Sipahijolla wildlife sanctuary lake.

Female : Body size 0.29 mm. Valves with longitudinal lines. Posteroventral and posterodorsal corner 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 anterior margin. Postabdomen with 7-8 anal denticles. Claw with long basal spine.

Distribution : INDIA : Rajasthan and Tamil Nadu.

Elsewhere : South-East Asia.

***Alona intermedia* Sars, 1862 (Fig. 13)**

1888. *Alona intermedia* Sars, *Forth. Vidensk. Selsk. Christiania. 7* : 1-74.

Material examined : Several females from Gramtali pond, Sonamura ; Trishna wildlife sanctuary temporary pond and Ricefield marshes of Rajnagar ; Gumti reservoir, Jothanbari and Dhanisagar lake, Udaipur.

Female : Body size 0.33 mm. Valves with longitudinal lines, posterodorsal and posteroventral corners rounded. Rostrum blunt, antennules not reaching apex of rostrum. Ocellus smaller than eye and situated about halfway between eye and apex of rostrum. Plate of labrum rounded anteriorly with a group of setules ventrally. Postabdomen with 8-9 anal denticles and 9-10 groups of lateral setae. Claw with a basal spine.

Distribution : INDIA : West Bengal.

Elsewhere : South-East Asia.

***Alona karua* (King, 1853) (Fig. 14)**

1853. *Alona karua* King, *Pap. Proc. R. Soc. van Diemens Land 2* : 243-263.

1971. *Biapetura karua* Smirnov, *USSR Acad. Sci. Zool. Institute Nova. ser. 101. Leningrad*, 539 pp.

Material examined : Several females from Roadside weed ponds II and III and roadside stream pond, Manu ; Rudrasagar lake, Indiranagar Eichornia pond, Gramtali weedy pond and Battali pond, Sonamura ; Trishna wildlife sanctuary temporary pond, Rajnagar ; Paticksagar lake, Roadside weedy pond and Roadside ricefields, Amarpur ; Dhanisagar and Amarsagar ricefields, Udaipur.

Female : Body size 0.29 mm. Body with distinct lines and polygonal pattern. Posteroventral corner rounded with 2-3 denticles followed by a

row of setules. Antennules not reaching apex of rostrum. Ocellus small, situated closer to eye. Postabdomen broadly rounded. Claw with a short basal spine.

Distribution : INDIA : Andaman and Nicobar Islands, Meghalaya, Tamil Nadu and Tripura.

Elsewhere : Cosmopolitan.

Remarks : Very common. Occurs in all marshy habitats.

***Alona verrucosa* Sars, 1901 (Fig. 14)**

1901. *Alona verrucosa* Sars, *Arch. Math. Nat.* **23** : 1-102.

1988. *Biapertura verrucosa* Michael and Sharma *Fauna of India*, Cladocera, 262 pp.

Material examined : Several females from Rudrasagar lake and Battali weed pond, Sonamura; Trishna wildlife sanctuary ricefields, Rajnagar, Gumti reservoir, Jothanbari and Dhanisagar and Jagannath dighy, Udaipur.

Female : Body size 0.28 mm. Body elongated oval. Posteroventral and posterodorsal corners rounded. Antennules not reaching apex of rostrum. Ocellus small, situated slightly closer to eye than to apex of rostrum. Postabdomen with 5-6 denticles. Claw with a short basal spine.

Distribution : INDIA : Gujarat, Rajasthan, Tamil Nadu and Tripura.

Elsewhere : South-East Asia, Ethiopian and Neotropical regions.

***Alona kwangsiensis* Chiang, 1963 (Fig. 14-15)**

1963. *Alona kwangsiensis* Chiang, *Acta. Zool. Sinica*, **15** : 255-263.

Material examined : Several females from Battali weed pond, Sonamura and Roadside weed pond, Amarpur.

Female : Body size 0.45 mm. Shape oval in outline maximum height slightly before middle. Valves with a series of setae, distinct lines and polygonal patterns. Ventral margin of valves with a series of setae, posteroventral corner rounded with 5 denticles attached marginally upto one-

third of the posterior region, followed by a row of small spines running the apex of rostrum. Postabdomen with distinct preanal and postanal corners and broadly rounded dorsal margin. About 7-8 denticles attached submarginally followed by 3 groups of spines along the anal groove up to the preanal corner.

Distribution : INDIA : New record.

Elsewhere : China.

Genus *Oxyurella* Dybowski & Growchowski, 1894

***Oxyurella sinhalensis* (Daday, 1898) (Fig. 14)**

1898. *Alonopsis singalensis* Daday, *Terems. Fuzetek.* **21** : 1-123.

1957. *Oxyurella singalensis* Fryer, *Arch. hydrobiol.*, **53** : 223-239.

Material examined : Several females from Indiranagar Eichornia pond, Gramtali weed pond, Sonamura ; Floating Mimosapudica pond and Roadside ricefields, Amarpur ; Gumti reservoir, Jothanbari ; Dhanisagar, Jagannath dighy and Amarsagar ricefield, Udaipur ; Sipahijolla wildlife sanctuary lake.

Female : Body size 0.82 mm. Valves evenly rounded. Rostrum blunt, antennules not reaching the apex. Ocellus smaller than the eye and situated closer to the eye than to the apex of rostrum. Labrum round. Postabdomen long with 10-12 anal denticles which decrease in size. Claw long with a long basal spine and three short spines.

Distribution : INDIA : Andaman and Nicobar Islands, Rajasthan and Tamil Nadu.

Elsewhere : South-East Asia and Ethiopian region.

SUMMARY

Forty-nine species have been recorded from Tripura, belonging to six families and 29 genera. Larger species of the genus *Daphnia* are completely absent. This may be due to fish and insect predation. Three are 3 species of *Simocephalus* abundant in all wetlands.

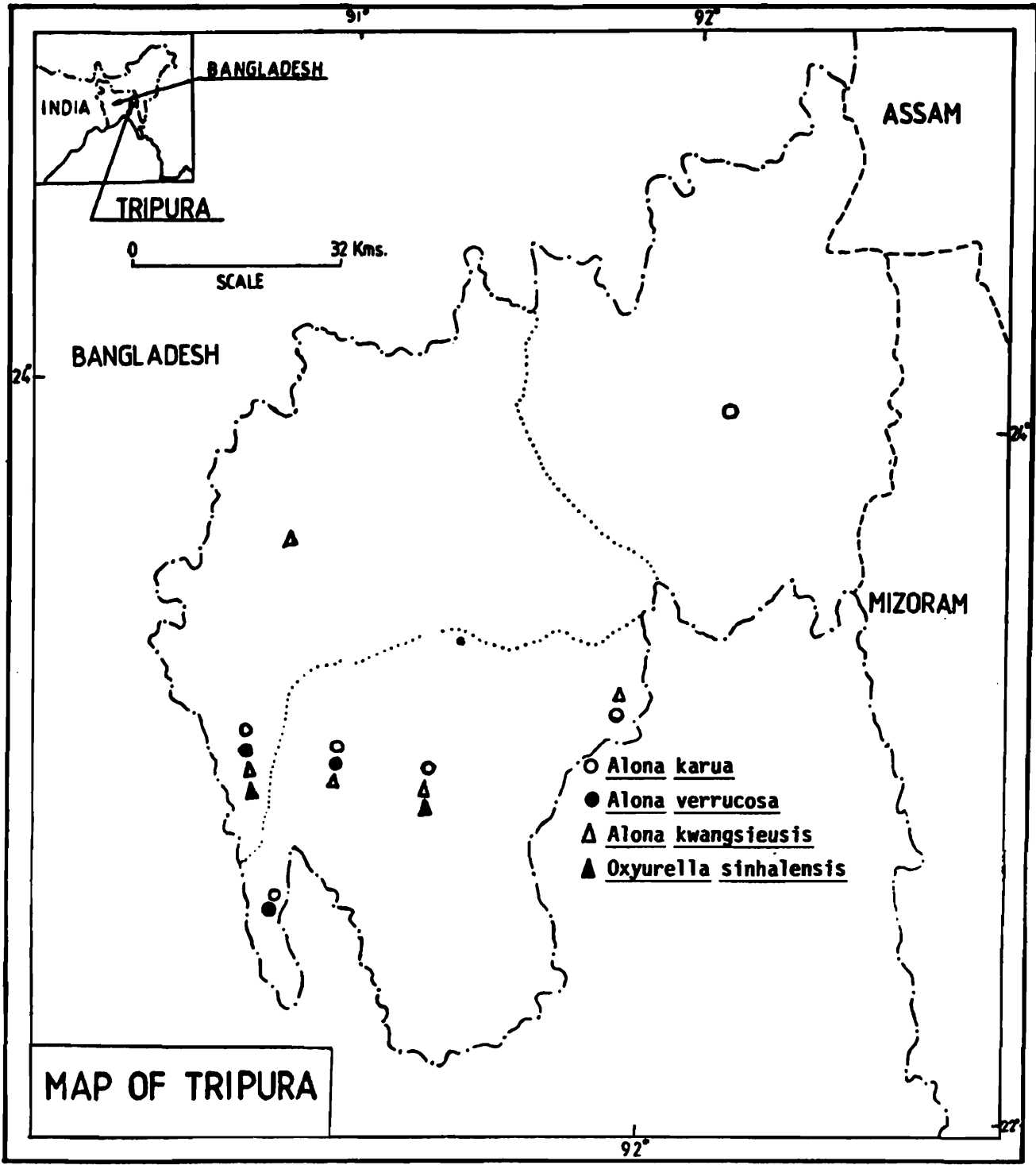


Fig. 14. Distribution of Cladocera fauna of Tripura - Chydoridae.

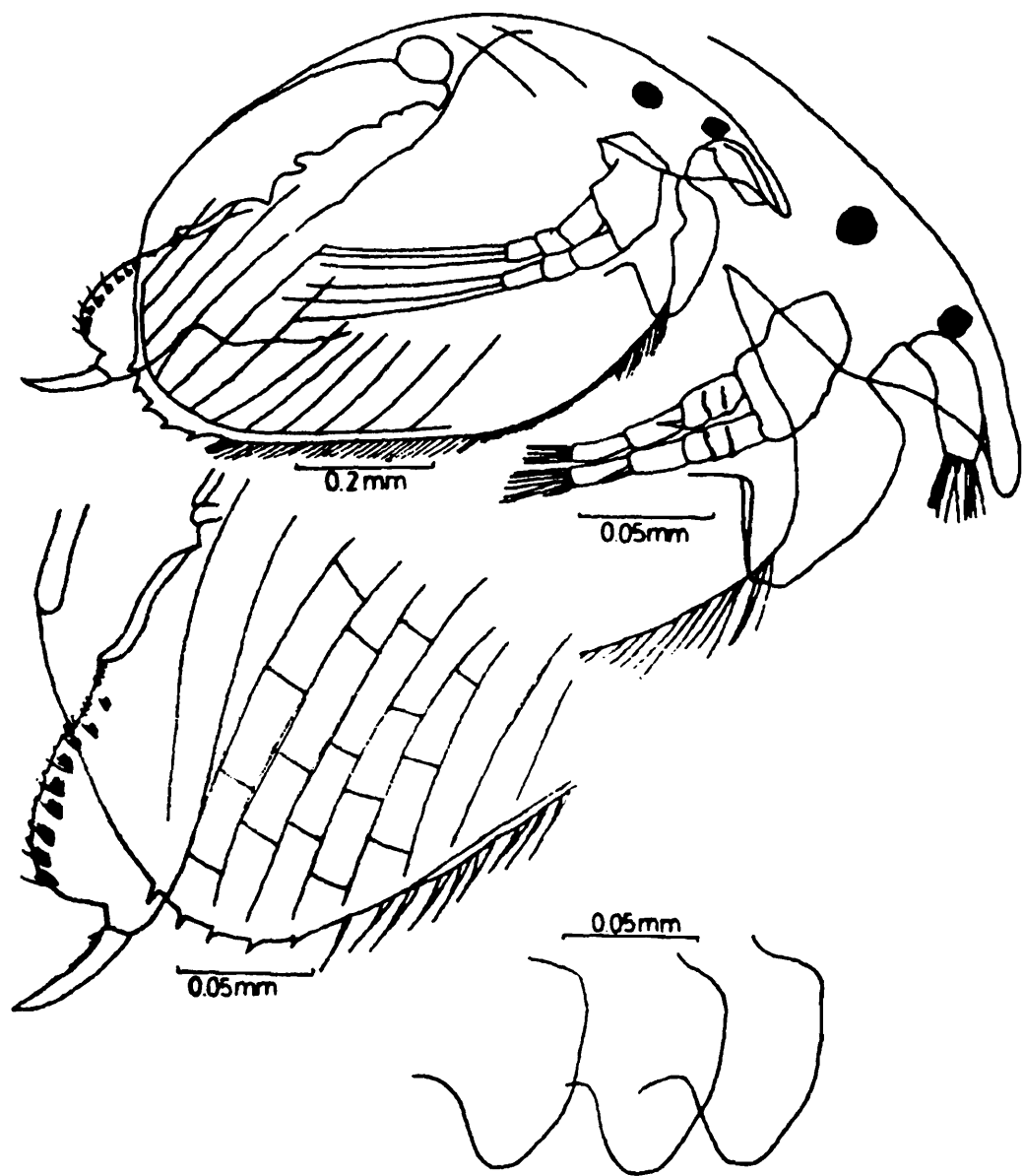


Fig. 15. *Alona kwangsiensis* female.

APPENDIX I

List of wetland surveyed for Cladocera fauna

Sl. No.	Date	District	Name of wetland
1.	7. 11. 92	Telliamura	Kollahati Lake I
2.	„		Kollahati Lake II
3.	„		Kollahati R. B. Pond
4.	„		North Gokulnagar Pond 1
5.	„		North Gokulnagar Pond 2
6.	„		North Gokul Nagar Pond 3
7.	„		Boranucholk T. Pond
8.	„		Boranucholk Fish Pond
9.	„		„ Polluted Pond
10.	„		„ Fish Pond
10a.	„		Khowai River
11.	9. 11. 92	Manu	Manu Forest Dept. Pond
12.	„		Reddish brown pond
13.	„		Fish Pond near G. H.
14.	„		Gagarachara Pond
15.	„		Roadside Pond
16.	„		Roadside Stream Pond
17.	„		Roadside Weedy Pond
18.	„		R/B Roadside pond
19.	„		Roadside Fish Pond
20.	„		Jammirsara Lake
21.	11. 11. 92	Sonamura	Rudrasagar Lake
22.	„		Rudrasagar Open Water
23.	„		Rudrasagar West Side
24.	11. 11. 92	Sonamura	Indiranagar Pond
25.	„		Gramtali weedy pond
26.	„		Pond with bund

APPENDIX I**List of Wetland Surveyed for Cladocera Fauna**

Sl. No.	Date	District	Name of wetland
27.	11. 11. 92	Sonamura	Battali Pond
28.	„		Battali. Weedy Pond
29.	13.11.92	Rajnagar	Trishna Wildlife Sanctuary 3 no. Lake.
30.	„		Trishna North Lake
31.	„		TWS Temporary Pond
32.	„		TWS Small Paddle
33.	„		TWS 3 No. Lake Pond
34.	„		TWS R/B Pond
35.	„		TWS Ricefield
36.	„		TWS Ricefield
37.	„		TWS No. 2 Lake
38.	15. 11. 92	Amarpur	Upendranagar Tank
39.	„		Phaticksagar Lake
40.	„		Roadside Floating Weedy Pond
41.	„		Roadside Weedy Pond
42.	„		Amarpur Jothanbari R/S Pond
43.	„		River Gomati
44.	16. 11. 92	Jothanbari	Gumti River
45.	„		Gumti River
46.	„		Gumti River at Karaichara
47.	17. 11. 92	Udaipur	Suksagar Ricefield
48.	„		Dhanisagar Lake
49.	„		Jagannath Digby
50.	„		Amarsagar Lake
51.	„		Suksagar Ricefield
52.	19. 11. 92	Sepahijolla	Sipahijola Sanctuary Lake

Occurrence of two holarctic species, *Sida crystallina* and *Disparalona rostrata*, are important finding from this region. *Echinisca capensis monodi* earlier reported from China, USSR and Malaysia is reported for the first time from India from Gumti reservoir. The wetlands harbour Indo-Malayan, Palaearctic and Tropical Indian elements. Out of the six families of Cladocera which are represented in Tripura, Chydoridae is the largest having 28 species, which is incidentally one of the largest groups occurring anywhere in the world.

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FRESHWATER BRYOZOA

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INTRODUCTION

Freshwater bryozoa belongs to smaller coelomate groups comprising five families of the phylum Bryozoa with relatively simple body organisation. They live in the aquatic environment of ponds, water reservoirs, lakes, streams and adhering to the surface of the substratum, i.e., aquatic weeds, logs, stones, bricks, etc. They live together in the form of a colony, usually yellowish-brown, pinkish-brown, dark brown, reddish brown, green or black in colour.

Perusal of literature on the freshwater bryozoa of India reveals that very little attention has been paid to this group. Only Annandale (1911) has dealt with the group covering the whole India. Others like Roonwal (1969) made a collection of bryozoa from Rajasthan which was worked out by Rao (1976). Further Rao (1972) made a taxonomic review of bryozoans from the Narmada System, Rao *et al.* (1962) provided an account of bryozoans from the Vindhyan region. As a result of these works, seventeen species have so far been recorded from India, out of which four species are reported from the Eastern Himalayas, (Kurseong and Darjeeling district of West Bengal and Sikkim), but none is reported from Tripura.

The present work is an attempt to study the systematics of the group of the state of Tripura. Material for the study was collected through field surveys from all the districts of Tripura during April, 1992. The material so far collected is represented by four species under two genera and one family, none of them is new to science but all the species are recorded for the first time from the area under study. The present paper deals with the synonymy (original and latest ones), diagnostic characters, distribution together with

the key to identification of four species. In addition to this, a general account of morphology and terminology as well as methods of collection, narcotisation and preservation, have also been included.

MORPHOLOGY AND TERMINOLOGY

Polypide : It is an organ connected directly and indirectly with nutrition and a part of the muscular system and also retractile in nature.

Zooecium : It is a living cage in which polypide is enclosed. The shape and structure varies greatly in different groups—in its simplest form it is a cylindrical tube of living matter which secretes an outer horny or gelatinous covering. It possess an apical aperture “orifice” through which certain parts of polypide can always be extruded or withdrawn into it along with a portion of the former. Zooecia of a colony may be separated but are contiguous with walls in contact or in common.

Lophophore or Tentacular crown : It consists of a body wall extension being subdivided distally into a single row of ciliated tentacles. All parts of the lophophore are hollow, having a continuous coelomic cavity. It is a circular or horse-shoe shaped surrounding the mouth.

Tentacles : They serve as organs for capture of prey but are not highly contractile and not provided with nettle cells but are covered with cilia. In extruded stage they form a conspicuous calyx-like crown to the zooecium but in retracted condition they are closely packed together and lie parallel to one another.

Mouth : It is a hole situated in the midst of the tentacles and leads directly into a funnel-shaped oesophagus.

Statoblast : It is a flattened and has a circular, oval or approximately oval outline. It consists essentially masses of cells enclosed in a capsule with thick horny walls. This capsule is surrounded by a "swim-ring" composed of mass of horny walled chambers filled with air. Sometimes margin of the "Swim-ring" bears peculiar hooked processes.

NARCOTISATION AND PRESERVATION

The living specimens are placed in a glass tube nearly filled with clean water and allowed to expand their tentacles. 2% aqueous solution of cocaine, 2-3 drops at a time, are gradually dropped in the water containing fully expanded specimens and the process is to be continued until tentacular movement ceases. Then commercial formaldehyde solution is to be added drop by drop. The material is to be kept as it is for half an hour. For anatomical investigation, the material is to be washed thoroughly with tap water and treated with different alcoholic grade (up to 90%). For museum, purpose, the material is to be kept permanently in 8% formalin.

Statoblast : It is the asexual reproductive body and to be treated with strong nitric acid for a few minutes. Then acid is to be removed from the statoblast with water, and the material after passing through different alcoholic grade and oil of cloves is to be mounted on a slide with a small quantity of Canada balsam under a coverslip, taking care that the statoblast lie parallel to the later.

SYSTEMATIC ACCOUNT

Class PHYLACTOLAEMATA

Family PLUMATELLIDAE

Genus 1. *Plumatella*

- (1) *Plumatella diffusa* Leidy
- (2) *Plumatella fruticosa* Allman
- (3) *Plumatella javanica* Kraepelin

Genus 2. *Hyalinella* Jullien

- (4) *Hyalinella punctata* (Hancock)

Class PHYLACTOLAEMATA

Diagnosis : Zooecia never distinct from one another and their orifices circular; polypide possess a leaf-like ciliated organ, epistome, arising within the lophophore between mouth and anus and projecting upwards and forwards over mouth; lophophore either horse-shoe shaped or circular; tentacles webbed at base; statoblast, a peculiar reproductive body, present.

Family PLUMATELLIDAE

Diagnosis : Lophophore horse shoe-shaped; ectocyst well developed but not specialised to form an organ of progression; statoblasts provided with "Swim-ring" having chitinous chambers containing air.

Remarks : The material studied possessed statoblast without marginal processes.

Key to Genera

1. Zooecia flat, embedded in a gelatinous investment *Hyalinella* Jullien
- Zooecia cylindrical, not embedded in a gelatinous investment *Plumatella* Lamarck

Genus 1. *Plumatella* Lamarck

1816. *Plumatella* Lamarck, *Animan sansvert* (ed. Ire), 2 : 106.
1976. *Plumatella* : Rao, *Rec. zool. Surv. India*, 69 : 334.

Diagnosis : Zoarium dendritic, recumbent, erect or partly recumbent and partly erect; zooecia tubular, not confined in a gelatinous syoecium; ectocyst usually horny; statoblasts of two kinds : free and stationery; polypide with less than 65 tentacles.

Habitat : The zoaria of the species of *Plumatella* found firmly attached to stones, bricks, logs of wood, sticks, floating seeds, stems and roots of water plants and occasionally to the shells of molluscs.

Distribution : Central Africa; Europe; India; North America.

Key to species

1. Ectocyst by no means, of a uniform pale colour; zooecia straight, curved or sinuous, elongate, cylindrical but never emarginate or furrowed *P. fruticosa* Allman
- Ectocyst rigid; zooecia emarginate and furrowed 2
2. Ectocyst pigmented *P. diffusa* Leidy
- Ectocyst colourless *P. javanica* Kraepelin

(1) *Plumatella diffusa* Leidy

1852. *Plumatella diffusa* Leidy *Proc. Acad. Philad.*, 5 : 261.
1911. *Plumatella diffusa* : Annandale, *The Fauna of British India*, : 223.

Material : 8 colonies, Uttakhali, North Tripura district, 11.iv.1992; 10 colonies, West Panisagar, North Tripura district, 19.iv.1992, B. P. Halder and Party; 20 colonies, Champaknagar, West Tripura district, 28.iv.1992, B. P. Halder and Party.

Diagnosis : Zoarium covers a considerable area on flat surfaces and sometimes found crowded together on the stems of plants; upright branches occur rarely and never consists of more than three zooecia; zooecia distinctly L-shaped, long limb usually adherent; zooecia cylindrical and as a rule obscurely emarginate and furrowed; ectocyst stiff, never deeply pigmented; free statoblasts produced in very great profusion and vary considerably as regards size and outline while fixed statoblasts resembling those of *P. emarginata*; capsule large, its sides convex outwards and the extremity more or less broadly rounded; polypide shorter and stouter than that of *P. emarginata*.

Habitat : Attached to floating objects, i.e., stems of certain water plants, stones, bricks at the edge of ponds.

Distribution : *India* : Tripura- North and West Tripura districts; E. Himalayas; Meghalaya; Punjab; Sikkim; West Bengal.

Elsewhere : Europe; Pakistan; Bangladesh; North America.

Remarks : *P. diffusa* in lower Bengal is a cold weather species. It is remarkable for the enormous number of gemmules it produces. This is the first record from Tripura.

(2) *Plumatella fruticosa* Allman

1844. *Plumatella fruticosa* Allman, *Ann. Mag. nat. Hist.*, (1) 13 : 328.
1976. *Plumatella fruticosa* : Rao, *Rec. zool. Surv. India*, 69 : 338.

Material : 8 colonies, Uttakhali, 11.iv.1992; 8 colonies, Barukandi, 14.iv.1992; 10 colonies, Shonichara, 14.iv.1992, All North Tripura district, B. P. Halder and Party; 10 colonies, Kalitilla, 26.iv.1992, West Tripura district, B. P. Halder and party.

Diagnosis : Zoarium in the typical form loose in appearance and ectocyst by no means rigid; branching lateral and as a rule occurs chiefly on one side of a main branch or trunk; zooecia cylindrical and bear a simple keel on their dorsal surface; never emarginate or furrowed; ectocyst thin, colour usually uniform pale pinkish brown and fading little towards the tip of the zooecium; both free and stationery statoblasts formed, but stationery statoblasts rare in occurrence; free statoblasts very elongate; capsule relatively large, resembling swim-ring in outline and its sides distinctly convex and ends rounded; polypide about 40-50 tentacles and not festooned at base.

Habitat : The stems of aquatic plants, floating seeds and logs, stones and bricks in the pond.

Distribution : *India* : Tripura—North and west Tripura districts; Himalayan region; Kerala; Maharashtra; Meghalaya; Orissa; Rajasthan; Sikkim; West Bengal.

Elsewhere : Africa; Europe; Pakistan; Bangladesh; North America.

Remarks : *P. fruticosa* in lower Bengal is a cold weather species. Annandale (1911) reported this species from Kurseong in the Eastern Himalayas and from Simla in the Western Himalayas. This is the first record from Tripura.

(3) *Plumatella javanica* Kraepelin

1906. *Plumatella javanica* Kraepelin, *Mitt. nat. Mus. Hamburg*, **23** : 123.

1976. *Plumatella javanica* : Rao, *Rec. zool. Surv. India*, **69** : 339.

Material : 24 colonies, Shibpara, North Tripura; 13.iv.1992, B.P. Haldar and party; 8 colonies, Shonichara, North Tripura, 14.iv.1992, B. P. Haldar and party; 8 colonies, Kamalpur, North Tripura, 22.iv.1992, B.P. Haldar and Party; 10 colonies, Dakshin Pulinpur, West Tripura., 27.iv.1992 B. P. Haldar and party.

Diagnosis : Zoarium always entirely recumbent having lateral and irregular branches; zooecia slender, long, strongly emarginate and furrowed; ectocyst hyaline and colourless; free statoblasts with rounded extremities and sides slightly or distinctly convex; variable in length, either distinctly elongate or elongate only to a moderate degree; capsule relatively large, and free portion of the swim-ring not much broader at the ends than at the sides; fixed statoblasts elongate and surrounded by an irregularly shaped chitinous membrane.

Habitat : Leaves of water-lilies, floating seeds and sticks, submerged leaves of Pandani and stems of water plants in the pond.

Distribution : *India* : Tripura—North and West Tripura districts; Kerala; Madhya Pradesh; Meghalaya; Sikkim; Tamil Nadu; West Bengal.

Elsewhere : Europe, China, Japan; Java; North America.

Remarks : The transparent glassy ectocyst and strong furrowed keel are very characteristics of this species. This is the first record of this species from Tripura.

Genus 2. *Hyalinella* Jullien

1885. *Hyalinella* Jullien, *Bull. Soc. Zool. France*, **10** : 133.

1976. *Hyalinella* : Rao, *Rec. zool. Surv. India*, **69** : 340.

Diagnosis : Zoarium entirely recumbent and often appears to form an almost uniform flat

layer instead of a dendritic body; orifice of the zooecium prominent; ectocyst almost gelatinous in nature, soft, swollen and contractile, and capable of transverse wrinkling all over the zooecium which never emarginate.

Habitat : Submerged roots and stems of water plants, submerged leaves and submerged bricks and stones in the pond.

Distribution : Europe; India; North America.

(4) *Hyalinella punctata* (Hancock)

1850. *Plumatella punctata* Hancock, *Ann. Mag. nat. Hist.*, (2) **5** : 173.

1976. *Hyalinella punctata* : Rao, *Rec. zool. Surv. India*, **69** : 340.

Material : 10 colonies, Pacherthal, North Tripura district, 21.iv.1992, B. P. Haldar and Party.

Diagnosis : Zoarium entirely recumbent and often appears to form an almost uniform flat layer instead of a dendritic body; zooecia greatly swollen with colourless or faintly brown gelatinous ectocyst and neither emarginate nor furrowed; stationary statoblasts absent; free statoblast variable and often asymmetrical in outline, but free portion of swim-ring always of nearly equal diameter all round the periphery and the capsule relatively large; polypide comparatively short and stout, and having 20 to 30 tentacles.

Habitat : Submerged bricks, woods, stones, leaves and stems of water plants in the pond and also the tips of creepers falling into water in the pond.

Distribution : *India* : Tripura—North Tripura district; Madhya Pradesh; Meghalaya; Rajasthan; Sikkim; West Bengal.

Elsewhere : Europe; North America.

Remarks : In Tripura *H. punctata* flourishes both during the "rains" and in winter. This is the first record of this species from Tripura.

SUMMARY

The paper deals with a systematic account of four species of freshwater bryozoa hitherto known from Tripura. Each of the species is provided with a synonymy, diagnostic characters, habitat and distribution. It also furnishes the keys to families, genera and species for easy identification. A general account on morphology and terminology, and narcotisation and preservation have also been included.

ACKNOWLEDGEMENT

The author is grateful to Dr. A. K. Ghosh, ex-Director, Zoological Survey of India, Calcutta, for providing all sorts of facilities during the present investigation. He is indebted to Dr. S. K. Chanda, Scientist-SD, for his constant encouragement and to Dr. B. P. Haldar, Assistant Zoologist, for his initiative and interest during the entire period of studies and for his valuable suggestions in connection with the preparation of this manuscript.

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MOLLUSCA

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INTRODUCTION

Though the rich molluscan fauna of the entire North-east Indian region has been more or less thoroughly explored and studied by earlier malacologists during the last century, the focus was mostly on Abor Hills, Dafla Hills, Garo and Khasi Hills, Naga Hills, North Cachar Hills etc. The politically defined areas of Tripura somehow failed to attract the attention of the earlier malacologists. There are no previous records of molluscs from Tripura. The present report provides the first account of Tripura molluscs.

The material for our study was collected by recent survey parties, both from Headquarters and the Eastern Regional Station, Shillong as listed below.

The classification followed here is that of Taylor and Sohl (1961) for the land molluscs and that of the freshwater molluscs is after Subba Rao (1989).

Collecting stations are shown in the map of Tripura, which is given at the end.

List of collectors

Dr. V.C. Agrwal, 1969, 1971
Dr. V.T. Darlong, 1988
Dr. R.H. Kamble, 1989
Dr. Y.P. Sinha, 1989
Dr. H.P. Mookherjee, 1989, 1990
Dr. T. Ray, 1992

List of molluscs recorded from Tripura

Phylum MOLLUSCA
Class GASTROPODA

Order MESOGASTROPODA

Family CYCLOPHORIDAE

1. *Cyclophorus (Salpingophorus) aurantiacus* var. *pernobilis* (Gould)
2. *Pterocyclus parvus* (Pearson)

Family VIVIPARIDAE

3. *Angulyagra oxytropis* (Benson)
4. *Bellamya bengalensis* f. *typica* (Lamarck)
5. *Bellamya bengalensis* f. *balteata* (Benson)
6. *Bellamya bengalensis* f. *doliaris* (Gould)
7. *Bellamya dissimilis* (Mueller)
8. *Cipangopaludina lecythis* (Benson)

Family PILIDAE

9. *Pila theobaldi* (Hanley)

Family BITHYNIIDAE

10. *Digoniostoma cerameopoma* (Benson)
11. *Digoniostoma pulchella* (Benson)

Family THIARIDAE

12. *Thiara (Melanoides) tuberculata* (Mueller)
13. *Thiara (Tarebia) lineata* (Gray)
14. *Thiara (Tarebia) granifera* (Lamarck)
15. *Paludomus (Paludomus) conica* (Gray)
16. *Paludomus (Paludomus) conica* var. *kopiliensis* Nevill
17. *Paludomus (Paludomus) blanfordiana* Nevill
18. *Brotia (Antimelania) costula* (Rafinesque)

- Order BASOMMATOPHORA
- Family LYMNAEIDAE
19. *Lymnaea (Pseudosuccinea) acuminata* f. *typica* Lamarck
20. *Lymnaea (Pseudosuccinea) acuminata* f. *rufescens* Gray
21. *Lymnaea (Pseudosuccinea) luteola* f. *typica* Lamarck
22. *Lymnaea (Pseudosuccinea) luteola* f. *australis* Annandale & Rao
- Family PLANORBIDAE
23. *Indoplanorbis exustus* (Deshayes)
24. *Gyraulus labiatus* (Benson)
25. *Gyraulus convexiusculus* (Hutton)
26. *Segmentina (Polypylis) calatha* (Benson)
- Order STYLOMMATOPHORA
- Family ENIDAE
27. *Rachis bengalensis* (Lamarck)
- Family SUCCINEIDAE
28. *Succinea daucina* Pfeiffer
- Family SUBULINIDAE
29. *Lamellaxis gracile* (Hutton)
30. *Glessula gemma* (Reeve)
31. *Glessula naja* Pilsbry
- Family ACHATINIDAE
32. *Achatina (Lissachatina) fulica fulica* (Bowdich)
- Family STREPTAXIDAE
33. *Huttonella bicolor* (Hutton)
- Family TROCHOMORPHIDAE
34. *Sivella castra* (Benson)
- Family ARIOPHANTIDAE
35. *Macrochlamys indica* Godwin-Austen
36. *Macrochlamys sequax* (Benson)
37. *Macrochlamys petasus* (Benson)
38. *Austenia cacharica* (Godwin-Austen)
39. *Sitala infula* (Benson)
40. *Girasia hookeri* Gray
- Family CAMAENIDAE
41. *Amphidromus sylheticus* (Reeve)
- Order SOLEOLIFERA
- Family VERONICELLIDAE
42. *Laevicaulis alte* (Ferussac)
- Class BIVALVIA
- Order UNIONOIDA
- Family UNIONIDAE
43. *Lamellidens marginalis* (Lamarck)
- Family AMBLEMIDAE
44. *Parreysia (Parreysia) favidens* var. *marcens* (Benson)
45. *Parreysia (Parreysia) favidens* var. *plagiosoma* (Benson)
46. *Parreysia (Parreysia) favidens* subsp. *assamensis* Preston
47. *Parreysia (Radiatula) pachysoma* (Benson)
48. *Parreysia (Radiatula) caerulea* var. *gaudichaudi* (Eydoux)
- A. Freshwater molluscs**
- Key to the families*
1. Shell with a single valve 2
- Shell with two valves 7
2. Shell with an operculum 3
- Shell without an operculum 6
3. Operculum with concentric growth markings 4
- Operculum with spiral growth markings 5
4. Shell large, globose, aperture ovate, operculum calcareous PILIDAE
- Shell moderately large, pyramidal, aperture subcircular, operculum horny VIVIPARIDAE

5. Shell more than 10 mm. in length, ovate, with sculpture **THIARIDAE**
 Shell less than 10 mm. in length, ovate, without sculpture **BITHYNIIDAE**
6. Shell elongate with a raised spire, columella twisted **LYMNAEIDAE**
 Shell discoid, spire depressed, columella not twisted **PLANORBIDAE**
7. Shell with strong beak sculpture, all four gills marsupials **AMBLEMIDAE**
 Shell with weak beak sculpture, only outer two gills marsupials **UNIONIDAE**

Family **VIVIPARIDAE**

Sub Family **BELLAMYINAE**

Key to genera

1. Shell ornamented with a number of well-developed spiral ridges **ANGULYAGRA**
 Shell smooth, without distinct ridges or sculpture 2
2. Adult shell large, without any coloured band, body whorl rounded
 **CIPANGOPALUDINA**
 Adult shell medium-sized, usually with coloured bands, when without band, body whorl subangulate **BELLAMYA**

Genus ***Bellamyia*** Jousseaume, 1886

1886. *Bellamyia* Jousseaume, *Bull. Soc. Zool. France*, 2 : 478.

1989. *Bellamyia* : Subba Rao, *Handbook Freshwater Molluscs of India*, p. 44.

Key to the species

- Shell with dark spiral bands ... ***B. bengalensis***
 Shell without dark spiral bands
 ***B. dissimilis***

Bellamyia bengalensis f. typica (Lamarck)

1822. *Paludina bengalensis* Lamarck, *Hist. nat. Anim. sans vert.*, 6(2) : 174.

1989. *Bellamyia bengalensis f. typica* : Subba Rao, *Handbook Freshwater Molluscs of India*, p. 45, fig. 55.

Material examined : West Tripura district :

- (i) 1 ex., Stn. No 1. 4 kms. N. of Agartala, 9.11.09—(Coll. V. C. Agarwal) ;
- (ii) 1 ex., Pond at Kalital, S. E. of Forest Bungalow, Teliamura, 7.2.89—(Coll. H. P. Mookherjee & S.C. Mitra) ;
- (iii) 5 exs. Kamalghat, 1.6.89,
- (iv) 1 ex., Simna, 1.6.89,
- (v) 4 exs., Cheliakhola, 4.5.89—(Coll. R. H. Kamble & party) ;
- (vi) 6 exs., Ditch near Pratapgarh village, N. E. of Agartala, 17.11.90,
- (vii) 4 exs. Tank at College Nura, Agartala, 17.10.90,
- (viii) 9 exs., marshy land near Benjimara village, 2 kms. S. of Sonamura, 23.11.90,
- (ix) 2 exs., Jheels on the Western side of Sonamura, 25.11.90—(Coll. H. P. Mookherjee & S. Barua) ;
- (x) North Tripura district : 1 ex., Chowmanu, 20.6.88—(Coll. V.T. Darlong & Party) ;
- (xi) 1 ex., from a small pond at Ambassa colony, 3 kms. from forest Rest House, Dullubari, 13.2.89,
- (xii) 8 exs., Pond at Vidyanagar village, east of Koilasahar, 22.2.89—(Coll. H. P. Mookherjee & S. C. Mitra) ;
- (xiii) South Tripura district : 8 exs., Stn. 12, Garjee, 27. 12. 69—(Coll. V.C. Agarwal).

Measurements (in mm.) :

Length	Diameter	Height of aperture
11.60–28.00	10.10–17.70	6.70–14.35

Diagnosis : Spire and body whorl of equal height, body whorl convex, aperture subcircular, irregularly alternating dark narrow and broad bands present.

Distribution : India : Tripura (W., N., S.) Tripura districts, throughout rest of India.

Elsewhere : Myanmar.

Remarks : This form is essentially a stagnant water dweller, commonly found in ponds, ditches, wet paddy fields etc.

***Bellamya bengalensis f. balteata* (Benson)**

1836. *Paludina bengalensis f. balteata* : Benson; *J. Asiat. Soc. Beng*; 5 (2) : 745
 1989. *Bellamya bengalensis f. balteata* : Subba Rao, *Handbook Freshwater Molluscs of India*, p. 45, fig. 63.

Material examined : West Tripura district :

- (i) 7exs., Stn. 8, Bishalgarh, ca, 20 kms. S. of Agartala, 20.11.68—(Coll. V.C. Agarwal) ;
- (ii) 11exs., Rudrasagar Lake near Melaghar, 10 kms. N. of Sonamura, 24. 11.90—(Coll. H. P. Mookherjee & S. Barua) ;
- (iii) North Tripura district : 3 exs., Freshwater pond at Padmapur village, N. of Dharmanagar, 24.2.89—(Coll. H. P. Mookherjee & S.C. Mitra) ;
- (iv) 4 exs., Kalikapur near Dharmanagar. 4.12.89—(Coll. Y.P. Sinha) ; South Tripura district ;
- (v) 14 exs., From a pond at Ampinagar, 19.1.71—(Coll. V.C. Agarwal).

Measurements (in mm.) :

Length	Diameter	Height of aperture
22.50–25.80	14.70–15.80	11.10–13.0

Diagnosis : Shell narrow, imperforate with straight sides, whorls contracted, aperture ovoid.

Distribution : India : Tripura (N. & S. Tripura), Assam, (eastern part of Brahmaputra valley).

Elsewhere : Bangladesh.

***Bellamya bengalensis f. doliaris* (Gould)**

1843. *Paludina doliaris* Gould, *Proc. Boston Soc. nat. hist.*, 144.
 1989. *Bellamya bengalensis f. doliaris* : Subba Rao, *Handbook Freshwater Molluscs of India*, p. 47.

Material examined : West Tripura district : 1 ex., Sadipara, 26.6.89—(Coll. R. H. Kamble & party).

Measurements (in mm.) :

Length	Diameter	Height of aperture
21.0	13.95	11.50

Diagnosis : Shell smaller and more conical than in *typica*, easily recognised by its biangulate body whorl.

Distribution : India : Tripura (W. Tripura), Madhya Pradesh, Maharashtra, Orissa, West Bengal.

Elsewhere : Myanmar.

***Bellamya dissimilis* (Mueller)**

1774. *Nerita dissimilis* Muellar, *Hist. Verm. Test.* 2 : 184.
 1989. *Bellamya dissimilis* : Subba Rao, *Handbook Freshwater Molluscs of India*, P. 48, figs. 64–67.

Material examined : West Tripura district :

- (i) 1 ex., Bishalgarh, ca 30 kms. S. of Agartala, 20.11.69—(Coll. V.C. Agarwal) ;
- (ii) 3 exs., ditch near Pratapgarh village, N. E. of Agartala. 17.11.90.
- (iii) 5 exs., Rajbari Tank, Agartala, 4.12.90—Coll. H. P. Mookherjee & S. Barua).

Measurements (in mm.) :

Length	Diameter	Height of aperture
17.29–20.0	12.10–14.35	8.90–11.40

Diagnosis : Shell smaller, narrower without bands, with faint microscopic spiral stae, body whorl subangulate at the periphery, rim of aperture often black.

Distribution : India : Tripura (West Tripura), Common throughout rest of India.

Elsewhere : Bangladesh, Malaysia, Myanmar, Pakistan, Sri Lanka.

Genus *Angulyagra* Rao, 1931

1931. *Angulyagra* Rao, *Rec. Indian Mus.*, 33 : 301.
 1989. *Angulyagra* : Subba Rao, *Handbook Freshwater Molluscs of India*, p. 50

Angulyagra oxytropis (Benson)
(Fig. 2)

1836. *Paludina oxytropis* Benson, *J. Asiat. Soc. Beng.*, 5 : 745.
1989. *Angulyagra oxytropis* : Subba Rao, *Handbook Freshwater Molluscs of India*, p. 51, fig 70.

Material examined : South Tripura district : 3 exs., Canal at Bagapa, S. Tripura, 27.3.92—(Coll. T. Roy).

Measurements (in mm.) :

Length	Diameter	Height of aperture
24.0–31.9	28.25–23.85	13.4–15.45

Diagnosis : Shell large, thin, conical, flat on base, acuminate, narrowly perforate, with distinct spiral ridges, the ridges are darker in colour, aperture subcircular, subvertical, peristome thin.

Distribution : India : Tripura (S. Tripura), Manipur, Meghalaya.

Genus *Cipangopaludina* Hannibal, 1912

1912. *Cipangopaludina* Hannibal *Proc. malac. Soc. Lond...*, 10 : 194.
1989. *Cipangopaludina* : Subba Rao, *Handbook Freshwater Molluscs of India*, p. 49

Cipangopaludina lecythis (Benson)

1836. *Paludina lecythis* Benson. *J. Asiat. Soc. Beng.*, 5 : 745.
1989. *Cipangopaludina lecythis* : Subba Rao, *Handbook Freshwater Molluscs of India* p. 50, fig. 73.

Material examined :

- (i) South Tripura district : 3 exs., Canal at Bagapa, S. Tripura, 27.3.92—(Coll. T. Roy)
- (ii) 11 exs., Dhanga Sagar, Udaipur, 26.3.92—(Coll. R. Roy) ;
- (iii) West Tripura District : 3 exs., Pond at Bisramgune, 25.3.92—(Coll. T. Roy).

Measurements (in mm.) :

Length	Diameter	Height of aperture
23.0–40.75	20.7–34.65	14.0–23.6

Diagnosis : Shell large, globose, olive greenish in colour, spire conical with an acuminate apex, aperture large, oval, outer lip thin and sharp.

Distribution : India : Tripura (S. & W. Tripura), Manipur, Meghalaya.

Elsewhere : Myanmar.

Family PILIDAE

Genus *Pila* (Bolten) Roeding, 1798

Primarily inhabitants of stagnant water bodies, shows amphibious adaptations.

1798. *Pila* (Bolten) Roeding, *Mus. Bolten*, pt. 2 : 145.
1989. *Pila* : Subba Rao, *Handbook Freshwater Molluscs of India*, p. 57.

Pila theobaldi (Hanley)

1875. *Ampullaria theobaldi* Hanley, *Proc. zool. Soc. Lond.*, 608.
1925. *Pila theobaldi* : Prashad, *Mem. Indian Mus.*, 8 : 77, pl. 15, fig. 3.
1989. *Pila theobaldi* : Subba Rao, *Handbook Freshwater Molluscs of India*, p. 60, fig 84.

Material examined :

- (i) West Tripura district : 12 exs., N. of Agartala, 9.11.69 ;
- (ii) 13 exs., 2 kms. S. of Rest House, Charilum, 17.11.69 ;—(Coll. V.C. Agarwal & Party) ;
- (iii) 2 exs. Abhoya, S. of Agartala, 22.8.78—(Coll. S. K. Chanda) ;
- (iv) 1 ex., Senihani, 31.5.89 ;
- (v) 1 ex., kamalghat, 1.6.89—(Coll. R. H. Kamble & party) ;
- (vi) 2 exs., Ditch near Pratapgarh, 1 km. E. of Howrah river, N. of Agartala, 17.11.90—(Coll. H. P. Mookherjee & S. Barua) ;
- (vii) North Tripura District : 2 exs., pond at Baulia basti, 3 kms. from Dullubari Forest Rest House, Ambassa, 14.2.89 ;

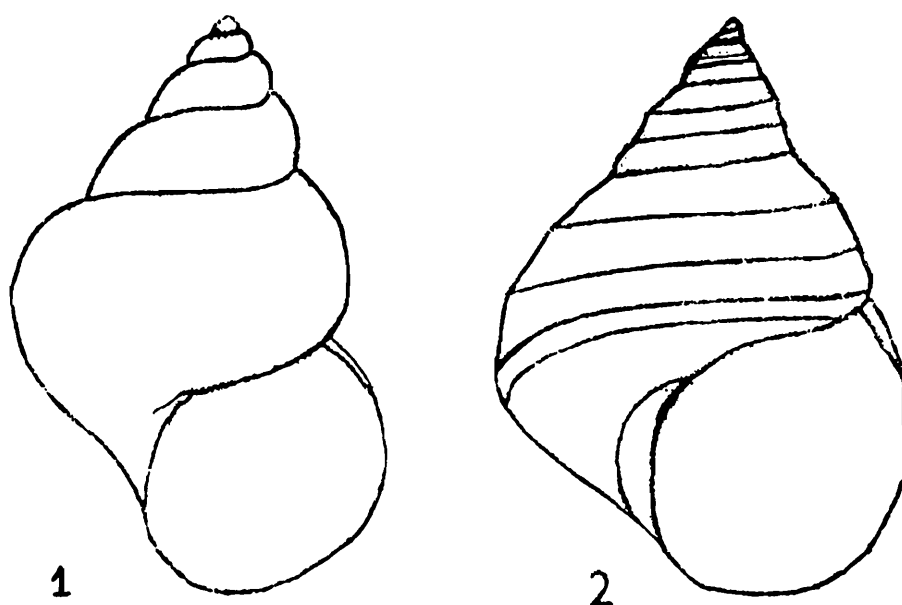


Fig. 1. *Cipangopaludina lecythis* (30.75 x 27.6 mm) 2. *Angulyagra oxytropis* (26.0 x 19.75 mm)

- (viii) 1 ex., Ditch at Chandipur Village, W. Koilasahar, 18.2.89 ;
- (ix) 2 exs., Hower Bazar, 10 kms. from Koilasahar, 29.2.89—(Coll. H.P. Mookherjee & S.C. Mitra) ;
- (x) South Tripura district : 2 exs., Amarapur, 22.2.89—(Coll. V.T. Darlong & party) ;
- (xi) 2 exs., Pond north of Paratia Forest House, 27.11.90 ;
- (xii) 1 ex., Pond near a paddy field, Trishna Wild Life Sanctuary, N. E. of Rajnagar—(Coll. H. P. Mookherjee & S. Barua).

Measurements (in mm.) :

Length	Diameter	Height of aperture
40.0–72.15	36.55–65.80	30.35–50.00

Diagnosis : Shell globosely inflated, sutures more impressed than in *P. globosa*, but not canaliculate as in *P. virens*, openly umbilicate.

Distribution : India : Tripura (W., N. and S. Tripura).

Elsewhere : Myanmar.

Remarks : This is the largest species of the genus *Pila* and is recorded for the first time from India.

Family BITHYNIIDAE

Genus *Digoniostoma* Annandale, 1920

1920. *Digoniostoma* Annandale, *Indian J. Med. Res.*, 7 : 104.

1989. *Digoniostoma* : Subba Rao, *Handbook Freshwater Molluscs of India*, p. 79.

These molluscs are the inhabitants of freshwater streams, stagnant water pools, paddy fields etc.

Key to species

Umbilicus with a distinct channel, lip at base of columella strongly reflected
.....*D. cerameopoma*

Umbilicus without a distinct channel, lip at base of columella not reflected*D. pulchella*

Digoniostoma cerameopoma (Benson)

1830. *Paludina cerameopoma* Benson, *Gleanings in Science*, Calcutta, 2 : 125.

1989. *Digoniostoma cerameopoma* : Subba Rao, *Handbook Freshwater Molluscs of India*, p. 79, fig. 121.

Material examined :

- (i) West Tripura district : 4 exs., Cherilum, 17.11.69.
- (ii) 9 exs., Bishalgarh, 20 kms., S. of Agartala, 26.11.69—(Coll. V.C. Agarwal) ;
- (iii) 6 exs., ditches of Pratapgarh village, 18.11.90 ;

- (iv) 4 exs., Jheels on the western side of Sonamura, 25.11.90—(Coll. H.P. Mookherjee & S. Barua).

Measurements (in mm.):

Length	Diameter	Height of aperture
6.10–7.85	3.85–4.35	3.70–4.30

Diagnosis : Shell ovately elongate with 5 whorls, sculptured with very fine, faint spiral striae and weak growth lines; suture impressed, umbilicus narrow but deep with a well defined channel; peristome continuous and reflected; aperture oval and oblique, operculum calcareous, concave, nucleus subcentral.

Distribution : India : Tripura (W. Tripura). Assam, Bihar, Madhya Pradesh, Punjab, Rajasthan, West Bengal.

Elsewhere : Pakistan.

Digoniostoma pulchella (Benson)

1836. *Paludina pulchella* Beson. *J. Asiat. soc. Beng.*, 5 : 746.
1989. *Digoniostoma pulchella* : Subba Rao. *Handbook Freshwater Molluscs of India*, p. 80, figs. 113, 114, 119 & 120.

Material examined : West Tripura district : 5 exs., Raibari tank, Agartala, 4.12.90—(Coll. H. P. Mookherjee & S. Barua).

Measurements (in mm.):

Length	Diameter	Height of aperture
5.85–7.35	5.25–5.0	2.95–3.25

Diagnosis : Shell comparatively elongate, spire greater than the bodywhorl, suture impressed, umbilicus almost sealed.

Distribution : India : Tripura (W. Tripura). Common throughout rest of India from Assam in the east to Jammu in the north-west, Andamans.

Elsewhere : Malayan Archipelago, Myanmar.

Family THIARIDAE

Members of this Family are commonly found in stagnant pools, lakes etc. But in general, they

prefer streams and rivers. Some are exclusively running water dwellers.

Represented by three genera under three subfamilies.

Key to the genera

1. Shell elongate, turreted, spire longer than bodywhorl.....2
Shell oblong globose, spire shorter than bodywhorl.....*Paludomus*
2. Shell upto 5 cms. in length, operculum pearshaped with a basal nucleus.....*Thiara*
Shell above 5 cms. in length, operculum circular with a central nucleus.....*Brotia*

Subfamily THIARINAE

Genus *Thiara* Roeding, 1798

1798. *Thiara* Roeding. *Mus. bolten.* 2 : 109.
1989. *Thiara* : Subba Rao, *Handbook Freshwater Molluscs of India*, p. 94.

Key to the subgenera

1. Shell with upto 9 whorls, sculptured with elevated axial and spiral ridges, giving a granular appearance.....*Tarebia*
2. Shell with upto 12 whorls, sculptured with spiral and axial striae, giving a tubercular appearance*Melanoides*

Thiara (Melanoides) tuberculata (Mueller)

1774. *Nerita tuberculata* Mueller, *Hist. Verm. Terr. fluv.*, 2 : 191.
1836. *Melania pyramis* : Benson, *J. Asiat. Soc. Beng.*, 5 : 334.
1989. *Thiara (Melanoides) tuberculata* : Subba Rao, *Handbook Freshwater Molluscs of India*, p. 103.

Material examined :

- (i) West Tripura district : 5 exs., Pond at Jaynagar, 2 kms. from Teliamura, 6.2.89—(Coll. H.P. Mookherjee & S.C. Mitra) ;
- (ii) 3 exs., Rudrasagar lake, Melaghar, 10 kms. n. of Sonamura—(Coll. H.P. Mookherjee & S. Barua) ;

- (iii) North Tripura district : 1 ex., Nalkata, 14.6.88-(Coll. V.T. Darlong & party) ;
- (iv) 6 exs., ditch at Chandipur village, W. of Kailasahar, 18.2.89-(Coll. H.P. Mookherjee & S.C. Mitra) ;
- (v) 1 ex., Unakote and around Kailasahar 6.2.89-(Coll. Y.P. Sinha) ;
- (vi) South Tripura district : 1 ex., Amarpur, 22.2.89-(Coll. V.T. Darlong & party).

Measurements (in mm.) :

Length	Diameter	Height of aperture
16.40-29.90	7.0-9.80	6.50-10.0

Diagnosis : Shell easily discernible by its high spire, moderately large body whorl and dark reddish brown dots and flames irregularly and longitudinally arranged on the surface.

Distribution : India : Tripura (North, South and West Tripura). Common throughout rest of India except Kashmir.

Elsewhere : North Africa, S. E. Asia and S. China, Malaysia. N. Australia and various Pacific Islands.

Subgenus *Tarebia* H.& A. Adams, 1854

Key to the species

Shell with distinct spiral rows of nodules
.....*T. granifera*

Shell with distinct spiral bands*T. lineata*

Thiara (Tarebia) lineata (Gray)

- 1828. *Helix lineata* Gray, in Wood's Index Test. Suppl., p. 24. fig. 68
- 1989. *Thiara (Tarebia) lineata* : Subba Rao, *Handbook Freshwater Molluscs of India*, p. 101, fig. 191.

Material examined :

- (i) West Tripura district : 3 exs., Howrah river, N. of Agartala, 16.11.90 ;
- (ii) 15 exs., ditch near Pratapgarh village, N. of Agartala, 18.11.90-(Coll. H. P. mookherjee & S. Barua) ;

- (iii) North Tripura district : 1 ex., Ditch at Chandipur village, W. of Kailasahar, 18.2.89-(Coll. H. P. Mookherjee & S.C. Mitra).

Measurements (in mm.) :

Length	Diameter	Height of aperture
10.25-13.20	4.0-5.40	3.45-5.0

Distribution : India : Tripura (West & North Tripura), Assam, Bihar, Madhya Pradesh, Uttar Pradesh, Maharashtra, West Bengal.

Elsewhere : Bhutan, Myanmar, Sri Lanka :

Thiara (Tarebia) granifera (Lamarck)

- 1822. *Melania granifera* Lamarck, *Hist. nat. Anim. sans Vert.*, 7 (2) : 167.
- 1989. *Thiara (Tarebia) granifera* : Subba Rao, *Handbook Freshwater Molluscs of India*, p. 101, figs. 212, 213.

Material examined :

- (i) West Tripura district : 3 exs., Howrah river, N. of Agartala, 16.11.90 ;
- (ii) North Tripura district : 2 exs., Ditch near Pratapgarh village, 18.11.90-(Coll. H.P. Mookherjee & S. Barua)

Measurements (in mm.) :

Length	Diameter	Height of aperture
12.75-19.80	5.0-7.20	5.20-7.80

Diagnosis : This species is very often confused with *T. lineata*. The differentiating character of presence of nodules is intergrading to some extent. However following Subba Rao (1989) it is treated as a distinct species here

Distribution : India : Tripura (West & North Tripura), Bihar, Madhya Pradesh and West Bengal.

Elsewhere : Madagascar, Malaysia, Philippines, Formosa and Pacific Islands. Introduced into United States of America, (Abbott, 1952).

Genus *Paludomus* Swainson, 1840

- 1840. *Paludomus* Swainson, *Treatise on Malacology*, p. 340.
- 1989. *Paludomus* : Subba Rao, *Handbook Freshwater Molluscs of India*, p. 140.

Subgenus *Paludomus* s. str.

Paludomus (Paludomus) conica (Gray)

1834. *Melania conica* Gray, *Griffith Cuvier, Moll.*, pl. 14, fig. 5.

1989. *Paludomus (Paludomus) conica* : Subba Rao, *Handbook Freshwater Molluscs of India*, p. 113, figs. 227 & 228.

Material examined :

- (i) West Tripura district : 3 exs., Khowai river, Teliamura, 2.2.71—(Coll. V.C. Agarwal) ;
- (ii) 3 exs., Sadipara, 26.2.89—(Coll. R. H. Kamble & party) ;
- (iii) North Tripura district : 1 ex., Kanchanpur, 18.2.71—(Coll. V. C. Agarwal) ;
- (iv) 1 ex., Sindukumar Para. Gaynamachara river, 12.8.79—(Coll. K.P. Singh & party) ;
- (v) 49 exs., Kanchanpur, 11.6.88 ;
- (vi) 5 exs., Nalkata, 14.6.88,
- (vii) 6 exs., Mosauli, 15.6.88,
- (viii) 3 exs., Debsai Chowdhury Para, 16.6.88,
- (ix) 5 exs., 11 kms. from Pacharthal, 17.6.88,
- (x) 3 exs., Bagbasa, 17.6.88—(Coll. V.T. Darlong & Party) ;
- (xi) 2 exs., Dhalai river, Dullubari, Ambassa, 15.2.89—(Coll. H. P. Mookherjee & S. C. Mitra) ;
- (xii) 11 exs., Panisagar and around Dharmanagar, 7.2.89,
- (xiii) 11 exs. Aglapur, Dharmanagar, 13.12.89,
- (xiv) 8 exs., Ambassa, 13.12.89,
- (xv) 4 exs. Churraibari and around Dharmanagar, 19.12.89—(Coll. Y.P., Sinha & party) ; 25.1.71
- (xvii) 10 exs., Stream by the side of a green tilla, N. E. of Rajnagar, 1.12.80,
- (xviii) 6 exs., from a stream by the side of a hillock Trishna Wild life Sanctuary,

1.12.90,—(Coll. H. P. Mookherjee & S. Barua).

Measurements (in mm.) :

Length	Diameter	Height of aperture
12.90–22.20	8.85–14.90	8.80–12.80

Diagnosis : Shell globularly conical, thick, whorls 5 ; surface more or less smooth excepting the sutural region which contains one broad or sometimes 3 to 4 spiral ridges ; colour yellowish brown to dark brown, often with dark spiral bands.

Distribution : India : Tripura (West, South & North Tripura), Assam, Meghalaya.

Elsewhere : Bangladesh, Bhutan.

Remarks : This species mostly occurs in slow moving waters.

Paludomus conica var. *kopiliensis* Nevill

1884. *paludomus Conica* var. *kopiliensis* Nevill. *Handlist Moll. Indian Mus.*, 2 : 289.

1915. *Paludomus conica* var. *kopiliensis* : Preston. *Fauna Brit. India, Mollusca* (Freshwater gastropoda & Pelecypoda) p. 40.

Material examined : South Tripura district : 5 exs. Maharani, 24.2.89—(Coll. V. T. Darlong & party).

Measurements (in mm.) :

Length	Diameter	Height of aperture
12.50–16.0	9.50–11.0	9.35–10.60

Fig-3

Diagnosis : Shell in this subspecies differs from the typical form in having a shorter spire, a proportionately larger and much inflated body whorl which is subangulate at the periphery.

Distribution : India : Tripura (South Tripura), Assam.

Paludomus (Paludomus) blanfordiana Nevill

1877. *Paludomus blanfordiana* Nevil, *J. Asiat. Soc. Beng.*, 50(20 : 159, pl. 5, figs. 3, 3a.

1989. *Paludomus* (*Paludomus*) *blanfordiana* : Subba Rao, *Handbook Freshwater Mollusca of India*, p. 112, figs. 222, 239.

Material examined : South Tripura district : 14 exs., from a 'Charra' by the side of a green hillock, Trishna Wild Life Sanctuary. Rajnagar, 1.12.90—(Coll. H.P. Mookherjee & S. Barua).

Measurements (in mm.) :

Length	Diameter	Height of aperture
12.55–6.05	9.0–19.75	8.20–19.0

Diagnosis : Shell ovately globose, thin, bodywhorl inflated, dirty yellow in colour, sometimes with black encrustation, surface sculptured with spiral striae, body whorl with three characteristic broad bands of chocolate brown. which can be seen from inside the aperture also, aperture ovate, columella nearly straight, callus tinged with chocolate brown.

Distribution : India : Tripura (South Tripura), Assam, Meghalaya.

Elsewhere : Myanmar.

Remarks : The shells collected were lying on the stream bed almost camouflaged with small black gravels, in slow moving water, associated with the shells of *P. conica*.

Subfamily MELANATRIINAE

Genus *Brotia* H. Adams, 1866

1866. *Brotia* H. Adams, *Proc. zool. Soc. Lond.*, p. 50.
1989. *Brotia* : Subba Rao, *Handbook Freshwater Molluscs of India*, p. 107.

Subgenus *Antimelania* Crosse & Fischer, 1892

Shell with aperture rounded at the base but not projecting as in *Brotia* s. str.

Brotia* (*Antimelania*) *costula (Rafinesque)

1833. *Melania costula* Rafinesque, *Atlantic Journ.* No. 5 : 166.
1956. *Brotia costula* : Benthem Jutting, *Treubia*, 23 (2) : 374, fig. 76.
1989. *Brotia* (*Antimelania*) *costula* : Subba Rao, *Handbook Freshwater Molluscs of India*, p. 108, figs. 192–194, 197, 198.

Material examined :

- (i) West Tripura district : 1 ex., Abhoya river, Abhoya, 3.12.69,
- (ii) 3 exs., Pathalia Ghat, 30.5.89—(Coll. V. T. Darlong & party),
- (iii) 11 exs., Howrah river, by the side of Agartala, 19.11.90,
- (iv) 8 exs., Rudrasagar Lake, Melaghar, 10 kms. N. E. of Sonamura, 24.11.90.
- (v) 2 exs., Jheels on the western side of Sonamura, 25.11.90,
- (vi) 4 exs., Sonaicherri stream, Motinagar, 10 kms. N. of sonamura, 25.11.90—(Coll. H. P. Mookherjee & S. Barua) ;
- (vii) North Tripura district : 1 ex., Kukichera, 13.6.88 (Coll. V. T. Darlong & part),
- (viii) 1 ex., Manu river near Forest Rest House, Kailasahar, 19.2.89,
- (ix) 2 exs., Juri river near Dewanpasa village, Dharmanagar, 26.2.89,—(Coll. H.P. Mookherjee & S.C. Mitra) ;
- (x) South Tripura district : 2 exs., Kanchanpur, 18.2.71—(Coll. V.C. Agarwal & party),
- (xi) 1 ex., Jalaibari, 25.2.89—(Coll. V. T. Darlong & party).

Measurements (in mm.) :

Length	Diameter	Height of aperture
20.75–86.30	9.0–34.40	8.90–28.90

Diagnosis : Shell elongate with regularly increasing whorls, whorls 12–14, sculptured with spiral ridges or nodules, prominent axial ribs, sometimes with spines.

Distribution : India : Tripura (North & South Tripura), Assam, Manipur, Meghalaya, Uttar Pradesh, West Bengal.

Elsewhere : Bhutan, Indonesia, Myanmar, Pakistan.

Remarks : This species is very variable and has thirteen varieties and subvarieties described

under it which are intergrading to each other. It generally occurs in muddy bottoms of rivers and stagnant waters.

Order BASOMMATOPHORA

Family LYMNAEIDAE

Genus *Lymnaea* Lamarck, 1799

1799. *Limnaea* Lamarck, *Proc. Mouv. Clas. cog.*, p. 75.

1989. *Lymnaea* : Subba Rao, *Handbook Freshwater Molluscs of India*, p. 124

Inhabits all types of freshwater habitats including temporary waterbodies.

Subgenus *Pseudosuccinea* Baker

Key to species

Outer lip much expanded and rounded in outline, spire more acuminate ...*L. acuminata*

outer lip less expanded and straight in outline, spire less acuminate*L. luteola*

Lymnaea (pseudosuccinea) acuminata
f. *typica* Lamarck

1822. *Limnaea acuminata* Lamarck, *Hist. nat. Anim. Sans Vert.*, 6(2) : 160.

1989. *Lymnaea (Pseudosuccinea) acuminata* f. *typica* : Subba Rao, *Handbook Freshwater Molluscs of India*, p. 127, figs. 258, 259.

Material examined :

(i) West Tripura district : 2 exs., Bishalgarh, 20 kms. S. of Agartala, 20.11.69—(Coll. V.C. Agarwal).

(ii) 2 exs., Jheels of Benjimara village, S. of Sonamura, 23.11.90—(Coll. H.P. Mookherjee & S. Barua).

Measurements (in mm.) :

Length	Diameter	Height of aperture
9.0–15.60	5.60–8.90	6.0–12.80

Diagnosis : Shell ovate with a short acuminate spire, body whorl much inflated, a little angular above, aperture large.

Distribution : India : Tripura (West Tripura), common throughout rest of India.

Elsewhere : Bangladesh, Myanmar, Pakistan.

Remarks : This species generally occurs in permanent water bodies with abundant vegetations.

Lymnaea (Pseudosuccinea) luteola f. *typica* Lamarck

1822. *Limnaea luteola* Lamarck, *Hist. nat. Anim. sans Vert.* 6 (2) : 160

1989. *Lymnaea (Pseudosuccinea) luteola* f. *typica* : Subba Rao, *Handbook Freshwater Molluscs of India*, p. 129, figs. 275, & 276.

Material examined : South Tripura district : 2 exs., Amarpur, 22.2.89—(Coll. V.T. Darlong & party).

Measurements (in mm.) :

Length	Diameter	Height of aperture
13.0–21.80	7.80–11.60	10.40–13.90

Diagnosis : Shell ovate with a less acuminate spire, body whorl much inflated and a little compressed, aperture less expanded.

Distribution : India : Tripura (South Tripura). Common throughout rest of India.

Elsewhere : Bangladesh, Myanmar, Nepal, Pakistan.

Remarks : It has no particular habitat. Very often occurs in temporary water bodies which dry up in summer.

Lymnaea (Pseudosuccinea) acuminata f. *rufescens* Gray

1822. *Limnaea rufescens* Gray, in Sowerby's *Genera of Recent and fossil shells*, 1(7) : *Limnaea*, fig. 2.

1989. *Lymnaea (Pseudosuccinea) acuminata* f. *rufescens* : Subba Rao, Mitra & Manna, *Fauna of Orissa : State Fauna Series*, 1(2) : 298, figs. 9E, 9F.

Material examined : West Tripura district : 1 ex., Jheels on the western side of Sonamura, 25.11.90—(Coll. H. P. Mookherjee & S. Barua).

Measurements (in mm.) :

Length	Diameter	Height of aperture
20.45–31.00	10.00–15.80	14.90–25.80

Diagnosis : Shell uniformly narrowly elongate with a long spire, aperture uniformly less expanded and broadly angulate above.

Distribution : India : Tripura (West Tripura). Common throughout rest of India.

Remarks : This species occurs in permanent freshwater tanks and lakes with ample vegetations.

***Lymnaea (Pseudosuccinea) luteola*
f. *australis* Annandale & Rao**

1925. *Limnaea (Pseudosuccinea) luteola f. australis* Annandale & Rao, *Rec. Indian Mus.* 27 : 184.

1989. *Lymnaea (Pseudosuccinea) luteola f. australis* ; Subba Rao, *Handbook Freshwater Molluscs of India*, p. 129, figs. 279.

Material examined :

- (i) West Tripura district : 8 exs., Pond at Office Tilla village at Khowai, 30 kms. N. of Teliamura, 9.2.89–(Coll. H. P. Mookherjee & S.C. Mitra) ;
- (ii) 6 exs., Rajbari tank, Agartala, 4.2.90–(Coll. H.P. Mookherjee & S. Barua) ;
- (iii) North Tripura district : 6 exs., Pond near Ramakrishna Mahavidyalaya, Kailashar, 20.2.89–(Coll. H.P. Mookherjee & S.C. Mitra) ;
- (iv) 2 exs., unokoti and around Kailasahar, 6.2.89–(Coll. Y.P. Sinha) ;
- (v) South Tripura district : 11 exs., Paddy fields by the side of a tilla of forest of Trishna Wild Life Sanctuary, Rajnagar, 1.2.90–(Coll. H.P. Mookherjee & S. Barua).

Measurements (in mm.) :

Length	Diameter	Height of aperture
11.80–14.50	7.50–8.60	9.20–11.40

Diagnosis : Shell smaller than in *typica* with a comparatively larger spire, body whorl well rounded.

Distribution : India : Tripura (West, North & South Tripura). Common throughout rest of India.

Elsewhere : Bangladesh, Myanmar, Pakistan, Sri Lanka.

Family PLANORBIDAE

Essentially found in shallow stagnant waters, ponds, ditches etc.

Represented by two subfamilies, Bulininae and Planorbinae and by three genera.

Key to genera

1. Shell large with rounded
.....whorls *Indoplanorbis*
Shell small with greatly flattened whorls....2
2. Whorls narrowly coiled, internal lamellae present*Segmentina*
Whorls widely coiled, internal lamellae absent*Gyraulus*

Subfamily PLANORBINAE

Genus *Gyraulus* Charpentier, 1837

1837. *Gyraulus* Charpentier, *Neue Denkschr. Allg. Schweiz. Gesell.* 1. No. 2 : 21.

1989. *Gyraulus* : Subba Rao, *Handbook Freshwater Molluscs of India*, p. 153.

Key to the species

Body whorl distinctly wide, descending in front, white rib within aperture*G. labiatus*

Body whorl not much wide, not descending in front, no within the aperture
.....*G. convexiusculus*

Gyraulus labiatus (Benson)

1850. *Planorbis labiatus* Benson, *Ann. Mag. nat. Hist.*, (2) 5 : 350.

1989. *Gyraulus labiatus* Subba Rao, *Handbook Freshwater Molluscs of India*, p. 155, figs. 342–344.

Material examined :

- (i) West Tripura district : 1 ex., Jheels of Benjimara village, S. of Sonamura, 23.11.90.

- (ii) 3 exs., Rudrasagar Lake, Melaghar, 10 kms. N. of Sonamura, 24.11.90—(Coll. H. P. Mookherjee & S. Barua) ;

- (iii) North Tripura district : 1 ex., from a small pond at Ambassa colony, 3 kms. from Forest Rest House, Dullubari, 13.2.89—(Coll. H. P. Mookherjee & S. C. Mitra).

Measurements (in mm.) :

Height	Diameter
0.85–0.95	4.0–4.65

Diagnosis : Shell depressed with $3\frac{1}{2}$ whorls, obliquely striate, aperture oblique and a little descending in front, body whorl with remarkable deviation from main axis, a whitish rib present within the aperture.

Distribution : India : Tripura (West and North Tripura), Madhya Pradesh, Maharashtra, Tamil Nadu, West Bengal.

Gyraulus convexiusculus (Hutton)

1899. *Planorbis convexiusculus* Hutton, *J. Asiat. Soc. Beng.*, 18(2) : 657.

1989. *Gyraulus convexiusculus* : Subba Rao, *Handbook Freshwater Molluscs of India*, p. 154, figs. 362–364.

Material examined :

- (i) West Tripura district : 1 ex., Small ditch on way to Golabari village, 3 kms from forest Rest House, Teliamura, 8.2.89,
- (ii) 1 ex., Pond at Khowai, N. of Teliamura, 9.2.89,
- (iii) 3 exs., Small ditch in Golabari village near Teliamura, 10.2.89—(Coll. H.P. Mookherjee & S. C. Mitra).

Measurements (in mm.) :

Height	Diameter
1.20–1.60	3.10–7.0

Diagnosis : Shell with 4–5 depressed whorls, conspicuously and obliquely striate, subangulate at the periphery, widely umbilicate, aperture ovately lunate.

Distribution : India : Tripura (West Tripura). Widely distributed in rest of the country.

Elsewhere : Extends from Iran to Philippines.

Remarks : It is a very common species and is abundantly found in lakes, ditches, ponds and wet paddy fields in Tripura.

Subfamily BULININAE

Genus *Indoplanorbis* Annandale & Prashad, 1921

1921. *Indoplanorbis* Annandale & Prashad, *Rec. Indian Mus.*, 22(4) : 578.

1989. *Indoplanorbis* : Subba Rao, *Handbook Freshwater Molluscs of India*, p. 142, figs. 326, 327

Indoplanorbis exustus (Deshayes)

1834. *Planorbis exustus* Deshayes, in Belangr, *Voy. Indesorientales*, p. 417. pl.1, figs. 11–13.

1989. *Indoplanorbis exustus* : Subba Rao, Mitra & Manna, *Fauna of Orissa : State Fauna series*, 1(2) : 302, figs. 11, A,B,C.

Material examined :

- (i) West Tripura district : 1 ex., Stn. 2. 4 Kms. N. of Agartala, 9.11.69,
- (ii) 6 exs., Stn. 7.2 kms. S. of Charilam, 17.11.69—(Coll. V. C. Agarwal, & Party)
- (iii) 1 ex., Ditch near Pratapgarh village N. of Agartala, 18.11.90.
- (iv) 2 exs., Jheels of Benjimara village, S. of Sonamura, 23.11.90
- (v) 4 exs., Jheels on the western side of Sonamura, 25.11.90.—(Coll. H. P. Mookherjee & S. Barua) ;
- (vi) North Tripura district : 1 ex., From a small pond at Ambassa colony, 3 kms. from Forest Rest House, Dullubari, Ambassa, 13.2.89
- (vii) 3 exs, Ditch at Chandipur village, W. of Kailasahar, 18.2.89—(Coll. H. P. Mookherjee & S. C. Mitra) ;
- (viii) South Tripura district : 2 exs., Stn. 34, Paddy fields bellow tilla of Shal Forest, Trishna Wild Life Sanctuary, Rajnagar, 1.12.90—(Coll. H. P. Mookherjee & S. Barua).

Measurements (in mm.) :

Height	Diameter
4.50–6.60	6.20–14.0

Diagnosis : Shell moderately large, thick, depressedly coiled, whorls rounded, apex sunken below the plane, aperture ear-shaped.

Distribution : India : Tripura (West, North & South Tripura). common throughout rest of India.

Elsewhere : Celebes, Indonesia, Java, Malaya, Myanmar, Pakistan, Persia, Sri Lanka, Sumatra, Thailand, Vietnam.

Remarks : This species very commonly occurs in ponds, ditches, lakes and paddy fields.

Genus *Segmentina* Fleming, 1817

1817. *Segmentina* Fleming, *Edinburgh Encyclopaedia, Conchology*, ed. 7 : vol. 12.

1989. *Segmentina* : Subba Rao, *Handbook Freshwater Molluscs of India*, p. 149.

Subgenus *Polypylis* Pilsbry, 1906

Segmentina (*Polypylis*) *calatha* (Benson)

1850. *Planorbis calathus* Beson, *Ann. Mag. nat. Hist.*, (2)5 : 348.

1989. *Segmentina* (*Polypylis*) *calatha* : Subba Rao, *Handbook Freshwater Molluscs of India*, p. 150, figs. 339-341.

Material examined :

- (i) West Tripura district : 1 ex., Small ditch on way to Golabari village (from weeds), 3 kms. from Teliamura, 10.12.89–(Coll. H.P. Mookherjee & S.C. Mitra) ;
- (ii) North Tripura district : 4 exs., Pond near Ramakrishna Mahavidyalaya, Kailasahar, 20.2.89–(Coll. H. P. Mookherjee & S. C. Mitra).

Measurements (in mm.) :

Length	Diameter	Height of aperture
1.35–1.55	3.05–4.80	1.20–1.50

Diagnosis : Shell small, glossy with 4 whorls, convex above and flattened below, body whorl

wide and angulate at the periphery, internally divided by white transverse laminae.

Distribution : India : Tripura (West & North Tripura), Assam, Bihar, Manipur, Uttar pradesh, West Bengal.

Elsewhere : Myanmar, Sri Lanka.

Remarks : This species is rather widely distributed in northern India and is found to occur among weeds in ponds, ditches, jheels etc. of Tripura.

Class BIVALVIA

Order UNIONOIDA

Family UNIONIDAE

A single genus, *Lamellidens* is represented in Tripura.

Genus *Lamellidens* Simpson, 1900

Lamellidens marginalis (Lamarck)

1819. *Unio marginalis* Lamarck, *Hist. nat. Anim. sans Vert.*, 4 : 79.

1989. *Lamellidens marginalis* : Subba Rao, *Handbook Freshwater Molluscs of India*, p. 168. fig. 404, 405.

1989. *Lamellidens marginalis* : Subba Rao, Mitra & Manna, *Fauna of Orissa : State Fauna series*, No. 1 : 306, figs. 13A, B.

Material examined :

- (i) West Tripura district : 3 exs., Pond at Golabari village, 3 kms. from Forest Rest House, Teliamura, 8.2.89,
- (ii) 2 exs., Pond at Office Tilla village, Khowai, 30 kms. N. of Teliamura, 9.2.89,
- (iii) 1 ex., Tikarma, 25.5.89–(Coll. R. H. Kamble & party) ; vi) 4 exs, Ditch near Pratapagarh village, N. E. of Agartala, 17.11.90,
- (iv) 2 exs., Rudrasagar Lake, Melaghar, 10 kms. N. of Sonamura, 24.11.90.
- (v) 1 ex., Howrah river near Pratapgarh, Agartala, 17.11.90–(Coll. H.P. Mookherjee & S. Barua)

- (vi) North Tripura district : 3 exs., from a small pond at Ambassa colony, 3 kms. from Forest Rest House, Dullubari, 13.2.89,
- (vii) 1 ex., Freshwater pond at Jagannathpur, 2 kms. from Ambassa on way to Gandhachhara, 15.2.89,
- (viii) 5 exs., Freshwater pond at Kubjar village, N. of Kailasahar, 21.2.89,
- (ix) 1 valve, pond at Vidyanagar village, E. of Kailasahar, 22.2.89–(Coll. H. P. Mookherjee & S.C. Mitra).
- (x) 11 exs., Aglapur near Dharmanagar, 13.2.89 –(Coll. Y. P. Sinha) ;
- (xi) 7 exs., Tarakpur, N. of Dharmanagar, 15.12.89–(Coll. Y. P. Sinha) ;
- (xii) 7 exs., Tarakpur, N. of Dharmanagar, 15.12.89.
- (xiii) South Tripura district : 1 ex., Paratia, 6 kms. of Udaipur, 30.11.69–(Coll. V.C. agarwal 7 party) ; xv) 3 exs., Howrah river near Pratapgarh, Agartala, 17.11.90–(Coll. H. P. Mookherjee & S. Barua).

Measurements (in mm.) :

Length	Width	Thickness
72.45–132.20	37.05–73.70	22.50–45.55

Diagnosis : Shell oblong-ovate, smooth, shining, blackish brown with fine radial striae with characteristic light brown border along the margin ; posterior end broad, roundly angulate, anterior end short and narrow ; hinge with two cardinals in the right valve and one in the left.

Distribution : India : Tripura (West, North and South Tripura). Common throughout rest of India.

Elsewhere : Bangladesh, Myanmar, Sri Lanka.

Remarks : Some of the mussels collected from a large pond at Golabari village with a muddy bottom, near Teliamura (from a depth of about 1/2 a meter) were unusually large reaching above 130.0 mm. in length.

Family **AMBLEMIDAE**
Subfamily **PARREYSIINAE**
Genus *Parreysia* Conrad, 1853

1853. *Parreysia* Conrad, *Proc. Acad. nat. Sci. Philad.*, 6 : 267.
1989. *Parreysia* : Subba Rao, *Handbook Freshwater Molluscs of India*, p. 176.

Represented by two subgenera, *Parreysia* s.str. and *Radiatula*.

Key to the species

- Shell thick, centre of ventral margin expanded, sculpture of the beak strong, surface without any prominent pattern of sculpture *Parreysia*
- Shell thin, centre of ventral margin more or less straight, sculpture of the beak not strong, surface with radiating or zig-zag or divaricating ridges *Radiatula*

Subgenus *Parreysia* s. str.

Parreysia (Parreysia) favidens sub sp.
assamensis Preston

1912. *Parreysia favidens* var. *assamensis* Preston, *Rec. Indian Mus.*, 7 : 299.
1989. *Parreysia (Parreysia) favidens* subsp. *assamensis* : Subba Rao, *Handbook Freshwater Molluscs of India*, p. 181, figs. 468, 469.

Material examined : West Tripura district : 3 exs., Howrah river, near Pratapgarh village, Agartala, 17.11.90—(Coll. H.P. Mookherjee & S. Barua).

Measurements (in mm.) :

Length	Width	Thickness
44.0–48.30	29.20–30.60	20.75–19.20

Diagnosis : Shell convex, greenish, anterior side more rounded than in typical form, posterior broadly angulate.

Distribution : India : Tripura (W. Tripura), Assam, Bihar.

***Parreysia (Parreysia) favidens* sub sp.
marcens (Benson)**

1862. *Unio favidens* var. *marcens* Benson, *Ann. Mag. nat. Hist.*, (3) 10 : 188.
1915. *Parreysia (Parreysia) favidens* var. *marcens* : Preston, *Fauna Brit. India, Mollusca*, (Freshwater Gastropoda & Pelecypoda), p. 159

Material examined :

- (i) North Tripura district : 5 exs., from Manu river near Forest Rest House, Kailasahar, 19.2.89,
- (ii) 1 ex., Juri river, Dharmanagar, 24.2.89— (Coll. H.P. Mookherjee & S.C. Mitra).

Measurements (in mm.) :

Length	Width	Thickness
32.0–71.40	23.10–46.15	14.90–28.70

Diagnosis : Shell larger and more elongate than in *typica*, umbonal region weakly sculptured, posterior margin broadly rounded.

Distribution : India : Tripura (North Tripura), Assam, Maharashtra, West Bengal.

***Parreysia (Parreysia) favidens* sub sp.
plagiosoma (Benson)**

1862. *Unio plagiosoma* Benson, *Ann. Mag. nat. Hist.*, (3) 10 : 191.
1918. *Parreysia (Parreysia) favidens* var. *plagiosoma* : Preston, *Fauna Brit. India, Mollusca*, (Freshwater Gastropoda & Pelecypoda), p. 162, fig. 14.

Material examined :

- (i) West Tripura district : 1 ex., Kamalghat, 1.6.89—(Coll. R.H. Kamble & party) ;
- (ii) 3 exs., Howrah river near Pratapgarh, N. of Agartala, 17.11.90—(Coll. H.P. Mookherjee & S. Barua).

Measurements (in mm.) :

Length	Width	Thickness
45.35–48.25	29.60–30.95	19.50–21.40

Diagnosis : Shell thinner and more trigonal, dorsal margin evenly sloping ; anterior

margin well rounded ; sculpture confined to beaks only.

Distribution : India : Tripura (West Tripura), Assam, West Bengal.

Subgenus *Radiatula* Simpson, 1900

Represented by two species.

Key to species

- Sculpture of divaricate ridges restricted to umbonal region *P. (R.) pachysoma*
- Sculpture of divaricate ridges extending throughout upper half of shell
..... *P (R.) caerulea*

***Parreysia (Radiatula) pachysoma* (Benson)**

1862. *Unio pachysoma* Benson, *Ann. Mag. nat. Hist.*, (3)10 : 186.
1989. *Parreysia (Radiatula) pachysoma* : Subba Rao, *Handbook Freshwater Molluscs of India*, p. 192, figs. 540, 541.

Material examined :

- (i) West Tripura district : 2 exs., ditch near Pratapgarh village, 1 km. E. of Howrah river, Agartala, 17.11.90—(Coll. H.P. Mookherjee & S. Barua) ;
- (ii) North Tripura district : 1 ex., Juri river, Dharmanagar, 24.2.89—(Coll. H.P. Mookherjee & S.C. Mitra) ;
- (iii) South Tripura district : 1 ex., takmachhara, Patichhari Reserve Forest, 28.11.90—(Coll. H.P. Mookherjee & S. Barua).

Measurements (in mm.) :

Length	Width	Thickness
35.10–46.50	18.45–23.90	15.40–18.30

Diagnosis : Shell characteristically differs from the other species by its rather narrower but more inflated shell with the umbones more pronounced and the radial sculpture absent on the sides.

Distribution : India : Tripura (West, North & South Tripura), Assam, West Bengal.

Parreysia (Radiatula) caerulea sub sp.
gaudichaudi (Eydoux)

1838. *Unio gaudichaudi* Eydoux, *Mag. de zool.*, 5 : 10, pl. 118, fig. 3.
1989. *Parreysia (Radiatula) caerulea* subsp. *gaudichaudi* : Subba Rao, *Handbook Freshwater Molluscs of India*, p. 188, figs. 518, 519.

Material examined :

- (i) West Tripura district : 1 ex., Benjimara village, 2 kms. S. of Sonamura, 23.11.90–(Coll. H.P. Mookherjee & S. Barua) ;
- (ii) 1 ex., Tikarma, 25.5.89–(Coll. R. H. Kamble & party) ;
- (iii) North Tripura district : 1 ex., Aglapur near Dharmanagar, 13.12.89–(Coll. Y.P. Sinha & Party).

Measurements (in mm.) :

Length	Diameter	Height of aperture
47.90–50.65	23.45–26.90	19.0–21.50

Diagnosis : Shell distinctly more tumid and inflated, posterior end abruptly pointed.

Distribution : India : Tripura (West and North Tripura), West Bengal.

Elsewhere : Bangladesh.

B. Land molluscs

Key to the families

1. Animal not possessing a shell.....*Veronicellidae*
- Animal possessing a shell 2
2. Shell with an operculum*Cyclophoridae*
- Shell without an operculum 3
3. Shell ovate to elongately turreted, higher than broad 4
- Shell low conical or depressedly turbinat, broader than high 9

4. Body whorl equallying more than 3/4 of total length*Succineidae*
- Body whorl less than 3/4 of total length 5
5. Shell strongly sculptured, aperture denticulate*Streptaxidae*
- Shell without strong sculpture, aperture without denticulation 6
6. Shell sinistral*Camaenidae*
- Shell dextral 7
7. Shell openly perforate, columella strongly reflected*Enidae*
- Shell imperforate, columella not reflected 8
8. Shell large (seldom less than 50 mm. in length) brightly coloured*Achatinidae*
- Shell smaller (not exceeding 20 mm. in length), drab-coloured*Subulinidae*
9. Shell flatly depressed, acutely carinate, extremity of foot without a caudal gland.....*Trochomorphidae*
10. Shell depressedly conoid (except in *Austenia* and *Girasia*, which are slug-like), rounded or angulate, extremity of foot with a caudal gland*Ariophantidae*

Order MESOGASTROPODA

Family CYCLOPHORIDAE

Terrestrial, found among vegetable debris or in shady places under vegetations etc.

Represented by two genera.

Key to the genera

- Shell thicker, larger (usually above 70 mm. in diameter, conically globose with a raised spire*Cyclophorus*
- Shell thinner, smaller (usually less than 30 mm. in diameter), depressed with a low spire*Pterocyclus*

Genus *Cyclophorus* Montfort, 1810

1810. *Cyclophorus* Montfort, *Conchyl. Syst.*, 2 : 290.
 1991. *Cyclophorus* : Subba Rao & Mitra, *Rec. zool. Surv. India*, Occ. paper 126 : 15.

Subgenus *Salpingophorus* Kobelt & Moellendorff, 1817*Cyclophorus (Salpingophorus) aurantiacus*
subsp. *pernobilis* Gould
(pl. 1, fig. 2)

1844. *Cyclophorus pernobilis* Gould, *Proc. Boston nat. Hist. Soc.*, 1 : 140.
 1914. *Cyclophorus (Salpingophorus) aurantiacus* var. *pernobilis* : Gude, *Fauna Brit. India*, Mollusca, 3 : 71.

Material examined :

- (i) West Tripura district : 1 ex., Among heaps of dry leaves, garden inside Forest Bungalow Compound, Teliamura, 6.2.89,
- (ii) 4 exs., Jungle at Golabari village, 3 kms. from Forest Bungalow, Teliamura, 8.2.89–(Coll. H.P. Mookherjee & S.C. Mitra) ;
- (iii) North Tripura district : 2 exs., Base of a wood apple tree at Baulia basti, 3 kms., from Forest Rest house, Ambassa, 14.2.89.
- (iv) 2 exs. Jungle at Jagannathpur, 2 kms. off Ambassa, 5.2.89–(Coll. H.P. Mookherjee & S.C. Mitra) ;
- (v) 2 exs., Baruakandi, Dharmanagar, 17.12.89 –(Coll. Y. P. Sinha).

Measurements (in mm.) :

Length	Diameter	Height of aperture
24.15–36.50	29.0–46.30	15.70–21.80

Diagnosis : Shell whitish, depressedly conoid with a pointed apex ; whorls 6, rather flattened above (in young shells whorls are angulate) ; sculpture consists of coarse spiral lines, crisscrossed by prominent growth markings ; aperture oblique, round, large ; peristome reddish pink.

Distribution : India : Tripura (North & West Tripura).

Elsewhere : Myanmar.

Remarks : The typical form of the species, which is of larger size, has a wider distribution starting from Myanmar, Malaya Peninsula and extending to Andhra Pradesh and Tamil nadu in India. This variety, hitherto known from Myanmar only is now for the first time recorded from India.

Genus *Pterocyclus* Benson, 1832

1832. *Pterocyclus* Benson, *J. Asiat. Soc. Beng.*, 2 : 11.
 1921. *Pterocyclus* : Gude, *Fauna Brit. India*, Mollusca, 3 : 97.

Pterocyclus parvus (Pearson)

1833. *Spiraculum parvus* Pearson, *J. Asiat. Soc. Beng.*, 2 : 592, pl. 20, fig. 7.
 1990. *Pterocyclus parvus* : Mitra & Dey, *Rec. zool. Surv. India*, 86 (1) : 52, pl. 5, figs. 1 & 2.

Material examined :

- (i) West Tripura district : 2 ex., under soil and on leaves of trees near Toy Train line, Sepahijala Wild Life Sanctuary, 20.11.90,
- (ii) 3 exs., from a stream near Lake, Sepahijala Wild Life Sanctuary, 20.11.90,
- (iii) 2 exs., from a nullah, Sepahijala Wild life Sanctuary, 20.11.90.
- (iv) 2 exs., Matinagar Reserve Forest, 10 kms. N. of Sonamura, 25.11.90 ;
- (v) North Tripura district : 1 ex., Jungle, E. of Forest Rest House, Ambassa, 12.2.89–(Coll. H.P. Mookherjee & S.C. Mitra) ;
- (vi) South Tripura district : 4 exs., Deer Park, Patichhari Reserve Forest, 7 kms. S. of Paratia, 28.11.90 ;
- (vii) 1 ex., from a tilla inside forest of Trishna Wild Life Sanctuary, 2.12.90–(Coll. H.P. Mookherjee & S. Barua)

Measurements (in mm.) :

Height	Diameter	Height of aperture
4.20–6.25	11.60–13.30	4.25–4.80

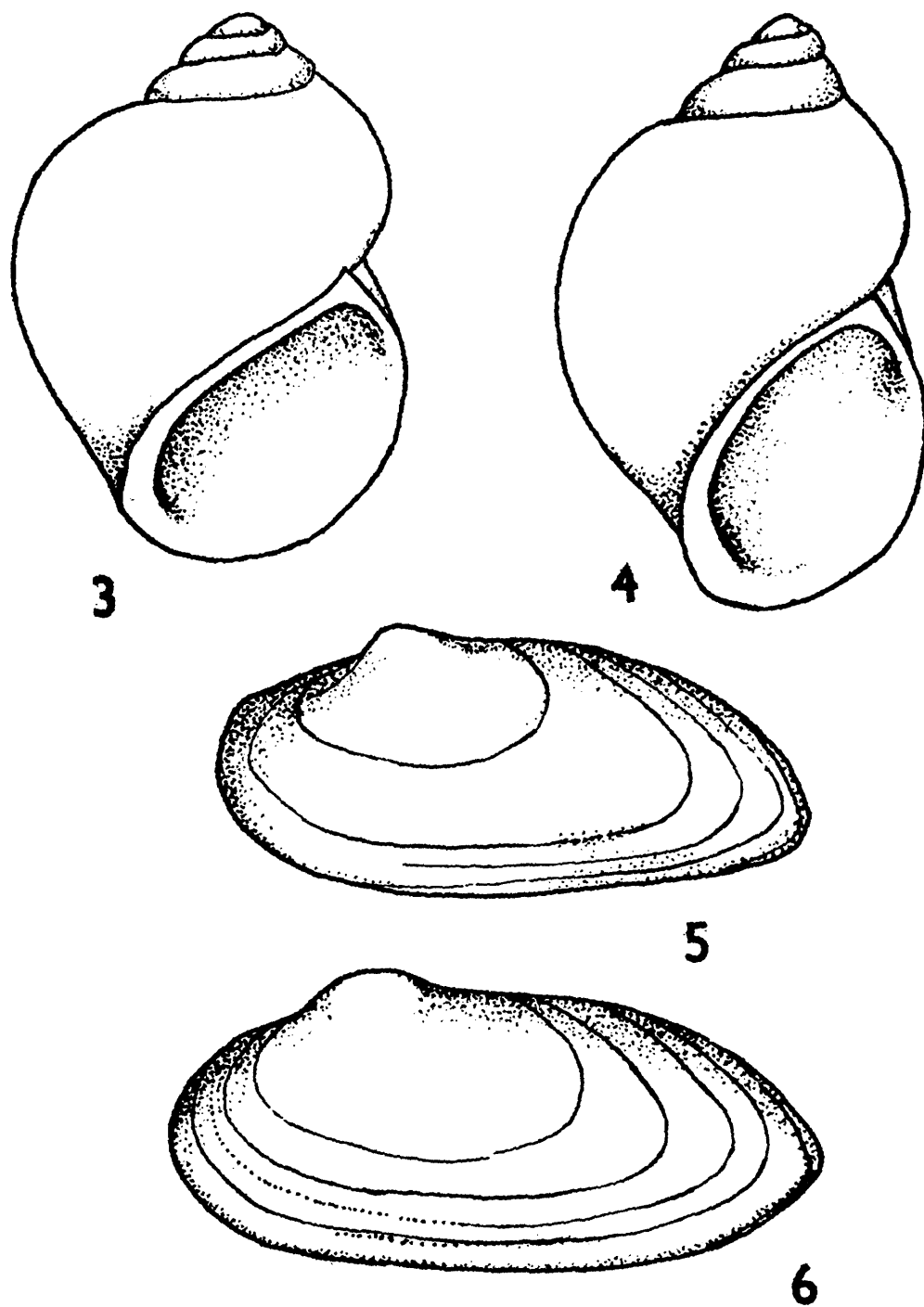
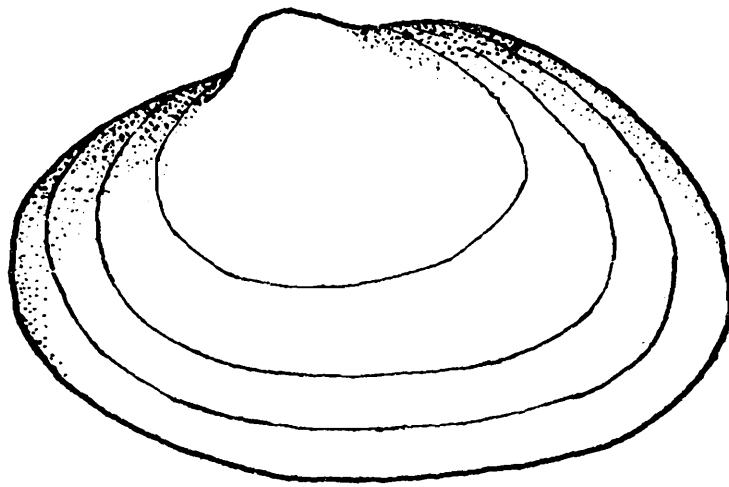
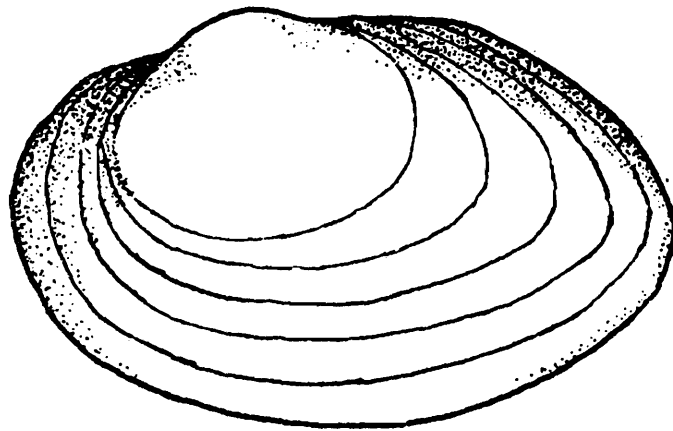


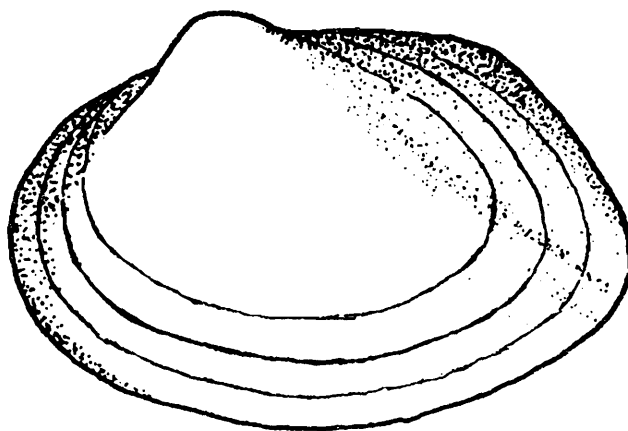
Fig. 3. *Paludomus* (*P.*) *conica kopiliensis* (25.6 x 17.9 mm) 4. *Paludomus* (*P.*) *conica* (30.6 x 20.0 mm) 5. *Parreysia* (*Radiatula*) *pachysoma* (45.9 x 20.8 mm) 6. *Parreysia* (*Radiatula*) *caerulea gaudichaudi* (46.15 x 21.9 mm).



7



8



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Fig. 7. *Parreysia (P.) favidens* var. *Plagiosoma* (51.0 x 35.0 mm) 8. *Parreysia (P.) favidens* var. *marcens* (55.2 x 37.15 mm)
9. *Parreysia (P.) favidens* var. *assamensis* (46.15 x 31.15 mm).

Diagnosis : Shell brown with dark zig-zag markings, depressed, openly umbilicate with a scarcely raised spire, Whorls 4 1/2, suture impressed, body whorl descending near the aperture; peristome double, thickened and reflected. A sinus like opening appearing as an incomplete tube formed by an interruption in the peristome, present.

Distribution : India : Tripura (North & West Tripura). Arunachal Pradesh, Assam, Meghalaya, Mizoram, Nagaland.

Order STYLOMMATOPHORA

Family ENIDAE

Genus *Rachis* Albers, 1850

1850. *Rachis* Albers, *Die Heliceen*, 182

Mostly arboreal in habit. Represented by a single species.

Rachis bengalensis (Lamarck)

1822. *Bulinus bengalensis* Lamarck, *Hist. nat. Anim. sans. Vert.*, 6(2) : 124.

1914. *Rachisellus bengalensis* : Gude, *Fauna Brit. India, Mollusca*, 2 : 273.

Material examined :

North Tripura district : 5 exs., from the wooden and bamboo structures of ceiling of Forest Rest House, Kailasahar, 18.2.89—(Coll. H.P. Mookherjee & S.C. Mitra).

Measurements (in mm.) :

Length	Diameter	Height of aperture
12.70–20.20	7.90–9.90	6.95–9.60

Diagnosis : Shell ovate, thin, openly perforate, whorls 6 with flattened surface (shape of the shell resembles that of the marine gastropod species *Littorina melanostoma*); 2–3 chocolate bands present encircling the whole length of the shell.

Distribution : India : Tripura (North Tripura), Maharashtra, Orissa, West Bengal.

Elsewhere : Bangladesh, Myanmar.

Remarks : It is arboreal in habit and is commonly found attached to stems and leaves of shrubs. The present material, collected in aestivating condition were found attached to the bamboo and wooden structures of the ceiling, at a height of about 4 meters above the ground,

Family SUCCINEIDAE

Genus *Succinea* Draparnaud, 1801

1801. *Succinea* Draparnaud, *Tabl. Moll. Terr. Fluv. France*, p. 55.

1914. *Succinea* : Gude, *Fauna Brit. India, Mollusca*, 2 : 445.

Amphibious. Mostly occurs in moist conditions. Represented by a single species.

Succinea daucina Pfeiffer

1854. *Succinea daucina* Pfeiffer, *Proc. zool. Soc. Lond.* p. 298.

1914. *Succinea daucina* : Gude, *Fauna Brit. India, Mollusca*, 2 : 413.

Material examined :

South Tripura district : 2 exs., In a moist shady place, under a decaying bananan plant, Ampinagar, 10.2.89—(Coll. H.P. Mookherjee & S.C. Mitra).

Measurements (in mm.) :

Length	Diameter	Height of aperture
3.60–6.05	2.0–3.60	2.70–3.70

Diagnosis : Shell ovately conical, finely striate, whorls 3, body whorl large equalling 2/3 of the shell length; columella curved; aperture oblique, large, oval; peristome simple.

Distribution : India : Tripura (South Tripura), West Bengal.

Family SUBULINIDAE

Subfamily OPEATINAE

Genus *Lamellaxis* Strebel & Pfeiffer, 1882

1882. *Lamellaxis* Strebel & Pfeiffer, *Beitr. Mexik Land U siissw Conch.*, 5 : 109.

1991. *Lamellaxis* : Subba Rao & Mitra, *Rec. zool. Surv. India*, Occ. paper No. 126 ; 42.

***Lamellaxis gracile* (Hutton)**

1834. No. 5, *Bulimus* Hutton, *J. Asiat. Soc. Beng.*, 3 : 84, 93.
1914. *Opeas gracile* : Gude, *Fauna Brit. India*, Mollusca, 2 : 365.
1989. *Lamellaxis gracile* : Subba Rao, Thakur & Mitra, *Fauna of Orissa, State Fauna Series-1*, Mollusca (Terrestrial), p. 26, fig. 2c.

Material examined :

- (i) West Tripura district : 1 ex., Khowai, 2.2.71-(Coll. V.C. Agarwal) ;
- (ii) 4 exs., Along the base of wall, garden of forest Bungalow, Teliamura, 9.2.89-(Coll. H.P. Mookherjee & S.C. Mitra) ;
- (iii) 7 exs., From a stream near Lake, Sepahijala Wild Life Sanctuary, 20.11.90,
- (iv) 1 ex., Forest Rest House Compound (below boulder), Sonamura, 23.11.90,
- (v) 2 exs., Akashmani Plantation area behind Rajbhavan, Agartala, 4.12.90-(Coll. H.P. Mookherjee & S. Barua) ;
- (vi) North Tripura district : 3 exs., From the garden in front of Forest Rest House, Ambassa, 15.2.89.
- (vii) 2 exs., Along the fence of the garden in front of Forest Rest House, Kailasahar, 18.2.89,
- (viii) 1 ex., Along the fence of the garden in front of Forest Rest House, Dharmanagar, 26.2.89-(Coll. H.P. Mookherjee & S.C. Mitra) ;
- (ix) South Tripura district : 2 exs., Kanchanpur, 15.2.71-(Coll. V.C. Agarwal) ;
- (x) 1 ex., In a moist shady place under a decaying banana plant, Ampinagar, S. of Teliamura-(Coll. H.P. Mookherjee & S. C. Mitra) ;
- (xi) 2 exs., Forest in front of Paratia Forest Rest House, 29.11.90
- (xii) 7 exs., Stn. No. 38, Forest Rest House garden, Trishna Wild Life Sanctuary, Rajnagar, 2.12.90, -(Coll. H.P. Mookherjee & S. Barua).

Measurements (in mm.) :

Length	Diameter	Height of aperture
4.0-10.50	1.20-2.50	1.50-2.70

Diagnosis : Shell small, cylindrically tapering, transparently pale, whorls rounded, last whorl wide ; sutures deep and crenulate ; aperture more or less ovate, longer than broad ; peristome thin without expansion, columellar lip straight, rounded below.

Distribution : India : Tripura (North, West & South Tripura). Common throughout rest of India.

Elsewhere : Bangladesh, China, East Africa, Japan, Malaya Peninsula, Myanmar, Pakistan, Philippines, Polynesia, Sri Lanka.

Remarks : These molluscs are generally observed in free moving condition in shady parts of the gardens, flower pots, moist walls etc.

Growth rate and fecundity of this species under laboratory conditions were studied by Subba Rao et. al. (1980, 1981).

As reported by the local people, this snail feeds on leaves and twigs of plants in floricultural gardens and causes considerable damage.

Subfamily SUBULININAE

Genus *Glessula* von Martens, 1850

1860. *Glessula* von Martens. *Die Heliceen*, ed. 2 : 254.

1914. *Glessula* : Gude, *Fauna Brit. India*, Mollusca, 2 : 254.

Inhabits shady and damp places with plenty of foliage and vegetative debris.

Represented by two species.

Key to the species

- Shell smaller (seldom exceeding 5 mm. in length), purple coloured.....*G. gemma*
- Shell larger (always exceeding 5 mm. in length), straw coloured.....*G. naja*

Glessula gemma (Reeve)

1850. *Achatina gemma* (Benson Ms.) Reeve, *Conch. Icon.*, 5, *Achatina*, pl. 22 : sp. 123.

1909. *Glessula gemma* : Pilsbry in Tryon's *Man. Conch.*, 20 : 97 ; pl. 13, figs. 1-3.

1990. *Glessula gemma* : Mitra & Dey, *Rec. zool. Surv. India*, 86(1) : 64, pl. 5, figs. 3,6 & 10.

Material examined :

- (i) West Tripura district : 6 exs., Along the base of wall, garden at Forest Bungalow, Teliamura, 9.2.89–(Coll. H.P. Mookherjee & S.C. Mitra) ;
- (ii) 1 ex., From a nullah, Sepahijala wild Life Sanctury, 6.11.90,
- (iii) 7 exs., From near a lake, Sepahijala wild Life Sanctuary, 20.1.90,
- (iv) 7 exs., Matinagar Forest Tilla, 10 kms. N. of Sonamura, 25.11.90,
- (v) 5exs., Akashmani Plantation behind Rajbhavan, Agartala, 4.12.90–(Coll. H.P. Mookherjee & S. Barua) ;
- (vi) North Tripura district : 1 ex., from garden in front of Forest Rest House, Ambassa, 15. 2. 89–(Coll. H. P. Mookherjee & S.C. Mitra).

Measurements (in mm.) :

Length	Diameter	Height of aperture
4.50–8.0	1.90–4.0	2.50–4.0

Diagnosis : Shell ovately conical, dark purple coloured, smooth, shining, whorls 6, rounded ; columella arched and truncate ; aperture rounded.

Distribution : India : Tripura (West & North, Tripura), Bihar, Kerala, Maharshttra, Meghalaya, West Bengal.

Elsewhere : Bangladesh, Myanmar.

Glessula naja Pilsbry

1909. *Glessula naja* Pilsbry, in Tryon's *Man, Conch.*, 20 : 90, pl. 12, fig. 10.

1914. *Glessula naja* : Gude, *Fauna Brit. India, Mollusca*, 2 : 426.

Material examined :

- (i) West Tripura district : 7 exs., base of jackfruit tree, Revenue Bungalow, Khowai, 30 kms. N. of Teliamura, 9.2.89–(Coll. H.P. Mookherjee & S.C. Mitra) ;
- (ii) 6 exs., From inside sepahijala Wild Life Sanctuary, 20.11.90,
- (iii) 5 exs., Matinagar Reserve Forest, 10 kms. N. of Sonamura, 25.11.90–(Coll. H.P. Mookherjee & S. Barua) ;
- (iv) North Tripura district : 1ex., Jungle, E. of Forest Rest House, Ambassa, 12.2.89,
- (v) 1ex., under dried leaves in a garden beyond Padmapur village, Dharmanagar, 24.2.89–(Coll. H.P. Mookherjee & S.C. Mitra) ;
- (vi) South Tripura district : 11exs. Patichhari Deer park, 7 kms. N. of Paratia, 28.11.90,
- (vii) 2 exs., Forest in front of Paratia Forest House, 29.11.90
- (viii) 1 ex., Stn. 39, Cashew garden Plantation N. of Forest Rest house near Bangladesh border, Rajnagar, 1.12.90,
- (ix) 2 exs., paddy field below tilla of Rajnagar, 1.12.90–(Coll. H.P. Mookherjee & S. Barua).

Measurements (in mm.) :

Length	Diameter	Height of aperture
14.0–20.0	5.1–6.75	4.75–6.0

Diagnosis : Shell narrowly turreted, yellowish in colour, sculptured with vertical grooves and very fine microscopic striae ; apex obtuse, whorls 9–10, fairly rounded, contracted near the apex, aperture suboblique, outer lip thin.

Distribution : India : Tripura (West, North & South Tripura). Assam.

Remarks : This species is closely related to *G. tenuispira* and its allies.

Family ACHATINIDAE

Genus *Achatina* Lamarck, 1799

1799. *Achatina* Lamarck, *Mem. Soc. Hist. nat. Paris*, 7 : 75.
1991. *Achatina* : Subba Rao & Mitra, *Rec. zool. Surv. India*, Occ. paper, 126 : 39.

Achatina (Lissachatina) fulica fulica (Bowdich)

1822. *Achatina fulica* 'Lamarck' Bowdich, *Elements of Conchology* ; 1. pl. 13, fig. 3.
1950. *Achatina (Lissachatina) fulica fulica* : Bequart, *Bull. Mus. Comp. zool., Harvard*, 105(1) : 216, pl. 8.
1989. *Achatina (Lissachatina) fulica fulica* : Subba Rao, Thakur & Mitra, *Fauna of Orissa, State Fauna Series* No. 1, 261, fig. 3, A & B.

Material examined :

- (i) West Tripura district : 1 ex., Garden at Bramhachhara, 2 kms. from Forest bungalow, Teliamura, 6.2.89,
- (ii) 7 exs., Among heaps of fallen leaves, garden inside Rest House, Teliamura, 6.2.89—(Coll. H.P. Mookherjee & S.C. Mitra) ;
- (iii) 1 ex., Kukichhara, 13.6.88,
- (iv) 1 ex., Pecharthal, 17.6.88—(Coll. V.T. Darlong & Party) ;
- (v) 1 ex., Baruakandi, Dharmanagar, 17.12.89—(Coll. Y.P. Sinha);
- (vi) South Tripura district : 2 exs., Kanchanpur, 13.2.71—(Coll. V.C. Agarwal).

Measurements (in mm.) :

Length	Diameter	Height of aperture
52.25–91.70	29.4–54.2	24.3–43.5

Diagnosis : Shell large, ovately conoid, pale yellowish to withish with brown streaks all over, whorls 8, rapidly increasing in width ; body whorl

large and inflated ; sutures deep with short spiral striae just below ; columella arched and truncate below.

Distribution : India : Tripura (North & West Tripura), Common throughout rest of India.

Elsewhere : Madagascar, Mauritius, Seychelles, Singapore, Zanzibar.

Remarks : This is a known agri-horticultural pest taking a serious proportion particularly in eastern region of the country. All the agricultural gardens were highly infested with this snails. Sometimes these are found to climb up high walls or tree trunks of betel nut up to a height of about 2½ meters. Since these are nocturnal in habit during day time for resting also they climb upto a certain height.

Family STREPTAXIDAE

Genus *Gulella* Pfeiffer, 1856

1856. *Gulella* Pfeiffer, *Malak Bl.*, 2 : 173.
1991. *Gulella* : Subba Rao, & Mitra, *Rec. zool. Surv. India*, Occ. paper No. 126 : 73.

Gulella (Huttonella) biclor (Hutton)

1834. *Pupa biclor* Hutton, *J. Asiat. Soc. Beng.*, 3 : 86 & 93.
1970. *Huttonella bicolor* : Dance, *J. Conch.*, 27 : 153.
1991. *Gulella (Huttonella) bicolor* : Subba Rao & Mitra, *Rec. zool. Surv. India*. Occ. paper No. 126 : 73, pl. 5, fig. 2.

Material examined :

- (i) West Tripura district : 2 exs., Forest Rest house garden, Sepahijala Wild Life Sanctuary, 20.11.90,
- (ii) 4 exs., Rest House garden, Forest Range, Sonamura 23.11.90—(Coll. H.P. Mookherjee & S. Barua) ;
- (iii) North Tripura district : 1 ex., Baulia Basti, 3 kms. From Dullubari Forest Rest House, Ambassa, 14.2.89,
- (iv) 1 ex., Garden at Rest House compound, Dharmanagar, 26.2.89—(Coll. H.P. Mookherjee & S. C. Mitra).

Measurements (in mm.):

Length	Diameter	Height of aperture
6.30–6.60	1.45–1.80	1.45–1.60

Diagnosis : Shell small, slender, cylindrically turreted, imperforate, apex blunt, finely but conspicuously striate, sutures deep, crenulate; whorls 8, flatly convex; body whorl laterally compressed and distorted forming two shallow pits behind the aperture; aperture quadrate and narrowed because of 4 teeth; peristome thickened and reflected.

Distribution : India : Tripura (West & North Tripura), common throughout rest of India including Andaman and Nicobar Islands.

Elsewhere : Mascarene, Seychelles, West Indies and the whole South-east Asia.

Remarks : It is a tropical carnivorous species and is reported by several observers to prey upon *Lamellaxis* species.

It usually occurs under leaves and humus in bushes, occasionally in open or cultivated fields.

Family TROCHOMORPHIDAE

Genus *Sivella* Blanford, 1863

1863. *Sivella* Blanford, *Ann. Mag. nat. Hist.*, (3) 9 : 86.

1914. *Sivella* : Gude, *Fauna Brit. India*, Mollusca, 2 : 3.

Following Solem (1966) *Sivella* is given a generic status.

Sivella castra (Benson)

1852. *Helix castra* Benson, *Ann. Mag. nat. Hist.*, (2) 10 : 349.

1914. *Trochomorpha (Sivella) castra* : Gude, *Fauna Brit. India*, Mollusca, 2 : 3.

1990. *Sivella castra* : Mitra & Dey, *Rec. zool. Surv. India*, 86 (1) : 55, pl. 3, figs. 3 & 4.

Material examined : South Tripura district : 1 ex., in a shady moist place inside a garden, Ampinagar, 20 kms. s. of. Teliamura, 10.2.89—(Col. H. P. Mookherjee & S. C. Mitra).

Measurements (in mm.):

Height	Diameter	Height of aperture
4.15	10.30	3.10

Diagnosis : Shell thin, depressedly conoid with a short apex, widely umbilicate and rather flattened at base, acutely keeled at the periphery, strongly, obliquely striate; whorls, a little convex; sutures shallow; aperture strongly oblique and quadrate in shape.

Distribution : India : Tripura (South Tripura), Assam, Arunachal Pradesh, Meghalaya, Mizoram, Sikkim, West Bengal.

Elsewhere : Malaysia, Malaya Peninsula, Myanmar, Thailand.

Remarks : It generally occurs in the moist soil at the base of brick structures like walls, pillars etc.

Family ARIOPHANTIDAE

It is the largest Family of Indian pulmonates and is represented by four genera in Tripura. It includes the slug-like *Austenia* and *Girasia* and shelled *macrochlamys* and *Sitala*.

Key to genera

1. Shell perfectly developed, fully external, calcareous 2
Shell imperfectly developed, partly external, or internal, membranous 3
2. Shell without distinct spiral striae, much broader than high MACROCHLAMYS
Shell with distinct spiral striae, as broad as high SITALA
3. Shell partly external, ear-shaped, calcareous ..
..... AUSTENIA
Shell internal, plate-like, membranous
..... GIRASIA

Genus *Macrochlamys* Gray, 1847

1847. *Macrochlamys* Gray, *Proc. zool. soc. Lond.*, p. 169.

1991. *Macrochlamys* : Subba Rao & Mitra, *Rec. zool. Surv. India*, Occ. paper No. 126 : 53.

Key to species

1. Shell smooth, upto 10 mm. in diameter
..... *M. petasus*
Shell striate above 10 mm. in diameter 2

2. Shell with faint spiral striae.....*M. indica*Shell papillosely decussate*M. sequax****Macrochlamys indica* Godwin-Austen**1883. *Macrochlamys indica* Godwin-Austen, *Land and Freshwater Moll. India*, 1 : 97, pl. 18 figs. 1-8b.1908. *Macrochlamys indica* : Blanford & Godwin-Austen, *Fauna Brit. India, Mollusca*, P. 95, text-fig. 43.1989. *Macrochlamys indica* : Subba Rao, Thakur & Mitra, *Fauna of Orissa, State Fauna Series, I*, Mollusca (Terrestrial) ; 272, fig. 6E.**Material examined :**

- (i) West Tripura district : 1 ex., From near a nullah, Sepahijala Wild Life Sanctuary, 20.11.90,
- (ii) 2exs. By the side of a stream near Toy Train Line, Sepahijala Wild Life Sanctuary, 21.11.90—(Coll. H.P. Mookherjee & S. Barua) ;
- (iii) North Tripura district : Garden inside Forest Rest House Compound, Kailashar, 18.2.89,
- (iv) 1 ex., Garden at Govindapur, near Ramakrishna Mahavidyalaya, Kailasahar, 20.2.89,
- (v) 4exs., Garden inside Forest Rest House compound, Dharmanagar, 26.2.89—(Coll. H.P. Mookherjee & S.C. Mitra).

Measurements (in mm.) :

Height	Diameter	Height of aperture
10.0–11.13	17.85–20.70	8.0–9.55

Diagnosis : Shell conoidly depressed, with a little raised spire, perforate, pale brownish, with faint spiral striae, whorls 5–6, rounded, body whorl obsoletely subangulate at the periphery ; aperture a little oblique, broadly lunate, reflected above, columellar margin triangularly reflected.

Distribution : India : Tripura (West & North Tripura), common throughout the rest of the country except the North-Western part.

Elsewhere : Bangladesh, Sri Lanka.

***Macrochlamys sequax* (Benson)**1859. *Helix sequax* Benson *Ann. Mag. nat. Hist.*, (3) 3 : 270.1908. *Macrochlamys sequax* : Blanford & Godwin-Austen, *Fauna Brit. India, Mollusca*, p. 36.**Material examined :**

- (i) West Tripura district : 2 exs., Indranagar, 11.11.69—(Coll V.C. Agarwal).
- (ii) 1 ex., Under soil and leaves of trees near Toy Train line, Sepahijala Wild Life Sanctuary, 19.11.90—(Coll. H.P. Mookherjee & S. Barua) ;
- (iii) North Tripura district : 1 ex., Ambassa, 9.2.71—(Coll. V.C. Agarwal) ;
- (iv) 4 exs., In a shady place under a decaying plantain tree, Ampinagar, 10.2.89—(Coll. H.P. Mookherjee & S.C. Mitra).

Measurements (in mm.) :

Height	Diameter	Height of aperture
5.50–7.50	12.8–15.20	5.0–6.50

Diagnosis : Shell depressed, perforate, polished, finely decussate by close oblique striae and spiral lines ; whorls 5, body whorl wide ; aperture oblique, roundly lunate ; peristome thin ; columellar margin briefly reflected and almost straight.

Distribution : India : Tripura (West & North Tripura), West Bengal.

***Macrochlamys petasus* (Benson)**1859. *Helix petasus* Benson, *Ann. Mag. nat. Hist.*, (3) 3 : 388.1908. *Macrochlamys petasus* : Blanford & Godwin-Austen, *Fauna Brit. India, Mollusca*, p. 115.1991. *Macrochlamys petasus* : Mitra & Dey, *Rec. zool. Surv. India*, 86(1) : 58, figs. 4 & 5.

- (i) West Tripura district : 2 exs., Matinagar Reserve Forest, 10kms. N. of Sonamura, 25.11.90—(Coll. H.P. Mookherjee & S. Barua) ;

- (ii) South Tripura district : 2 exs., paddy field at the foot of a tilla, Rajnagar, 1.12.90—(Coll. H.P. Mookherjee & S. Barua).

Measurements (in mm.) :

Height	Diameter	Height of aperture
2.50–3.60	4.75–6.70	2.0–3.10

Diagnosis : Shell depressed, perforate, polished, whorls 5–6, body whorl rounded to a little subangulate at the periphery, not much wide ; aperture widely lunate, peristome truncate with arcuate basal margin. columellar margin reflected above and oblique, yellowish in colour.

Distribution : India : Tripura (West & South Tripura), Arunchal Pradesh, Assam, Mizoram, West Bengal.

Elsewhere : Myanmar.

Genus *Sitala* H. Adams, 1865

1865. *Sitala* H. Adams, *Proc. zool. Soc. Lond.*, p. 408.
1991. *Sitala* : Subba Rao & Mitra, *Rec. zool. Surv. India*, Occ. paper No. 126 : 59.

Sitala infula (Benson)

1848. *Helix infula* Benson, *Ann. mag. nat. Hist.*, (2) 2 : 160.
1908. *Sitala infula* : Blanford & Godwin—Austen, *Fauna Brit. india. Mollusca*, p. 225, fig. 78.

Material examined : South Tripura district : Stn. 32 Forest Rest House compound, Trishna Wild Life Sanctuary, Rajnagar, 1.12.90—(Coll. H. P. Mookherjee & S. Barua).

Measurements (in mm.) :

Height	Diameter	Height of aperture
3.75–6.40	3.35–6.90	1.70–4.0

Diagnosis : Shell trochoid in shape, thin, very narrowly perforate ; surface conspicuously marked with spirally raised lines ; whorls $6\frac{1}{2}$, convex, last whorl carinate at the periphery with a swollen base ; aperture a little oblique, peristome simple, straight ; columellar margin more or less vertical and reflected.

Distribution : India : Tripura (South Tripura), Bihar, Maharashtra, Orissa, Sikkim, West Bengal.

Elsewhere : Myanmar.

Genus *Austenia* Nevill, 1878

1878. *Austenia* Nevill *Hand List Moll. Indian Mus.*, 1 : 16.
1908. *Austenia* : Blanford & Godwin—Austen, *Fauna Brit. India, Mollusca*, 191.

Austenia cacharica (Godwin—Austen)

1988. *Girasia cacharica* Godwin—Austen, *Land and Freshwater Moll. India*, 1 : 240, pl. 59, figs. 4, 4a.
1908. *Austenia cacharica* : Blanford & Godwin—Austen, *Fauna Brit. India, Mollusca*, p. 196.

Material examined : North Tripura district : 1 ex., kanchanpur, 17.6.88—(Coll. V.T. Darlong).

Measurements (in mm.) :

Height	Diameter	Height of aperture
4.25	7.85	7.50

Diagnosis : Shell fairly solid, ear-like in shape, smooth, polished ; apex depressed ; whorls $1\frac{1}{2}$, aperture ovate extending to almost the entire shell length ; columellar margin sinuate ; olivaceous in colour.

Distribution : India : Tripura (N. Tripura), Nagaland.

The present report is an southward extension of range of this species.

Genus *Girasia* Gray, 1855

1855. *Girasia* Gray, *Cat. Pulm. Brit. Mus.*, p. 61.
1908. *Girasia* : Blanford & Godwin—Austen, *Fauna Brit. India, Mollusca*, p. 198.

Girasia hookeri Gray

1855. *Girasia hookeri* Gray, *Cat. pulm. Brit. Mus.*, p. 61.
1908. *Girasia hookeri* : Blanford & Godwin—Austen, *Fauna Brit. India, Mollusca*, p. 200, fig. 70.

Material examined : West Tripura district : 2 exs., Garden in front of Forest Rest House, Sepahijala Wild Life Sanctuary—(Coll. H.P. Mookherjee & S. Barua).

Diagnosis : Shell internal, membranous, plate-like. Animal of variable colour from pale yellowish, dull gray or pale brown to dark brown with spots on the mantle ; the mantle is extended to cover a considerable portion of the animal in front.

Distribution : India : Tripura (West Tripura), Assam.

Remarks : These slug-like molluscs commonly inhabit damp shady places, vegetable debris etc.

Order SOLEOLIFERA

Family VERONICELLIDAE

Veronicellidae, the most common and widely distributed Family of land slugs, is represented by a single genus, *Laevicaulis*.

Genus *Laevicaulis* Simroth, 1913

1913. *Laevicaulis* Simroth, in Voltzkow, *Reise O Afr.* 3(3) : 147.

1914. *Laevicaulis* : Subba Rao & Mitra, *Rec. zool. Surv. India*. Occ. paper No. 126 : 36.

Living on grounds, between low vegetations, under decaying leaves, vegetable peels etc.

Laevicaulis alte (Ferussac)

1821. *Vaginulus alte* Ferussac, *Tabl. Syst. Linnaeus*, p. 14.

1979. *Laevicaulis alte* : Bishop, *Mem. Qd. Mus.*, 18 (1) : 55.

1991. *Laevicaulis alte* : Subba Rao & Mitra, *Rec. zool. Surv. India*, Occ. paper. No. 126 : 36.

Material examined :

- (i) West Tripura district : 1 ex., Charilam Forest Rest House, 25 kms. S. of Agartala—(Coll. V.C. Agarwal),
- (ii) 2 exs., Vegetable garden close to Meenakshi Hotel, Agartala, 17.11.90,
- (iii) 2 exs., on the road side to Zoo Garden, Sepahijala Wild Life Sanctuary, 19.11.90,
- (iv) 1 ex., (juvenile), Garden in front of Forest Rest House, Sepahijala Wild Life Sanctuary, 20.11.90—(Coll. H.P. Mookherjee & S. Barua) ;

- (v) North Tripura district : 1 ex., from inside soil, Kailasahar, 19.2.89—(Coll. H.P. Mookherjee & S.C. Mitra).

Measurements (in mm.) :

Length	Diameter
18.7–21.5	5.8–6.75

Diagnosis : Animal lacking a shell, elongate and linear when extended, mantle pigmented with dark brown colour, usually with a yellowish band down the middle ; foot narrow and transversely grooved.

The specimens examined are mostly young. This grows to a much bigger size.

Distribution : India : Tripura (North Tripura), Andaman & Nicobar Islands, Andhra Pradesh, Bihar, Gujarat, Maharashtra, Orissa, Pondicherry, Rajasthan, Tamilnadu, West Bengal.

Elsewhere : Australia, China, East Africa, Formosa, Hong Kong, Indonesia, Loyalti Islands, Madagascar, Malayasia, Mauritius, New Caledonia, Reunion Islands, Sri Lanka.

Remarks : Food preference, growth rate and fecundity of this species, under laboratory conditions, were investigated by Subba Rao *et al.* (1989).

These are active during March to October and feed on green vegetations and decaying organic materials, often causing damage to the garden plants.

Family CAMAENIDAE

Genus *Amphidromus* Albers, 1850

1850. *Amphidromus* Albers, *Die helieen.* p. 138.

1991. *Amphidromus* ; Subba Rao & Mitra, *Rec. zool. Surv. India*, Occ. paper No. 126 : 68.

Arboreal in habit. Represented by a single species.

Amphidromus sylheticus (Reeve)

1849. *Bulimus sylheticus* Reeve, *Conch. Icon.*, pl. 77, fig. 504.

1921. *Amphidromus sylheticus* : Gude, *Fauna Brit. India*, Mollusca 2 : 180.

1990. *Amphidromus sylheticus* : Mitra & Dey. *Rec. zool. Surv. India*, 86(1) : 63, pl. 4, figs. 3 & 4.

Material examined : North Tripura district : 2 exs., base of a wood apple tree at Baulia Basti, 3 kms. from Dull ubari Forest Rest house Ambassa, 14.2.89—(Coll. H. P. Mookherjee & S.C. Mitra).

Measurements (in mm.) :

Length	Diameter	Height of aperture
35.0	28.9	16.25

Diagnosis : Shell sinistral, perforate, ovately conical, radially striate ; whorls 5-6, convex, body whorl much swollen and sack-like at base ; aperture ovate, oblique, peristome white, reflected, a little thickened inside ; columellar margin slightly dilated at the parietal region ; greenish yellow in colour, gradually fading towards the apex and becoming white.

Distribution : India : Tripura (North Tripura), Meghalaya, Mizoram.

Elsewhere : Bangladesh.

Remarks : Godwin-Austen remarked that since the habitat of the species was 'slopes of Khasi and Garo Hills', its occurrence in sylhet, a district in the plains of lower Bengal, South of Khasi hills was unlikely (Gude, 1914). But the present material was collected from Tripura, further south of Khasi and Garo Hills, than Sylhet,

SUMMARY AND GENERAL DISCUSSION

Fortyeight species (including a few infra-specific categories) of molluscs under 29 genera and 18 families are recorded from the state of Tripura. Of these, 30 species (14 genera, 8 families) are freshwater and 18 species (15 genera, 10 families) land. It is the first report on molluscs of Tripura.

The material was collected from all the three districts. The maximum number of species (30) is recorded from West Tripura district, followed by north Tripura district (26) and South Tripura district (18).

Except five gastropods all the species of freshwater molluscs reported here are common throughout India. Four species, *Angulyagra oxytropis*, *Cipangopaludina lecythis*, *Paludomus conicus* and *P. blanfordiana* are restricted to the north-eastern region, especially Assam and Meghalaya, besides Tripura. *Pila theobaldi*, hitherto known from Myanmar (Subba Rao, 1989) was recently recorded from Meghalaya in India (Subba Rao, et. al.), and is now subsequently reproted from Tripura.

Among land molluscs, though the typical form of *Cyclophorus aurantiacus* has a much wider range of distribution, the subspecies *pernobilis* which was hitherto recorded from Myanmar, is reported for the first time form India. *Austenia cacharica* which was hitherto known from its type locality (N. Cachar Hills) only, is found to extend its range upto Tripura. Three more species, viz., *Pterocyclus parvus*, *Glessula naja* and *Amphidromus sylheticus* are restricted endemic to north east India. The remaining 13 species have all India distribution. Three of these, viz., *Lamellaxis gracile*, *Gulella bicolor* and *laevicaulis alte* have cosmopolitan distribution.

Though freshwater molluscs are quite adequately represented, collection of land forms are poor in comparison to those from other north-east Indian states. While 64 species of land operculates under 17 genera are recorded from Meghalaya (Subba Rao et. al 1995,). merely 2 species under 2 genera of land operculates could be collected from Tripura. Less habitat diversity may be one of the reasons of poor representation of land molluscs. Whereas in Meghalaya the altitude varies between approx. 500 m. (Nongpoh) to over 1900 m. (Shillong peak) the highest hill-top in Tripura is only 900 m. (Betalong Shiv). Rainfall is also much higher in Meghalaya reaching its peak at Cherrapunji (1270 cms.) against a moderate average precipitation of 200 cms. in Tripura. Moreover the humus-less sandy soil with very little water holding capacity, obviously does not offer an ideal situation for the land molluscs to thrive and flourish.

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**DISTRICT WISE DISTRIBUTION OF MOLLUSCS OF TRIPURA (BASED ON
AVAILABLE MATERIAL)**

	North Tripura district	South Tripura district	West Tripura district
Freswhater molluscs :			
<i>Bellamya bengalensis</i> f. <i>typica</i> (Lamarck)		+	++
" " f. <i>balteata</i> (Benson)	+	+	—
" " f. <i>doliaris</i> (Gould)	—	—	+
" <i>dissimilis</i> (Mueller)	—	—	+
<i>Angulyagra oxytropis</i> (Benson)	—	+	—
<i>Cipangopaludina lecythis</i> (Benson)	—	+	+
<i>Pila theobaldi</i> (Hanley)		+	++
<i>Digoniostoma cerameopoma</i> (Benson)	—	—	+
" <i>pulchella</i> (Benson)	—	—	+
<i>Thiara (Melanoides) tuberculata</i> (Mueller)	+	+	+
" (<i>Tarebia</i>) <i>lineata</i> (Gray)	+	—	+
" " <i>granifera</i> (Lamarck)	+	—	+
<i>Paludomus (P.) conica</i> (Gray)	+	+	+
" " "var. <i>kopiliensis</i> Nevill	—	+	—
" " <i>blanfordiana</i> Nevill	—	+	—
<i>Brotia costula</i> (Rafinesque)	+	+	—
<i>Lymnaea acuminata</i> f. <i>typica</i> lamarck	—	+	—
" " f. <i>rufescens</i> Gray	—	—	+
" <i>luteola</i> f. <i>typica</i> lamarck	—	+	—
" " f. <i>australis</i> Annandale & Rao	+	+	+
<i>Gyraulus labiatus</i> (Benson)			
<i>Gyraulus convexiusculus</i> (Hutton)	—	—	+
<i>Indoplanorbis exustus</i> (Deshayes)	+	+	+

	North Tripura district	South Tripura district	West Tripura district
<i>Segmentina (Polypylis) calatha</i> (Benson)	+	—	—
<i>Lamellidens marginalis</i> (Lamarck)	+	+	+
<i>Parreysia (P.) favidens assamensis</i> Preston	—	—	+
" " " <i>marcens</i> (Benson)	+	—	—
" " " <i>plagiosoma</i> (Benson)	—	—	+
" (<i>Radiatula</i>) <i>pachysoma</i> (Benson)	+	+	+
" " <i>caerulea gaudichaudi</i> (Eydoux)	+	—	+
Land molluscs :			
<i>Cyclophorus aurantiacus pernobilis</i> (Gould)	+	—	+
<i>Pterocyclus purvus</i> (Pearson)	+	—	+
<i>Rachis bengalensis</i> (Lamarck)	+	—	—
<i>Succinea daucina</i> Pfeiffer	—	+	—
<i>Lamellaxis gracile</i> (Hutton)	+	+	+
<i>Glessula gemma</i> (Benson)	+	—	+
" <i>naja pilsbry</i>	+	+	+
<i>Achatina fulica fulica</i> (Bowdich)	+	+	+
<i>Gulella bicolor</i> (Hutton)	+	—	+
<i>Sivella castra</i> (Benson)	—	+	—
<i>Macrochlamys indica</i> Godwin-Austen	+	—	+
" <i>sequax</i> (Benson)	+	—	+
" <i>petasus</i> (Benson)	—	+	+
<i>Sitala infula</i> (Benson)	—	+	—
<i>Austenia cacharica</i> (Godwin-Austen)	+	—	—
<i>Girasia hookeri</i> Gray	—	—	+
<i>Laevicaulis alte</i> (Ferussac)	+	—	—
<i>Amphidromus sylheticus</i> (Reeve)	+	—	—

MAP OF TRIPURA

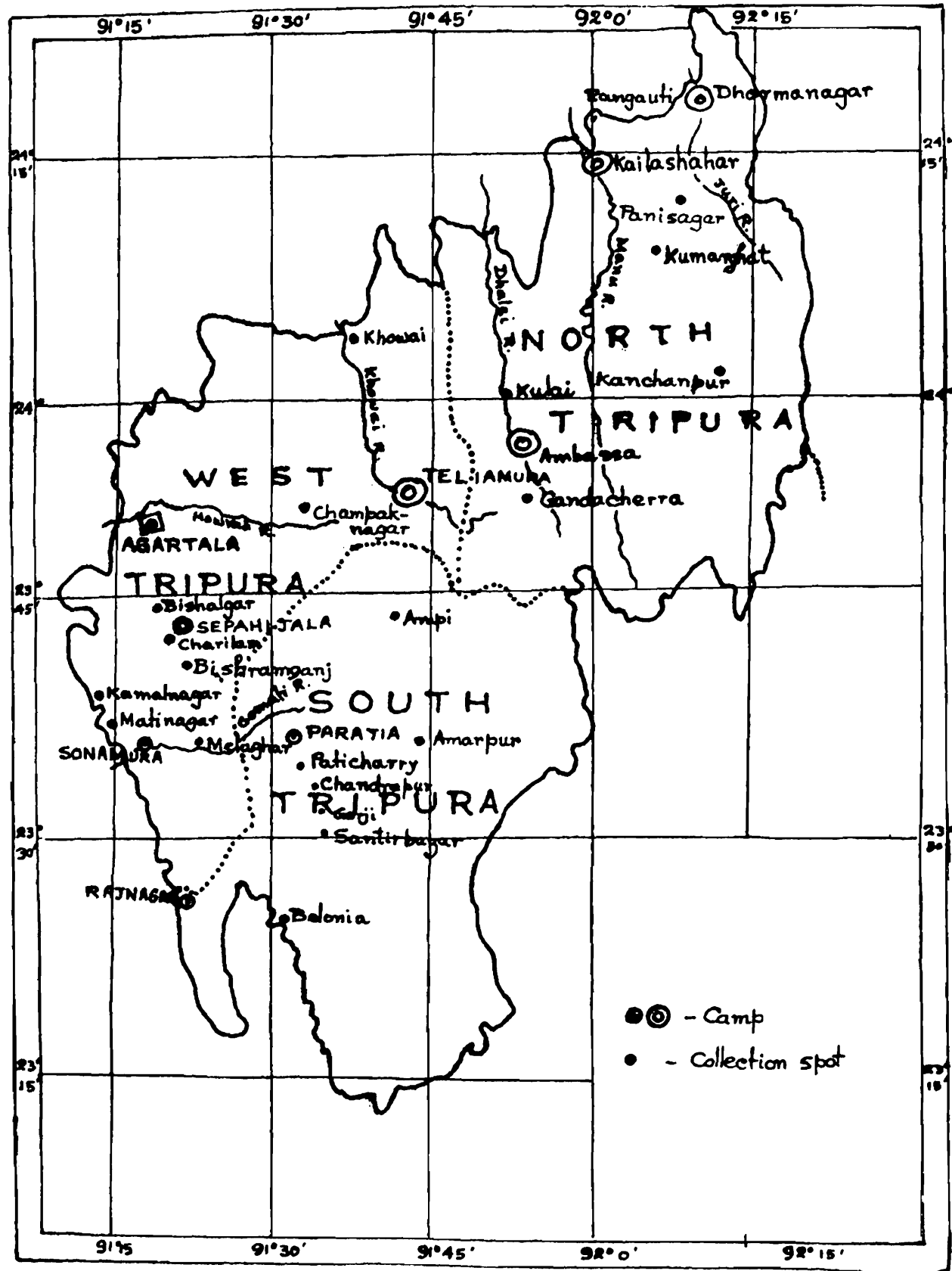


Plate I

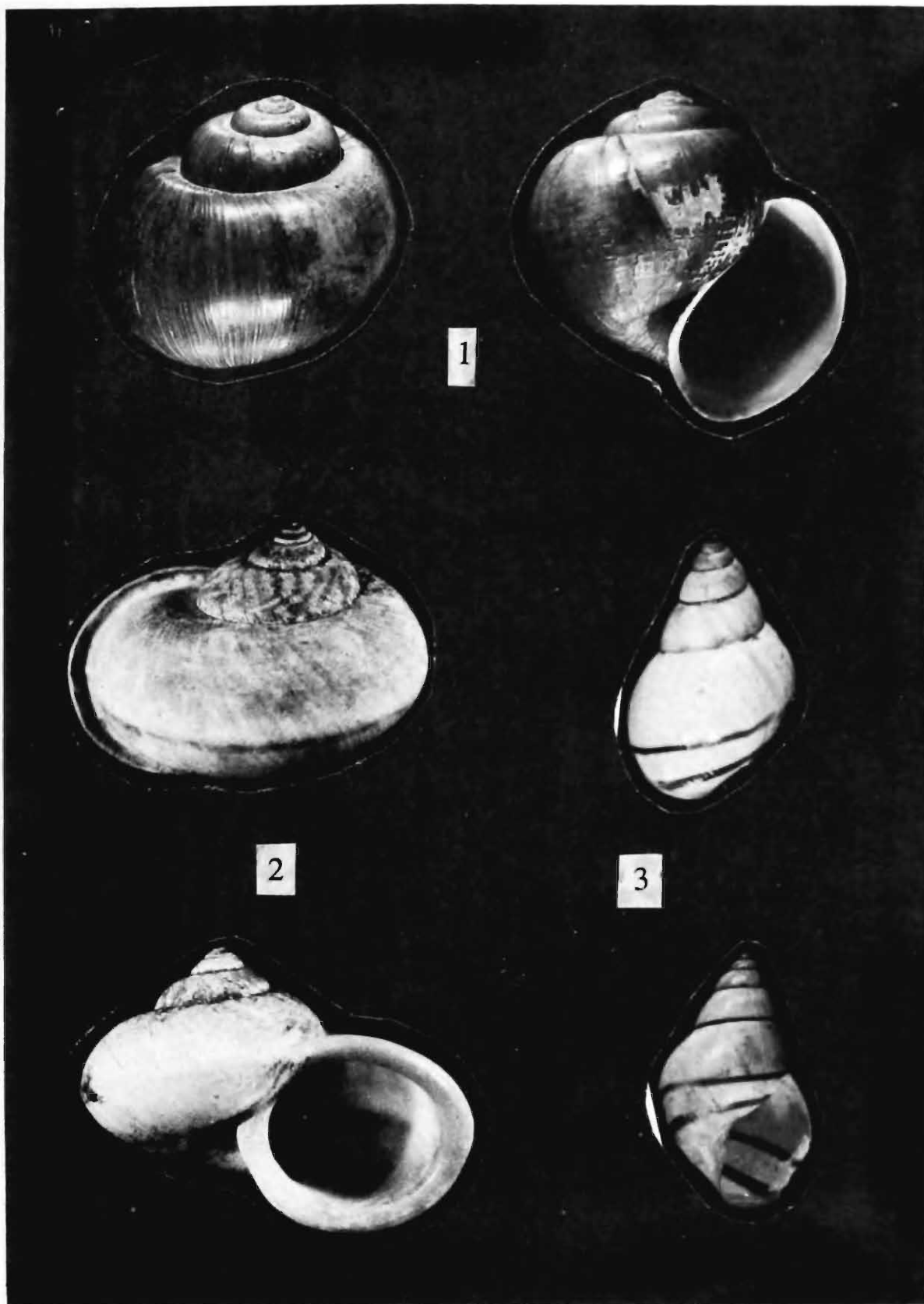


Fig. 1. *Pila theobaldi* (Hanley) (Dorsal & ventral)

Fig. 2. *Cyclophorus aurantiacus* sub sp. *pernobilis* (Gould) (Dorsal & ventral)

Fig. 3. *Rachis bengalensis* (Lamarck) (Dorsal & ventral)

Plate II

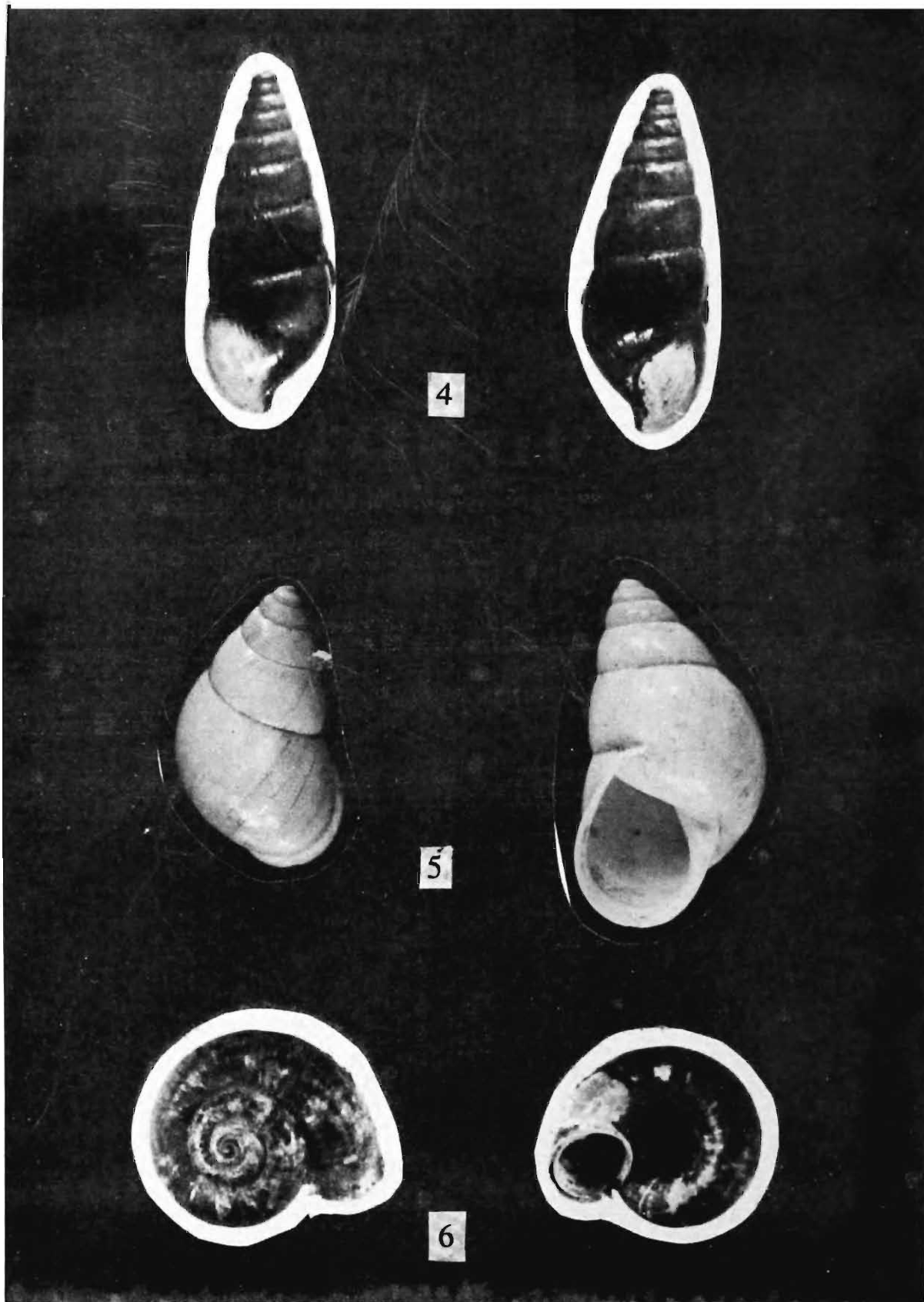


Fig. 4. *Glessula naja* Pilsbry (Dorsal & ventral)

Fig. 5. *Amphidromus sylheticus* (Reeve) (Dorsal & ventral)

Fig. 6. *Pterocyclus parvus* (Pearson) (Dorsal & ventral)