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Dr. J. R. B. ALFRED
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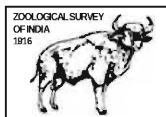
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Dr. J. R. B. ALFRED
Director
Zoological Survey of India



Rec. zool. Surv. India, **106** (Part-1) : 1-10, 2006

RHESUS MONKEY *MACACA MULATTA* IN THREE NORTHERN DISTRICTS OF WEST BENGAL, INDIA

S. CHAUDHURI, A. MURMU, P. C. MAZUMDAR AND J. R. B. ALFRED

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

INTRODUCTION

Among all other macaques in India, rhesus monkey (*Macaca mulatta*) is the most common monkey and occupied an important role in the cultural and traditional aspects of the country. It inhabits in diverse habitats from dense forests, mountains to open lands and near human settlements. The range of distribution of rhesus macaque and hanuman langur is very interesting. Hanuman langur (*Semnopithecus entellus*) is distributed throughout India except northeastern India while rhesus macaque occurs in all habitats of India. In southern Indian states, it is replaced by other two species viz. Bonnet macaque (*Macaca radiata*) and lion tailed macaque (*Macaca silenus*).

Studies on rhesus monkey were in carried out by a number of workers in West Bengal; Southwick *et al.*, (1964) surveyed in the road sides between Contai and Kakdwip in the south, from Bankura to Asansol in the west and Darjeeling district in the north. Mandal (1964) reported the behaviour of rhesus monkeys in the Sundarbans; Mukherjee and Gupta (1965) recorded on the habits of this species at Sundarbans. Khajuria (1966) published a brief account of the distribution of Assamese macaque found in certain parts of Darjeeling district, West Bengal. Mukherjee *et al.*, (1995) conducted a survey of Darjeeling district on the distribution, abundance of Rhesus and Assamese macaques.

This paper deals with the distribution, abundance and social composition of *Macaca mulatta* in three northern districts of West Bengal, India, viz. Darjeeling, Jalpaiguri and Coochbehar (Fig. 1). Field surveys carried out in 1997 at Darjeeling district and in 1998 at Jalpaiguri and Coochbehar districts. In West Bengal now the rhesus monkeys inhabit only in the north Bengal and in Sundarbans. So, these three northern most districts are taken up to find out their population trend.

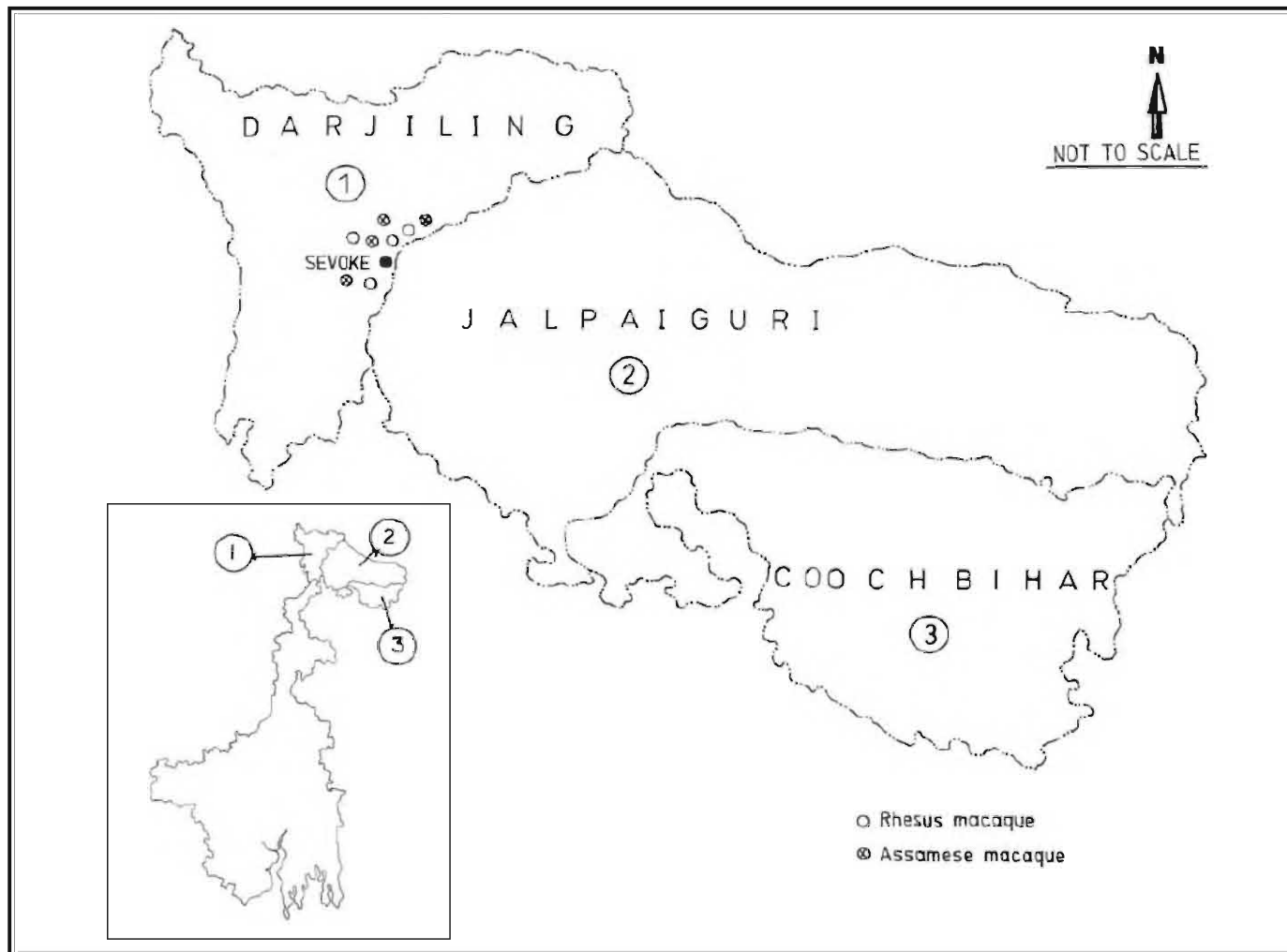


Fig. 1. : Map showing three study districts of North Bengal.

ECOLOGY OF THE STUDY AREAS

The Darjeeling district lies between 87°56'–88°2' E and 26°33'–27°13' N with an area of 3148 sq. km. The mean temperature varies from 18.5°–34°C (max) and 1.6°–8.5°C (min) with an average annual rain fall of about 2600–3000 mm. The major part of the district falls on Sub-Himalayan region, extended over an elevation of 50 m to 3800 m. About 20% of the total area are dense forests and 11% open forests. The detail ecology of the district was discussed elsewhere (Murmu *et al.*, 2004).

Jalpaiguri has an area of 6226 sq. km and it lies in the moist tropical zone. The average day temperature varies from 15.5°C to 32°C, depending upon the season. The effect of the south-east monsoon is marked by the onset of rain in the latter part May. The average annual rainfall varies from 4100–5100 mm. The main rivers of the district are Rydak, Jaldhaka, Torsa, Kaljini and Dhawis. The forests do not form a continuous belt, however, some well known forests such as Gorumama Wildlife Sanctuary, Chapramari Wildlife Sanctuary, Jaldapara Wildlife Sanctuary and Buxa Tiger Reserve are situated in this district. These forests lie on the elevated plateau of the rivers and in the flat plains. The total forested area is 23.5%, out of which 13.26% dense forests, 5.9% open forests and 4.37% plantation with a total area of 1465 sq. km. The Sal forest, which is most important from the economical and ecological point, extends over large parts of the plains and foothills. The bulk of the forest is situated in the Bhabar and Terai areas at the foothills with a general inclination from north to south.

The district Coochbehar geographically forms part of the Himalayan terai and lies between latitudes 25°87'–26°32' N and 88°47'–89°54' E longitudes. This district is almost plain land, which is intersected by numerous rivers such as Torsa, Jaldhaka, Kaljini, Gadadhar and Rydak. These rivers flow from northwesterly to southeasterly direction.

The mean temperature in the coldest months of January is 10.4°C and the mean maximum is 24.1°C. The average annual rainfall is 3200 mm. The total geographical area of the district is 3388 sq. km of which 37.1 sq. km is under forests and it is only 1.09% of the total area of the district.

METHOD

The survey was conducted on roadsides and forested areas. The roadside surveys were made from a slow moving vehicle with four observers, while the forest roads and trails were surveyed both on foot and on vehicle. Transect and point methods were applied to locate the monkeys. The transect method in the forest path was accomplished by slow walking and waiting for 5–6 minutes in every 200 m for visual and auditory signals of the presence of monkeys (Southwick *et al.*, 1961). The point method was adopted in Darjeeling district where the range of elevation was

200 m and above. The surveys conducted mainly in the forenoon (0700–1100 hr) and afternoon (1500–1800 hr) in summer and during the whole day in winter. A total of 300 hours were spent for census work. On locating the groups notes on their social composition, habitat and human interaction, were recorded. The individuals of the group were classified as adult males, adult females, juveniles and infants. The juveniles were those more than one year or less than three years old and infants were those carried by mothers, pre-weaned and less than one year old.

RESULTS

Darjeeling

21 groups of rhesus macaques were recorded in about 1200 km² survey. The 21 groups contained 402 monkeys of which 55 were adult males, 215 were adult females, 78 were juveniles and 55 infants. The group size varied from 2 to 38 excluding one temple group consisting of 72 monkeys (Table 1). The percentage compositions of 402 monkeys were 13.6% adult males, 53.5% adult females, 19.5% juveniles and 13.4% infants. The ratio of adult male to adult females was 1 : 3.9. The ratio of females to infants was 1 : 0.2 and ratio of sub-adults was 1 : 0.6. About 25.1% females having infants.

Habitat analysis revealed that rhesus of Darjeeling was harbouring in two main categories, roadsides and forests. Four groups were recorded in the forest consisting of 49 monkeys and 16 groups were found in roadsides with a total of 281 monkeys. One temple group was found in Darjeeling town containing 72 monkeys at an altitude of 2120 m. and it was the highest elevation where rhesus was found in the district.

Mukherjee *et al.*, (1995) recorded 11 groups of rhesus macaque with a total of 188 monkeys at Darjeeling. Out of which 23 were adult males, 97 were adult females, 34 each were juveniles and infants. So, there was a considerable increase in number of groups and total number of monkeys in all categories, but decrease in the percentage of infants from 18.1% to 13.4% and also marginal fall in female-subadult ratio. The comparative figure of both the surveys are given in Table 2.

The other species of monkey inhabiting at Darjeeling is Assamese macaque (*Macaca assamensis*). Mukherjee *et al.*, (1995) observed that Assamese macaque were more in relatively upper elevation whereas the rhesus inhabited in lower elevations. During the present survey a shift in their habitat preference was observed as the rhesus monkeys were approaching the upper ridges along roadside in this district.

Jalpaiguri

The monkeys that were encountered in the district from 2000 km² were all forest dwelling groups. 24 groups with a total of 318 monkeys were recorded. The social composition of monkeys

were 54 adult males, 150 adult females, 63 were juveniles and 51 infants. The group size varied from 2 to 45 individuals with an average of 13.25 ± 2.3 monkeys (Table 3). Adult males to adult females ratio was 1 : 2.77, adult females to juveniles and infants were 1 : 0.42 and 1 : 0.34 respectively. The percentage composition of the groups was 17% males, 47.2% females, 19.8% juveniles and 16% infants. The ratio of infants to adult females was quite less and 10 groups had no infants at all. 34% of females were carrying infants.

Extrapolation of rhesus macaque population distributed in the forested habitat of Jalpaiguri district provides an estimate of 0.04 groups/km² consisting of 0.53 monkeys/km² in the surveyed areas. The village and roadside monkeys were not encountered during the present survey. The forests of Jalpaiguri provide food and ideal shelter for monkeys as compared to other districts of West Bengal, where the bulk of primate population inhabits in the villages. The major food trees are *Terminalia belerica*, *T. cerenulata*, *Schima wallichii*, *Sterculia villosa*, *Michelia champaca*, *Amoora rohituka*, *Lagerstroemia parviflora*, *Michelia excelsa*, *Gmelina arborea* and numerous shrubs and herbs. This district is still retaining viable tropical rainforests in West Bengal.

Coochbehar

Only 3 groups of rhesus macaque were recorded totaling of 27 monkeys from an area of 1500 km² at Coochbehar (Table 4). These three forest groups inhabited exclusively in close proximity to each other in the eastern fringe of the district (Atiamochar range). Local inquiries also revealed that there were no monkeys in other parts of the district.

DISCUSSION

The present analysis indicates that amongst three surveyed districts, the rhesus population is more in Darjeeling district though the number of groups is more in Jalpaiguri district (Fig. 1). Mukherjee *et al.*, (1995) recorded 11 groups of rhesus macaque with a total of 188 monkeys in 1985 census. Out of these 11 groups, 3 were recorded in forests at Sevoke, 1 in Gorubathan forest (eastern side of the Darjeeling bordering Jalpaiguri) and the remaining groups were located in the roadside. During the survey it was found that Gorumara group was lost and the forest have become more open. In 1985 census 437 linear km. surveyed showed one rhesus group in every 39.7 km. at Darjeeling whereas during the present survey of 543 linear km. revealed one group in every 25.8 km. and 1 group/57 km². Though arithmetically the figure showed one group in every 25.8 linear km. when the groups are extrapolated in the total surveyed areas to monkey population in general, but the rhesus was concentrated in a very limited area of Darjeeling district mainly roadside forests.

Southwick *et al.*, (1964) recorded 6 groups of rhesus monkey in 120 miles of forest road survey, *i.e.*, one group in every 20 miles (32 km.) in northern Bengal. Southwick *et al.*, (1964)

opined that the accurate comparison couldn't be made with the estimated made during 1962, as the area was full of forests.

Population estimation for last 12 years indicates an increasing trend at lower elevation but a few groups are also observed in the higher elevation. Murmu *et al.*, (2004) also recorded that rhesus inhabiting in lower elevation (150–500 m) at Darjeeling. There is another monkey species at Darjeeling, the Assamese macaque (*Macaca assamensis*). The Assamese macaque is now restricted in its distribution at Darjeeling and at Gorumara wildlife sanctuary of Jalpaiguri district, West Bengal (Murmu *et al.*, 2004), while the rhesus macaques are found in all three districts. In the past Assamese macaque had a sizeable population at Jalpaiguri but due to invasion of highly adaptive species of rhesus macaque in the territory of Assamese macaque it was wiped out from other area and restricted in few pockets at Gorumara WLS. At Sevoke-Bagrakote road (Fig. 1) in the foothills these two species are harbouring in the same area but their home range did not overlap. Provision food is another factor for concentration of monkey's in roadsides. All the roadside groups are partially provisioned and the foodstuffs are offered by the commuters of the road mostly Bus or Truck drivers.

The rhesus population of Jalpaiguri district is restricted in the forest habitat. 318 monkeys in 24 groups were recorded in a large area of the forest. Further, the forest rhesus are very shy and it was not possible to count 3–4 groups during the field survey, hence these groups are not included in this report. Food is one of the important limiting factor in the distribution of animals. The rhesus macaques are predominantly ground feeder and they utilize mainly seeds and fruit including herbs, shrubs and leaves. The majority forests of the present Jalpaiguri having monoculture plantation and this not much suitable for primates.

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Table 1. : Distribution and social composition of Rhesus macaque at Darjeeling district.

Sl. No.	Location of group	Total	Males	Females	Juveniles	Infants
1.	Sukna forest, 1 km from Sukna Range office in Mahananda Wildlife Sanctuary	2	1	1	–	–
2.	Sukna forest	21	2	12	4	3
3.	Sukna forest	17	3	10	3	1
4.	2 km north of Rongton near Chunabhati	23	3	13	4	3
5.	5 km north of Sukna between Sukna and Tindharia	11	1	5	2	3
6.	7 km north of Sukna to Tindharia (60 km Milepost near falls)	4	1	3	–	–
7.	Garidhura (Range Bamanpukhri)	15	2	8	2	3
8.	Garidhura	12	2	6	2	2
9.	1.5 km from Garidhura village on Pankhabari road	14	1	6	3	4
10.	On Simulbari-Mirik road crossing	11	2	6	1	2
11.	0.5 km from Garidhura village on Pankhabari road	9	2	5	2	–
12.	2 km from Bamanpokri Range office towards Sukna	9	2	5	2	–
13.	Darjeeling town	72	10	32	19	11
14.	10 km from Jore Bungla (Ghoom towards Testa)	28	3	16	5	4
15.	6 km from Jore Bungla to Teesta	13	2	7	2	2
16.	3.5 km from Sevoke to Bagrakote	12	2	8	2	–
17.	4 km from Sevoke to Bagrakote	27	3	15	4	5
18.	Mongpong, 4.5 km from Sevoke to Bagrakote	38	4	20	9	2
19.	Samsing, 3.5 km from Samsing on Khasmehal Basti	20	3	13	2	2
20.	Mongpong, 4 km from Sevoke to Bagrakote (Ratikhola Jhora)	28	3	14	7	4
21.	Ringdung, 2 km from Mongpong	16	3	10	3	–
	TOTAL	402	55	215	78	54
	MEAN	19.14±3.33	2.61±0.42	10.23±1.54	3.71±0.91	2.57±0.56

Table 2. : Population composition of Rhesus macaque observed in 1985 and 1997 at Darjeeling district.

Year	Species	Km. surveyed (linear)	No. of groups seen	No. of groups counted	Km. per group	No. of monkey (sample size)	Average group size	Adults %		Sub-adults %	
								Male	Fem	JJ	II
1985	M. mulatta	437	11	11	39.73	188	17.09	12.23	51.59	18.09	18.09
1997	M. mulatta	543	21	21	25.8	402	19.14	13.68	53.48	19.40	13.43

Table 3. : Distribution and social composition of Rhesus macaque at Jalpaiguri district.

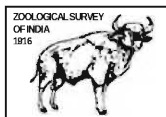
Sl. No.	Locality	Total	Adult Males	Adult Females	Juveniles	Infants
1.	Panijhora, 1 km from Rajabhatkhawa	7	2	3	–	2
2.	On Kalimpong-Lava road, 10 km from Lava	33	5	13	8	7
3.	Jayanti west beat (Buxa)	16	3	7	2	4
4.	22 miles beat office (Buxa)	3	1	2	–	–
5.	Rajabhatkhawa	7	2	4	1	–
6.	0.5 km from Rajabhatkhawa Tower road	6	1	2	2	1
7.	3 km from Rajabhatkhawa on Tower road	3	1	1	1	–
8.	Valka range, Barobisa F. R. H.	3	1	1	–	1
9.	1 km from Barobisa F. R. H.	2	1	1	–	–
10.	Rungdung village 2 km from Mongpong	16	3	10	3	–
11.	Elenbari	6	1	4	1	–
12.	Near Mongpong	10	2	6	1	1
13.	Chapramari Forest	19	4	8	5	2
14.	Chapramari Forest	12	3	6	2	1
15.	Bagrakote	16	2	7	4	3
16.	Lataguri Forest	21	3	12	6	–
17.	Lateguri Forest	2	1	1	–	–
18.	Lateguri Forest	8	2	4	–	–
19.	Khunia Basti-Murti Forest	15	2	8	3	2

Table 3. : (Cont'd.).

Sl. No.	Locality	Total	Adult Males	Adult Females	Juveniles	Infants
20.	Murti Forest	30	4	14	6	6
21.	Chilapata Forest	19	2	10	2	5
22.	Kodali Basti	45	5	16	12	12
23.	3 km from Kodali Basti	14	2	7	3	2
24.	2 km from F. R. H. at Barobisa	5	1	3	1	—
	TOTAL	318	54	150	63	51
	MEAN	13.25± 2.3	2.25± 0.26	6.25± 0.92	2.62± 0.62	2.12± 0.60

Table 4. : Distribution and social composition of Rhesus macaque of Coochbehar district.

Sl. No.	Locality	Total	Adult Males	Adult Females	Juveniles	Infants
1.	Atiamochar Range	5	1	2	1	1
2.	Atiamochar Range	10	2	5	1	2
3.	Atiamochar Range	12	2	7	1	2
	TOTAL	27	5	14	3	5
	MEAN	9± 2.55	1.66± 0.40	4.66± 1.77	1± 0	1.66± 0.4



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RECORDS OF SOIL INHABITING ORIBATID MITES (ACARI : ORIBATEI) IN THE SUNDARBAN DELTA OF WEST BENGAL, INDIA

A. K. SANYAL

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

INTRODUCTION

Oribatid or Cryptostigmatial mites commonly called as 'beetle' or 'moss' mites appear to be predominant among the commonly soil inhabiting arthropods. These mites occur in soil, litter, humus and compost heaps. They are also found to inhabit other habitats like tree trunks, moss, lichens, etc. Oribatids are known to take active part in decomposition of organic matter promoting soil fertility. They also disseminate plant diseases mainly root rots and fungal diseases and also act as intermediate hosts of tapeworms of domestic ruminants.

In spite of the richness and variety of soils in India, the studies so far done on this group of mites are not sufficient. However, the status of oribatid mite in West Bengal has been studied by a number of workers, but the deltaic region of the state has not yet been explored thoroughly. The present author collected soil dwelling oribatid mites from different parts of deltaic area of South 24-Parganas, West Bengal during 1977-1978. A part of collections were then studied and 8 new species were described. In order to make a comprehensive idea about this tiny economically important soil fauna in an unique habit like deltaic areas dominated by mangroves, the present author wants to publish a consolidated report on oribatid fauna of the area with the idea that it would be a useful source of base-line data of nearly 30 years old to the present and future workers.

REVIEW OF THE STUDIES ON ORIBATED MITES OF SUNDARBAN DELTA OF WEST BENGAL

The study of oribatid mites of Gangetic delta of South 24-Parganas was started by the present author during 1977-'78. Sanyal & Bhaduri (1981) first described one new species *Atropacarus (Hoplophorella) sundarbanensis* from the area. Later 5 species viz., *Brachioppia ananthakrishni*, *Multioppia simplitricha*, *Oppia orientalis* and *Oppia remisetosa* were describe as new to science by Sanyal & Bhaduri (1985). Sanyal (1992) again described 3 new species under the genus

Schcloribates namely *bhadurii*, *indicus* and *rakhali*. The same publication also recorded few known species from the area.

MATERIAL AND METHODS

Oribatid mites were extracted from samples mainly litter, soil and humus collected from all possible habitats in different localities in the deltaic region of South 24-Parganas, West Bengal during 1977-1978. For details about collection and extraction of samples, preparation of specimens prior to identification and identification of specimens Sanyal (1992, 2000) may be consulted.

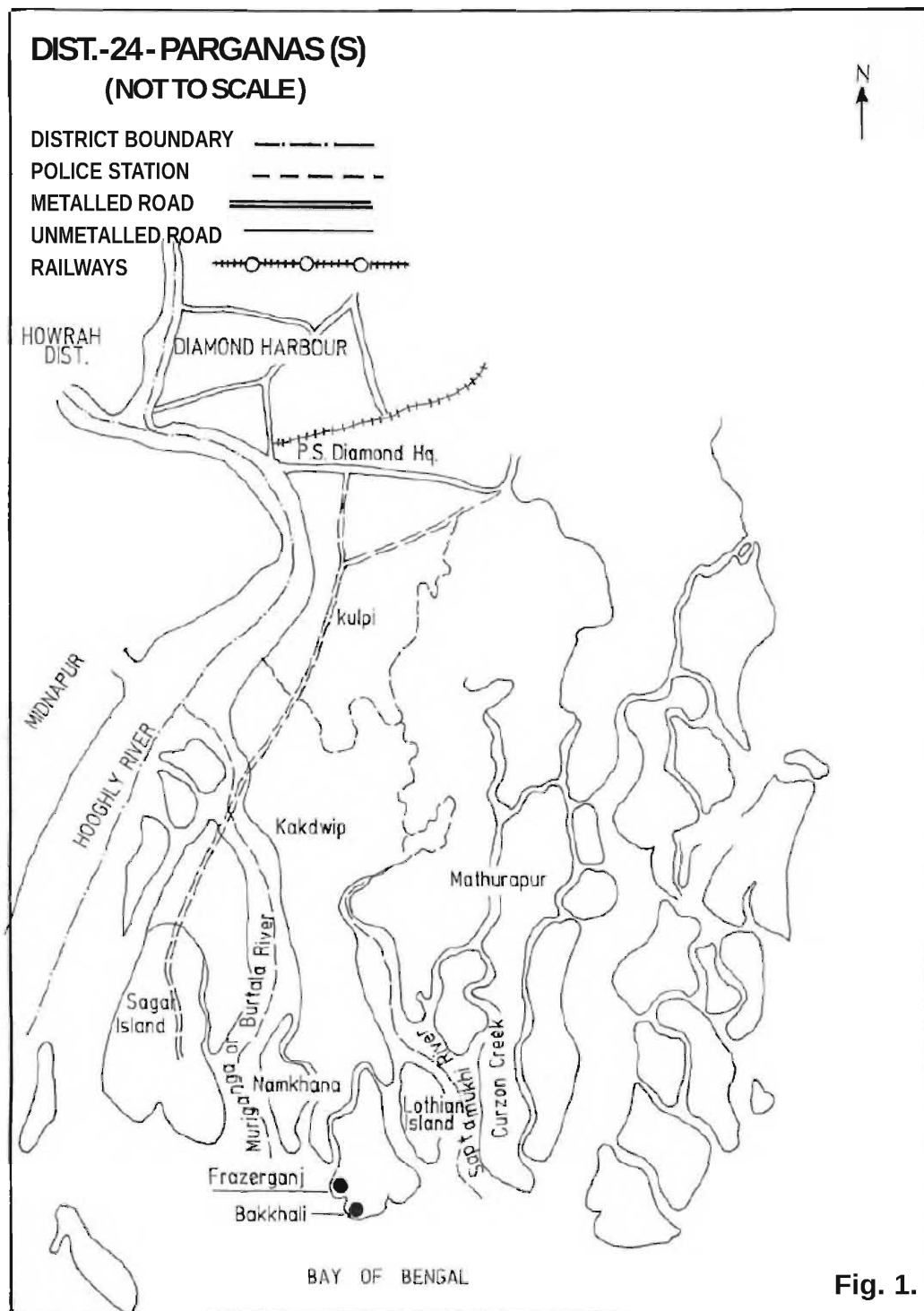
LOCALITIES SURVEYED

The present study included oribatid fauna from the litter, soil and humus samples collected from different plots in six localities namely Sagar Island, Kakdwip, Diamond Harbour, Bakkhali, Frazerganj and Namkhana at Sundarban delta, West Bengal [Fig. 1].

The dominant vegetation in the six localities were, *Acanthus illicifolius* Linn., *Hemigraphis hirta* Linn., *Nelsonia campestris* R. Br. (Acanthaceae); *Tylophora indica* Merr. (Asclepiadaceae); *Croton sparciflorus* Morung., *Excoecaria agallocha* Linn., *Jatropha* sp. (Euphorbiaceae); *Brachiaria* sp., *Cynodon dactylon* Pers., *Echinochloa colona* Link., *Paspalidium punctatum* Staff. (Gramineae); *Azadirachta indica* A. Juss. (Meliaceae); *Phoenix sylvestris* Roxb. (Palmae); *Cayrotia carnosa* Gegnep., *Cayrotia pedata* (Wall) Gegnep. (Vitaceae); *Acacia arabica* Willd. (Mimosae); *Clerodendron inerme* (L.) Gaertn. (Verbenaceae), etc.

LIST OF TAXA KNOWN FROM SUNDARBAN DELTA OF WEST BENGAL

- *1. Family HYPOCHTHONIIDAE Berlese, 1910
 - *1. Genus *Hypochthonius* Koch, 1835
- *1. *Hypochthonius* sp.
- *2. Family MESOPLOPHORIDAE Ewing, 1917
 - *2. Genus *Mesoplophora* Berlese, 1904
- *2. *M. pectinata* Mahuska, 1979
- *3. Family COSMOCHTHONIIDAE Grandjean, 1947
 - *3. Genus *Cosmochthonius* Berlese, 1910
- *3. *C. bengalensis* Chakraborty, Bhaduri and Raychaudhuri, 1972
 - 4. Genus *Phyllozetes* Gordeeva, 1978
- 4. *P. heterotrichus* Sanyal & Bhaduri, 1983



4. Family HAPLOCHTHONIIDAE Hammer, 1959
5. Genus **Haplochthonius** Willmann, 1930
5. *H. intermedius* Chakraborty, Bhaduri & Raychaudhuri, 1977
5. Family PHTHIRACARIDAE Perty, 1841
6. Genus **Atropacarus (Hoplophorella)** Niedbala, 1986
6. *A. (Hoplophorella) scapellatus* (Aoki, 1965)
7. *A. (Hoplophorella) sundarbanensis* Sanyal & Bhaduri, 1981
6. Family EUPHTHIRACARIDAE Jacot, 1930
7. Genus **Rhysotritia** Markel and Meyer, 1959
8. *R. ardua* var. *otaheitensis* Hammer, 1972
7. Family LOHMANIIDAE Berlese, 1916
8. Genus **Cryptacarus** Grandjean, 1950
9. *C. tuberculatus* Csiszar, 1961
- *9. Genus **Haplacarus** Wallwork, 1962
- *10. *Haplacarus foliatus bengalensis* Bhattacharya *et al.*, 1974
- *8. Family EPILOHMANNIIDAE Oudemans, 1923
- *10. Genus **Epilohmannia** Berlese, 1916
- *11. *E. pallida pacifica* Aoki, 1965
- *9. Family TRHYPOCHTHONIIDAE Willmann, 1931
- *11. Genus **Allonothrus** Hammer, 1953
- *12. *A. indicus* Bhaduri & Raychaudhuri, 1968
- *10. Family MALACONOTHRIDAE Berlese, 1916
- *12. Genus **Malaconothrus** Berlese, 1906
- *13. *M. geminus* Hammer, 1972
- *11. Family BASILOBELBIDAE Balogh, 1961
- *13. Genus **Basilobelba** Balogh, 1958
- *14. *B. indica* Bhaduri, Chakraborti & Raychaudhuri, 1974
- *12. Family CARABODIDAE Koch, 1837
- *14. Genus **Carabodes** Koch, 1836
- *15. *C. peniculatus* Aoki, 1970

- *13. Family TECTOCEPHEIDAE Grandjean, 1954
- *15. Genus *Tectocepheus* Berlese, 1913
- *16. *T. velatus velatus* (Michael, 1888)
- *14. Family OTOCEPHEIDAE Balogh, 1961
- *16. Genus *Dolicheremaeus* Jacot, 1938
- *17. *D. bengalensis* Sanyal, 1992
- *18. *D. coronarius* Chakraborti, Bhadhuri & Kundu, 1981
- 15. Family OPPIIDAE Grandjean, 1954
- 17. Genus *Brachioppia* Hammer, 1961
- 19. *B. ananthakrishni* Sanyal & Bhaduri, 1985
- 18. Genus *Multioppia* Hammer, 1961
- 20. *M. simplitricha* Sanyal & Bhaduri, 1985
- 19. Genus *Oppia* Koch, 1836
- 21. *O. orientalis* Sanyal & Bhaduri, 1985
- 22. *O. ramisetosa* Sanyal & Bhaduri, 1985
- 23. *O. yodai* Aoki, 1965
- *16. Family CHAUNOPROCTIDAE Balogh, 1961
- *20. Genus *Chaunoproctus* Pearce, 1906
- 24. *C. abalai* Bhaduri, Bhattacharya & Raychaudhuri, 1975
- *17. Family XYLOBATIDAE Balogh & Balogh, 1984
- *21. Genus *Xylobates* Jacot, 1929
- *25. *X. seminudus* Hammer, 1971
- 18. Family HAPLOZETIDAE Grandjean, 1936
- 22. Genus *Haplozetes* Willmann, 1935
- 26. *Haplozetes* sp.
- 23. Genus *Lauritzenia* Hammer, 1958
- 27. *L. longipluma* Hammer, 1958
- 19. Family SCHELORIBATIDAE Grandjean, 1953
- 24. Genus *Euscheloribates* Kunst, 1958
- *28. *E. samsinaki* Kunst, 1958

25. Genus *Schellobates* Berlese, 1908
29. *S. bhaduri* Sanyal, 1992
30. *S. natalensis* Pletzen, 1963
31. *S. indicus* Sanyal, 1992
32. *S. rakhali* Sanyal, 1992
20. Family AUSTRACHTERIIDAE Luxton, 1985
26. Genus *Lamellobates* Hammer, 1958
33. *L. palustris* Hammer, 1958
- *27. Genus *Paralamellobates* Bhadhri & Raychoudhuri, 1968
- *34. *P. bengalensis* Bhadhri & Raychoudhuri, 1968
21. Family GALUMNIDAE Jacot, 1925
28. Genus *Galumna* von Heyden, 1826
35. *G. crenata* Deb & Raychoudhuri, 1975
- *36. *G. flabellifera orientalis* Aoki, 1965

*(Taxa with asterik mark is first record from Sundarban delta)

SYSTEMATIC ACCOUNT

Key to the families and genera of oribatid mites from Sundarban delta of West Bengal

1. Ptychoid body, propodosoma can be shut back against hysterosoma and ventral region like blade of penknife, generally laterally compressed body 2
- Body not ptychoid, propodosoma can not be shut back like blade of penknife; body not laterally compressed 4
2. Notogaster with 1–3 transverse sutures; anogenital region brachypylic i.e. genital and anal plates round and well developed Mesoplophoridae Ewing — (i)
- (i) Anal plates with two pairs of setae; genital setae arranged as 1 + 6 *Mesoplophora* Berlese
- Notogaster without transverse suture; anogenital region macropylic i.e. genital and anal plates meeting each other 3
3. Anogenital region narrow, 'v'-shaped; body considerably compressed laterally Euphthiracaridae Jacot — (ii)
- (ii) One interlocking triangle present in middle of anogenital region; notogaster not sculptured *Rhysotritia* Markel and Meyer

- Anogenital region wide, almost 'v'-shaped; body only slightly compressed laterally Phthiracaridae Perty — (iii)
- (iii) Genital setae forming a row or almost a row, located near the paraxial margin, distance between g_6 and g_5 greater than that between g_5 and g_4 *Atropacarus (Hoplophorella)* Niedbala
- 4. Anogenital region of macropyline type; no ventral plate; tibia and genu of similar length and shape 5
- Anogenital region of brachypyline type; ventral plate present; tibia and genu of different length and shape 11
- 5. Notogaster with 1 or 3 transverse sutures 6
- Notogaster without transverse sutures 8
- 6. Notogaster with only one transverse suture Hypochthoniidae Berlese — (iv)
- (iv) Shoulder without tubercle; notogastral setae simple *Hypochthonius* Koch
- Notogaster with 3–4 transverse sutures 7
- 7. Notogastral setal e_1, e_2, f_1, f_2 long and rigid, arising on the transverse sutures Cosmochthoniidae Grandjean — (v)
- (v) Notogaster subdivided by 3 transverse sutures into 4 shields; tarsal claw formula 2–3–3–3 *Cosmochthonius* Berlese
- Notogaster subdivided by 4 transverse sutures into 5 shields; tarsal claw formula 2–2–2–3. *Phyllozetes* Gordeeva
- All notogastral setae almost similar in length, not rigid, arising on the shields Haplochthoniidae Hammen — (vi)
- (vi) Notogaster with 3 sutures, with 4 shields; no preanal plate; rostral setae present *Haplochthonius* Willmann
- 8. Body dichoid *i.e.*, articulation between legs II and III; preanal plate present Lohmanniidae Berlese*
- Body holoid *i.e.* the body regions rigidly coalesced; preanal plate absent 9
- * Genital plates with transverse suture (vii)
- Genital plates without transverse suture (viii)
- (vii) Anal and adanal plates separated; no long branched setae *Cryptacarus* Grandjean
- (viii) 5 pairs of setae in the ano-adanal plates *Haplacarus* Wallwork
- 9. Three pairs of setae on epimere 3 10
- 10. Genital setae 4–14 pairs; adanal setae two pairs Trhypochthoniidae Willmann — (ix)
- (ix) Pentagonal notogaster; notogastral setae spatulate; 7–14 pairs of genital setae; legs tridactylous *Allonothrus* Hammen
- Genital setae 4–6 pairs; adanal setae three pairs Malaconothridae Berlese — (x)
- (x) Notogaster largely parallel sided; legs monodactylous *Malaconothrus* Berlese

11. Notogaster pycnonotic i.e. ototaxic organs absent; usually pteromorphae absent 12
 — Notogaster poronotic i.e., areae porosae, sacculi or pori absent; pteromorphae usually present 20
12. Anogenital plate schizogastric type; 14 pairs of notogartral setae
 *Epilohmanniidae* Oudemans — (xi)
 (xi) Transverse line between genital and anal plates; genital plates usually with more than 7
 pairs of setae *Epilohmannia* Berlese
 — Ventral plate hologastric type 13
13. Prodorsum having lamellae 14
 — Prodorsum without true lamellae; either thin crest-shaped lamellae or thin costulae present or
 both lamellae and costulae absent 16
14. Translamella present, dorsosejugal suture absent or incomplete 15
 Translamella often absent; dorsosejugal suture complete; lamellae with short cuspides
 *Carabodidae* Koch — (xiv)
15. Dorsosejugal suture absent; lamellae with relatively long cuspides; lamellar—interlamellar
 complex 'N'-shaped *Tectocephidae* Grandjean — (xii)
 (xii) Lamellae wide; notogaster with 10 pairs of setae; genital setae 6 pairs; humeral appendages
 horizontal; legs monodactyle *Tectocephus* Berlese
 — Dorsosejugal suture incomplete in the middle; lamellae with short cuspides; no 'N'-shaped
 complex *Chaunoproctidae* Pearce — (xiii)
 (xiii) Lamellae and translamella present; notogaster with 10 pairs of setae; genital setae 6
 pairs; legs tridactylous *Chaunoproctus* Pearce
 (xiv) 10 pairs of notogastral setae; notogaster without tubercle *Carabodes* Koch
16. Ventral neotrichy present, more than 4 pairs of aggenital + adanal setae 17
 — Ventral neotrichy absent 18
17. Exuvia or atleast tritonymphal exuvia affixed to one tubercle on notogaster
 *Basilobelbidae* Balogh — (xv)
 (xv) Mandibles normal; rostrum not pointed; aggenital setae 5 pairs; adanal setae 5 pairs ...
 *Basilobelba* Balogh
18. Body elongate, mostly at least twice longer than wide; prodorsal and notogastral condyles
 present; notogastral setae 10–14 pairs *Otocephidae* Balogh — (xvi)
 (xvi) Pedotecta 2 + 3 distinct but not so conspicuously developed; genital plates with 4 pairs
 of setae; anal plates with 2 pairs of setae *Dolicheremaeus* Jacot
 — Body not elongate, mostly never twice as long as wide 19

19. Chelicera normal; prodorsum without tectopodial fields and lamellar knob
 Oppiidae Grandjean — (xvii)
 (xvii) Sensillus unbranched, club-shaped or faintly globular, head may be terminated in pointed tip sometimes with 1–2 long seta-like processes; rostral setae smooth or may be minutely ciliated *Oppia* Koch
 — Sensillus branched, branches radiating from the posterior border of the compressed clavate head; rostral setae feathered (xviii)
 (xviii) 10 pairs of nogastral setae; pore *iad* usually placed obliquely to the anal field
 *Brachioppia* Hammer
 — 13 pairs of notogastral setae; pore *iad* usually placed parallel to the anal field
 *Multioppia* Hammer
20. Pteromorphae movable, articulate or semicircular; prodorsum without true projecting lamellae; some chitinous lines on the prodorsum Galumnidae Jacot — (xix)
 (xix) Lamellar setae placed between lines *L* and *S* *Galumna* Heyden
 — Pteromorphae immovable but not articulate, sometimes absent 21
21. Prodorsum with tulatorium; lamellae broad, sometimes synlamella type
 Austrachipteriidae Luxton — (xx)
 (xx) Interlamellar area small; lamellae without free tips *Lamellobates* Hammer
 — Interlamellar area large; lamellae with free tips
 *Paralamellobates* Bhaduri and Raychoudhuri
 Prodorsum without tulatorium; usually 3–5 pairs of genital setae (exceptionally 6 pairs) 22
22. Notogaster with true areae porosae 23
 — True areae porosae absent, notogaster with secculi or pori 24
23. Sensillus long, reclinate, setiform, often slightly lanceolate at its tip
 Xylobatidae Balogh and Balogh — (xxi)
 (xxi) Notogaster with 10–11 pairs of setae or alveoli; 4–6 pairs of genital setae; sensillus not pilose; legs monodactylous *Xylobates* Jacot
24. Pteromorphae movable, hinged Haplozetidae Grandjean — (xxii)
 (xxii) Interlamellar setae not originating on dorsosejugal suture; notogastral setae distinct ..
 *Lauritzenia* Hammer
 — Interlamellar setae originating on dorsosejugal suture; notogastral setae hardly discernible .
 *Haplozetes* Willmann
 — Pteromorphae immovable or absent Scheloribatidae Grandjean — (xxiii)
 (xxiii) 3 pairs of genital setae *Euscheloribates* Kunst
 — 4 pairs of genital setae *Scheloribates* Berlese

1. Family HYPOCHTHONIIDAE Berlese, 1910

1. Genus *Hypochthonius* Koch

1836. *Hypochthonius* Koch, Deutschlands Crustaceen, Myriapoden und Arachniden, 1-9.

1. *Hypochthonius* sp.

Material examined : 5♂♂, Bakkhali, 26.i.1977, from soil, coll. A. K. Sanyal; 7♂♂, Frazergunj, 15.ii.1977, from litter, coll. A. K. Sanyal; 2♂♂, Namkhana, 30.vi.1978.

Remarks : The specimens seem to be new species but could not be identified upto species level due to non availability of sufficient literature.

2. Family MESOPLOPHORIDAE Ewing, 1917

2. Genus *Mesoplophora* Berlese

1904. *Mesoplophora* Berlese, *Redia*, **2** : 23.

1979. *Mesoplophora pectinata* Mahunka, *Revue Suisse Zool.*, **86**(2) : 551.

Material examined : 3♂♂, Namkhana, 22.ii.1977, from soil, coll. A. K. Sanyal; 2♂♂, Sagar Island, 10.i.1977, from litter and soil, coll. A. K. Sanyal; 5♂♂, Bakkali, 10.viii.1977, from soil, coll. A. K. Sanyal.

Distribution : INDIA : Tripura.

3. Family COSMOCHTHONIIDAE Grandjean, 1947

3. Genus *Cosmochthonius* Berlese

1910. *Cosmochthonius* Berlese, *Redia*, **6**(2) : 218.

3. *Cosmochthonius bengalensis* Chakrabarti, Bhaduri and Raychoudhuri

1972. *Cosmochthonius bengalensis* Chakrabarti, Bhaduri and Raychaudhuri, *Acta Arachnol.*, **24**(2) : 86.

Material examined : 2♂♂, Frazergunj, 17.i.1977, from litter and soil, coll. A. K. Sanyal; 4♂♂, Kakdwip, 12.iv.1977, 1♀, Namkhana, 10.viii.1977, from litter and soil, coll. A. K. Sanyal.

Distribution : INDIA : West Bengal.

4. Genus *Phyllozetes* Gordeeva

1978. *Phyllozetes* Gordeeva, *Zool. Zh.*, **57** : 1099.

4. *Phyllozetes heterotrichus* Sanyal and Bhaduri

1983. *Trichthonius heterotrichus* Sanyal and Bhaduri, *Acarologia*, **24**(2) : 219.

Material examined : 3♂♂, Sagar Island, 8.ii.1977, from humus, coll. A. K. Sanyal; 2♂♂, Frazergunj, 10.viii.1977, from soil, coll. A. K. Sanyal.

Distribution : INDIA : West Bengal.

4. Family HAPLOCHTHONIIDAE Hammen, 1959

5. Genus *Haplochthonius* Willmann

1930. *Haplochthonius* Willmann, *Abh. naturw. ver. Bremen.*, **28**(1) : 2.

5. *Haplochthonius intermedius* Chakraborti, Bhaduri and Raychaudhuri

1977. *Haplochthonius intermedius* Chakraborti, Bhaduri and Raychoudhuri, *Sci. & Cult.*, **43**(4) : 178.

Material examined : 4♀♀, Kakdwip, 12.iv.1977, from humus, coll. A. K. Sanyal; 2♀♀, Diamond Harbour, 22.ix.1977, from soil, coll. A. K. Sanyal; 2♀♀, Bakhali, 24.xii.1977, from litter and soil, coll. A. K. Sanyal.

Distribution : INDIA : West Bengal.

5. Family PHTHIRACARIDAE Perty, 1841

5. Genus *Atropacarus* Ewing

1917. *Atropacarus* Ewing, *J. Economic Ent. Concord*, **10** : 131.

Atropacarus (Hoplophorella) Niedbala

1986. *Atropacarus (Hoplophorella)*, Niedbala, *Acarologia*, **27**(1) : 80.

6. *Atropacarus (Hoplophorella) scapellatus* (Aoki)

1965. *Hoplophorella scapellata*, Aoki, *Nat. Life Southeast Asia*, **4** : 131.

1992. *Atropacarus (Hoplophorella) scapellatus*, Niedbala, In : *Phthiracaroida (Acari, Oribatida). Systematic studies*, Amsterdam, 226.

Material examined : 4♀♀, Sagar Island, 8.ii.1977, from decomposed dung and soil, coll. A. K. Sanyal; 2♀♀, Frazergunj, 15.x.1977, from humus, coll. A. K. Sanyal; 3♀♀, Kakdwip, 20.ii.1978.

Distribution : INDIA : Assam, Bihar, Manipur, Orissa, Tripura, West Bengal.

Remarks : The species was reported earlier from Frazergunj by Sanyal and Bhaduri (1982).

7. *Atropacarus (Hoplophorella) sundarbanensis* Sanyal and Bhaduri, 1981

1992. *Atropacarus (Hoplophorella) sundarbanensis*, Sanyal and Bhaduri, *Indian J. Acar.*, **6**(1&2) : 35.

Remarks : Sanyal and Bhaduri (1981) described the species from Sagar Island, Bakkhali and Namkhana.

6. Family EUPHTHIRACARIDAE Jacot, 1930

6. Genus *Rhysotritia* Markel and Meyer

1959. *Rhysotritia* Markel and Meyer, *Zool. Anz.*, **163** : 329.

8. *Rhysotritia ardua* var. *otaheitensis* Hammer

1972. *Rhysotritia ardua* var. *otaheitensis* Hammer, *Biol. Skr. Dan. Vid. Selsk.*, **19**(3) : 12.

Material examined : 3EE, Kakdwip, 12.iv.1977, from humus, coll. A. K. Sanyal; 2EE, Sagar Island, 10.xii.1977, from soil, coll. A. K. Sanyal; 1E, Bakkhali, 24.xii.1977, from soil, coll. A. K. Sanyal.

Distribution : INDIA : Tripura, West Bengal.

7. Family LOHMANIIDAE Berlese, 1916

7. Genus *Cryptacarus* Grandjean

1950. *Cryptacarus* Grandjean, *Arch. Zool. exp. gen. Paris*, **87** : 138.

9. *Cryptacarus tuberculatus* Csiszar

1961. *Cryptacarus tuberculatus* Csiszar, *Acta. Zool. Acad. Sci. Hung.*, **7** : 346.

Material examined : 3EE, Sagar Island, 20.viii.1977, from litter and soil, coll. A. K. Sanyal; 3EE, Frazergunj, 15.x.1977, from soil, coll. A. K. Sanyal.

Distribution : INDIA : West Bengal.

8. Genus *Haplacarus* Wallwork

1962. *Haplacarus* Wallwork, *Acarologia*, **4** : 465.

10. *Haplacarus foliatus bengalensis* Bhattacharya *et al.*

1974. *Haplacarus foliatus bengalensis* Bhattacharya, Bhaduri and Raychaudhuri, *Oriental Ins.*, **8**(2) : 281.

Material examined : 5EE, Bakkhali, 10.viii.1977, from litter and soil, coll. A. K. Sanyal; 2EE, Kakdwip, 10.xii.1977, from humus, coll. A. K. Sanyal.

Distribution : INDIA : Tripura, West Bengal.

8. Family EPILOHMANNIIDAE Oudemans, 1923

9. Genus *Epilohmannia* Berlese

1916. *Epilohmannia* Berlese, *Redia*, **12** : 176.

11. *Epilohmannia pullida pacifica* Aoki

1965. *Epilohmannia pullida pacifica* Aoki, *Pacific Insects*, **7**(2) : 321.

Material examined : 4EE, Sagar Island, 22.ix.1977, from litter and soil, coll. A. K. Sanyal; 3EE, Frazergunj, 15.x.1977, from humus, coll. A. K. Sanyal; 2EE, Namkhana, 24.xii.1977, from soil, coll. A. K. Sanyal.

Distribution : INDIA : Kerala, Orissa, Tripura, West Bengal.

9. Family TRHYPOCHTHONIIDAE Willmann, 1931

10. Genus *Allonothrus* Hammen

1953. *Allonothrus* Hammen, *Proc. Acad. Sci. Amst.*, **56C** : 244.

12. *Allonothrus indicus* Bhaduri and Raychaudhuri

1968. *Allonothrus indicus* Bhaduri and Raychaudhuri, *Oriental Ins.*, **2(2)** : 195.

Material examined : 4♂♂, Namkhana, 17.i.1977, from soil, coll. A. K. Sanyal; 3♂♂, Diamond Harbour, 8.ii.1977, from litter and soil, coll. A. K. Sanyal; 2♂♂, Frazergunj, 15.x.1977, from humus, coll. A. K. Sanyal.

Distribution : INDIA : West Bengal.

10. Family MALACONOTHRIDAE Berlese, 1916

11. Genus *Malaconothrus* Berlese

1904. *Malaconothrus* Berlese, *Redia*, **2** : 24.

13. *Malaconothrus geminus* Hammer

1972. *Malaconothrus geminus* Hammer, *Biol. Skr. Dan. Vid. Selsk.*, **19(3)** : 20.

Material examined : 2♂♂, Diamond Harbour, 8.ii.1977, from soil, coll. A. K. Sanyal; 2♂♂, Namkhana, 24.xii.1977, from litter and soil, coll. A. K. Sanyal.

Distribution : INDIA : West Bengal.

11. Family BASIOBELBIDAE Balogh, 1961

12. Genus *Basilobelba* Balogh

1958. *Basilobelba* Balogh, *Rev. Zool. Bot. Afr.*, **58** : 9.

14. *Basilobelba indica* Bhaduri, Chakraborti and Raychaudhuri

1974. *Basilobelba indica* Bhaduri, Chakraborti and Raychaudhuri, *Acta Arachnol.*, **25(2)** : 86.

Material examined : 5♂♂, Frazergunj, 22.ii.1977, from litter and soil, coll. A. K. Sanyal; 2♂♂, Kakdwip, 18.iv.1977, from litter and soil, coll. A. K. Sanyal.

Distribution : INDIA : Orissa, Tripura, West Bengal.

12. Family CARABODIDAE Koch, 1837

13. Genus *Carabodes* Koch

1836. *Carabodes* Koch, *Deutschlands Crustacsen, Myriapoden und Arachnidean*, 3.

15. *Carabodes peniculatus* Aoki

1970. *Carabodes peniculatus* Aoki, *Bull. Nat. Sci. Mus. Tokyo*, **13**(3) : 417.

Material examined : 4EE, Sagar Island, 12.iv.1977, from litter and soil, coll. A. K. Sanyal; 3EE, Kakdwip, 20.ii.1978, from soil, coll. A. K. Sanyal; 1E, Frazergunj, 10.viii.1977, from humus, coll. A. K. Sanyal.

Distribution : INDIA : Tripura, West Bengal.

13. Family TECTOCEPHEIDAE Grandjean, 1954

14. Genus *Tectocephus* Berlese

1913. *Tectocephus* Berlese, *Redia*, **9** : 91.

16. *Tectocephus velatus velatus* (Michael)

1888. *Tectocephus velatus velatus* (Michael), *Ray. Soc.*, 65.

Material examined : 7EE, Frazergunj, 8.ii.1977 and 10.xii.1977, from litter and soil, coll. A. K. Sanyal; 2EE, Sagar Island, 12.iv.1977, from soil, coll. A. K. Sanyal.

Distribution : INDIA : Bihar, Himachal Pradesh, Orissa, Sikkim, Tripura, West Bengal.

14. Family OTOCEPHEIDAE Balogh, 1961

15. Genus *Dolicheremaeus* Jacot

1938. *Dolicheremaeus* Jacot, *Florida Ent.*, **21**(4) : 51.

17. *Dolicheremaeus bengalensis* Sanyal

1992. *Dolicheremaeus bengalensis* Sanyal, *Zoological Survey of India, Fauna of West Bengal*, Part 3 : 292.

Material examined : 3EE, Diamond Harbour, 12.iv.1977, from humus, coll. A. K. Sanyal; 2EE, Namkhana, 15.x.1977, from litter and soil, coll. A. K. Sanyal.

Distribution : INDIA : West Bengal.

18. *Dolicheremaeus coronarius* Chakraborti, Bhaduri and Kundu

1981. *Dolicheremaeus coronarius* Chakraborty, Bhaduri and Kundu, *Mitt. Zool. Mus. Berlin*, **57**(1) : 15.

Material examined : 3EE, Kakdwip, 8.ii.1977, from litter and soil, coll. A. K. Sanyal; 3EE, Sagar Island, 20.viii.1977, from humus, coll. A. K. Sanyal.

Distribution : INDIA : West Bengal.

15. Family OPPIIDAE Grandjean, 1954

16. Genus *Brachioppia* Hammer, 1961

1961. *Brachioppia* Hammer, *Biol. Skr. Dan. Vid. Selsk.*, **13**(1) : 51.

19. ***Brachioppia ananthakrishni*** Sanyal and Bhaduri

1985. *Brachioppia ananthakrishni* Sanyal and Bhaduri, *Indian J. Acar.*, **10**(1 & 2) : 15.

Remarks : The species was first described by Sanyal and Bhaduri (1985) from Diamond Harbour.

Distribution : INDIA : West Bengal.

17. Genus ***Multioppia*** Hammer

1972. *Multioppia* Hammer, *Biol. Skr. Dan. Vid. Selsk.*, **13**(1) : 61.

20. ***Multioppia simplitricha*** Sanyal and Bhaduri

1985. *Multioppia simplitricha* Sanyal and Bhaduri, *Indian J. Acar.*, **10**(1 & 2) : 15.

Remarks : Sanyal and Bhaduri (1985) described the species from Kakdwip, Frazergunj, Namkhana and Diamond Harbour.

Distribution : INDIA : West Bengal.

18. Genus ***Oppia*** Koch

1836. *Oppia* Koch, *Deutschlands Crustaceen, Myriapoden and Arachniden*, 1-9.

21. ***Oppia orientalis*** Sanyal and Bhaduri

1985. *Oppia orientalis* Sanyal and Bhaduri, *Indian J. Acar.*, **10**(1 & 2) : 15.

Remarks : Sanyal and Bhaduri (1985) described *Oppia orientalis* as new species from Bakkhali.

Distribution : INDIA : West Bengal.

22. ***Oppia ramisetosa*** Sanyal and Bhaduri

1985. *Oppia ramisetosa* Sanyal and Bhaduri, *Indian J. Acar.*, **10**(1 & 2) : 15.

Remarks : The species was described as new to science by Sanyal and Bhaduri (1985) from Kakdwip and Diamond Harbour.

Distribution : INDIA : West Bengal.

23. ***Oppia yodai*** Aoki

1965. *Oppia yodai* Aoki, *Nat. Life Southeast. Asia*, **4** : 169.

Material examined : 7♂♂, Diamond Harbour, 12.iv.1977, from litter and soil, coll. A. K. Sanyal; 4♂♂, Bakkhali, 10.viii.1977, from humus, coll. A. K. Sanyal; 2♂♂, Namkhana, 24.xii.1977, from soil, coll. A. K. Sanyal.

Distribution : INDIA : Tripura and West Bengal.

16. Family CHAUNOPROCTIDAE Balogh, 1961

19. Genus *Chaunoproctus* Pearce

1906. *Chaunoproctus* Pearce, *Journ. Roy. Micr. Soc.*, 271.

24. *Chaunoproctus abalai* Bhaduri, Bhattacharya and Chakraborti

1975. *Chaunoproctus abalai* Bhaduri, Bhattacharya and Chakraborti, *Mitt. Zool. Mus. Berlin*, 5(1) : 59.

Material examined : 3EE, Kakdwip, 10.i.1977, from litter and soil, coll. A. K. Sanyal; 4EE, Frazergunj, 15.x.1977, from soil, coll. A. K. Sanyal.

Distribution : INDIA : Tripura and West Bengal.

17. Family XYLOBATIDAE Balogh and Balogh, 1984

20. Genus *Xylobates* Jacot

1929. *Xylobates* Jacot, *Trans. Amer. Micr. Soc. Menasha*, 48 : 429.

25. *Xylobates seminudus* Hammer

1971. *Xylobates seminudus* Hammer, *Biol. Skr. Dan. Vid. Selsk.*, 16 : 38.

Material examined : 3EE, Diamond Harbour, 8.ii.1977, from soil, coll. A. K. Sanyal; 7EE, Sagar Island, 22.ix.1977, from humus, coll. A. K. Sanyal; 2EE, Bakkhali, 15.x.1977, from litter and soil, coll. A. K. Sanyal.

Distribution : INDIA : Tripura and West Bengal.

18. Family HAPLOZETIDAE Grandjean, 1936

21. Genus *Haplozetes* Willmann

1935. *Haplozetes* Willmann, *Zool. Jahrb. Syst.*, 66 : 333.

26. *Haplozetes* sp.

Material examined : 4EE, Kakdwip, 12.iv.1977, from soil, coll. A. K. Sanyal; 2EE, Frazergunj, 18.v.1977, from soil, coll. A. K. Sanyal; 3EE, Sagar Island, 20.vii.1977, from soil, coll. A. K. Sanyal.

Remarks : Due to nonavailability of pertinent literature the specimens could not be identified upto species level.

22. Genus *Lauritzenia* Hammer

1958. *Lauritzenia* Hammer, *Biol. Skr. Dan. Vid. Selsk.*, 10(1) : 83.

27. *Lauritzenia longipluma* Hammer

1958. *Lauritzenia longipluma* Hammer, *Biol. Skr. Dan. Vid. Selsk.*, 10(1) : 83.

Material examined : 7EE, Frazergunj, 18.iv.1977, from litter and soil, coll. A. K. Sanyal.

Distribution : INDIA : West Bengal.

19. Family SCHELOBATIDAE Grandjean, 1977

23. Genus *Euscheloribates* Kunst

1958. *Euscheloribates* Kunst, *Acta Soc. Ent. Cech.*, **55** : 67.

28. *Euscheloribates samsinaki* Kunst

1958. *Euscheloribates samsinaki* Kunst, *Acta Soc. Ent. Cech.*, **55** : 68.

Material examined : 5♀♀, Namkhana, 15.x.1977 and 24.xii.1977, from litter and soil, coll. A. K. Sanyal.

Distribution : INDIA : Tripura, West Bengal.

24. Genus *Scheloribates* Berlese

1908. *Scheloribates* Berlese, *Redia.*, **5** : 2.

29. *Scheloribates bhadurii* Sanyal

1992. *Scheloribates bhadurii* Sanyal, *Zoological Survey of India, Fauna of West Bengal*, Part 3 : 313.

Remarks : Sanyal (1992) described *S. bhadurii* as new species from Namkhana and Sagar Island.

Distribution : INDIA : West Bengal.

30. *Scheloribates indicus* Sanyal

1992. *Scheloribates indicus* Sanyal, *Zoological Survey of India, Fauna of West Bengal*, Part 3 : 315.

Remarks : *S. indicus* was described as new to science by Sanyal (1992) from Namkhana.

Distribution : INDIA : West Bengal.

31. *Scheloribates natalensis* Pletzen

1963. *Scheloribates natalensis* Pletzen, *Acarologia*, **5**(4) : 700.

Material examined : 10♀♀, Sagar Island, 8.ii.1977, from soil, coll. A. K. Sanyal; 5♀♀, Frazergunj, 18.iv.1977, from decomposed litter, coll. A. K. Sanyal; 3♀♀, Bakkhali, 24.xii.1977, from litter and soil, coll. A. K. Sanyal.

Distribution : INDIA : West Bengal.

32. *Scheloribates rakhali* Sanyal

1992. *Scheloribates rakhali* Sanyal, *Zoological Survey of India, Fauna of West Bengal*, Part 3 : 317.

Remarks : Sanyal (1992) described *S. rakhali* as new species from Frazergunj, Sagar Island and Kakdwip.

Distribution : INDIA : West Bengal.

20. Family AUSTRACHTERIIDAE Luxton, 1985

25. Genus **Lamellobates** Hammer

1958. *Lamellobates* Hammer, *Biol. Skr. Dan. Vid. Selsk.*, **10**(1) : 100.

33. **Lamellobates palustris** Hammer

1958. *Lamellobates palustris* Hammer, *Biol. Skr. Dan. Vid. Selsk.*, **10**(1) : 100.

Material examined : 4♂♂, Sagar Island, 12.iv.1977, from litter and soil, coll. A. K. Sanyal; 3♂♂, Kakdwip, 20.viii.1977, from soil, coll. A. K. Sanyal; 4♂♂, Diamond Harbour, 20.ii.1978, from litter and soil, coll. A. K. Sanyal.

Distribution : INDIA : Bihar, Meghalaya, Tripura, West Bengal.

26. Genus **Paralamellobates** Bhaduri and Raychaudhuri

1968. *Paralamellobates* Bhaduri and Raychaudhuri, *Oriental Ins.*, **2**(2) : 197.

34. **Paralamellobates bengalensis** Bhaduri and Raychaudhuri

1968. *Paralamellobates bengalensis* Bhaduri and Raychaudhuri, *Oriental Ins.*, **2**(2) : 197.

Material examined : 4♂♂, Sagar Island, 20.vii.1977, from litter and soil, coll. A. K. Sanyal; 2♂♂, Namkhana, 15.x.1977, from humus, coll. A. K. Sanyal.

Distribution : INDIA : Kerala, Sikkim, Tripura, West Bengal.

21. Family GALUMNIDAE Jacot, 1925

27. Genus **Galumna** von Heyden

1826. *Galumna* von Heyden, *Isis Oken*, **18** : 611.

35. **Galumna crenata** Deb and Raychaudhuri

1975. *Galumna crenata* Deb and Raychaudhuri, *Annot. Zool. Japan*, **48**(3) : 167.

Material examined : 5♂♂, Diamond Harbour, 8.ii.1977, from litter and soil, coll. A. K. Sanyal; 4♂♂, Namkhana, 18.iv.1977, from decomposed dung, coll. A. K. Sanyal; 4♂♂, Bakkhali, 15.x.1977, from litter and soil, coll. A. K. Sanyal.

Distribution : INDIA : West Bengal.

36. **Galumna flabellifera orientalis** Aoki

1965. *Galumna flabellifera orientalis* Aoki, *Nat. Life Southeast Asia*, **4** : 187.

Material examined : 3♂♂, Kakdwip, 10.i.1977, from litter and soil, coll. A. K. Sanyal; 4♂♂, Namkhana, 18.iv.1977, from decomposed dung, coll. A. K. Sanyal; 3♂♂, Frazergunj, 10.viii.1977, from litter and soil, coll. A. K. Sanyal.

Distribution : INDIA : West Bengal.

DISCUSSION

The analysis of the present study indicates that before the study of the collection of oribatid mites made during 1977-78, a total of 19 species under 14 genera and 10 families were known from Sundarban delta of West Bengal. The present work includes 17 species under 14 genera and 11 families to the list of earlier known taxa. Thus at present a total of 36 species under 28 genera and 21 families are known from the study area. Table 1 shows that maximum number (17) of oribatid species was recorded from Sagar Island and Frazergunj and minimum number (11) of species was reported from Diamond Harbour and Bakkhali.

Table 1. : Distribution of oribatid genus/species in different localities in Sundarban of South 24-Parganas, West Bengal.

Name of the genus/ species	Sagar Island	Kakdwip	Diamond Harbour	Bakkhali	Frazergunj	Namkhana
	1	2	3	4	5	6
<i>Hypochthonius</i> sp.				+	+	+
<i>M. pectinata</i>	+			+		+
<i>C. bengalensis</i>		+			+	+
<i>P. heterotrichus</i>	+				+	
<i>H. intermedius</i>		+	+	+		
<i>A. (H.) scapellatus</i>	+	+			+	
<i>A. (H.) sundarbanensis</i>	+			+		+
<i>R. ardua</i> var. <i>otaheitensis</i>	+	+		+		
<i>C. tuberculatus</i>	+				+	
<i>H. foliatus bengalensis</i>		+		+		
<i>E. pallida pacifica</i>	+				+	+
<i>A. indicus</i>			+		+	+
<i>M. geminus</i>			+			+
<i>B. indica</i>		+			+	
<i>C. peniculatus</i>	+	+			+	
<i>I. velatus velatus</i>	+				+	
<i>D. bengalensis</i>			+			+
<i>D. coronarius</i>	+	+				
<i>B. ananthakrishni</i>			+			

Table 1. : (Cont'd.)

Name of the genus/species	Sagar Island	Kakdwip	Diamond Harbour	Bakkhali	Frazergunj	Namkhana
	1	2	3	4	5	6
<i>M. simpliricha</i>		+	+		+	+
<i>O. orientalis</i>				+		
<i>O. ramisetosa</i>		+	+			
<i>O. yodai</i>			+	+		+
<i>C. abalai</i>		+			+	
<i>X. seminudus</i>	+		+	+		
<i>Haplozetes</i> sp.	+	+			+	
<i>L. longipluma</i>					+	
<i>E. samsinaki</i>						+
<i>S. bhadurii</i>	+					+
<i>S. natalensis</i>	+			+	+	
<i>S. indicus</i>						+
<i>S. rakhali</i>	+	+			+	
<i>L. palustris</i>	+	+	+			
<i>P. bengalensis</i>	+					+
<i>G. crenata</i>			+	+		+
<i>G. flabellifera orientalis</i>		+			+	+

SUMMARY

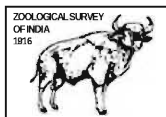
The paper deals with the oribatid mite fauna collected from six different localities like Sagar Island, Kakdwip, Diamond Harbour, Bakkhali, Frazergunj and Namkhana in Sundarban delta of West Bengal during 1977-1978. Altogether 36 soil inhabiting oribatid species pertaining to 28 genera and 21 families have been recorded. The work recorded 11 families 14 genera and 17 species for the first time from Sundarban delta. Key to identification of families and genera dealt in the paper has also been incorporated.

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Rec. zool. Surv. India, **106** (Part-1) : 33-37, 2006

STUDIES ON A NEW SPECIES OF LEECH OF THE GENUS *HAEMADIPSA* (HIRUDINEA : HAEMADIPSIDAE) FROM THE KODAIR FOREST OF TAMIL NADU, INDIA

P.K. BANDYOPADHYAY AND C.K. MANDAL*

Department of Zoology, University of Kalyani, Nadia, West Bengal

INTRODUCTION

Leeches belong to the Class Hirudinae of Phylum Annelida. *Hirudin* an anti-coagulant present in the salivary glands of leeches help them in sucking the blood of living organisms. It commonly parasitize on Molluscs, Fishes, Amphibians, Reptiles and Mammals, thus controlling their populations. Leech acts as a vector for protozoan parasites. It acts as a causative agent for Trypanosomiasis disease. Leeches are used for medical purposes from time immemorial. More than 312 species of leeches have been described by different authors from India of which 27 species from West Bengal and 21 species from Tamil Nadu were described by Mandal in 2004. Out of five families of leeches available in India, leeches belonging to two families (Hirudidae and Haemadipsidae) have medicinal value. The described new species is collected from Tamil Nadu during summer. Harding and Moore (1924, 1927), Sanjeeva Raj and Gladstone (1981) have contributed a lot to Indian science by describing many new species of leeches. The pioneer work on taxonomy of leeches was done by Soos (1965). Bandyopadhyay and Mandal (2005) have done some work on taxonomy and ecology of leeches of West Bengal. Blanchard (1917), Soota (1956), Julka and Chandra (1980), Chandra (1983), Ghosh (1998) and Mandal (1996, 2002, 2004) contributed a lot in the taxonomy of Indian leeches.

KEY WORDS : Leech, *Haemadipsa kodairensis* sp. nov., Tamil Nadu, India.

MATERIAL AND METHODS

Whenever leeches were found in the study sites attempts were made to note the population density of these creatures (in or under) per 30 cm² area. After making the collection, they were

*General Non-Chordata Section, Zoological Survey of India, Kolkata-700 016

sorted out. Then placed in a tray with a small quantity of water and were slowly killed by anaesthetizing them with alcohol in which leeches usually die in an extended condition. Just after maceration the leeches were kept in 70% alcohol for permanent preservation to study before maceration begin, they were rapidly passed between the fingers to remove the excess mucus and then straightened out and laid extended side by side in a flat dish. 4% formalin was used as fixative.

OBSERVATION

A new species of leech *Haemadipsa kodairensis* is described from Tamil Nadu (Figs. 1 and 2). It is distinguished in possessing the following characters. One black stripe on the median, dorso anterior region (one third of the body). Papilla all over the dorsal part. Lateral side bear one pair of pseudoline (brownish coloured). Body bears black spots all over the dorsal and ventral region. Length of a full grown preserved specimen is 20 mm width 5 mm. Posterior sucker is 4 mm in diameter. A living specimen becomes double in length at the time of preying. Clitellum is not prominent, stomach three chambered. One pair crop caeca placed posteriorly beside the stomach, vaginal stalk short and caecum rudimental (Table 1).

REMARKS

Of the five species of leeches described so far under the family Haemadipsidae, the present species presented here differs from the other species in respect of body colour, stripe, clitellar region. From the available data it appears that present species also differs from *H. dussumieri* in structure of stomach, caeca, crop, vaginal stalk. Considering all these, the present species is a new one and the name *Haemadipsa kodairensis* is designated.

Holotype : Z.S.I. Reg. No. An. 3257/1, 1 ex., Coll. C.K. Mandal, 18.11.2004, Kodair forest, Tirunelveli, Tamil Nadu, India.

Paratype : Z.S.I. Reg. No. An. 3258/1, 1 ex., Coll. C.K. Mandal, 18.11.2004, Kodair forest (South), Tirunelveli, Tamil Nadu.

SUMMARY

During survey in the Kodair forest of Tamil Nadu a new species of leech of the genus *Haemadipsa* has been observed for the first time in India. The leech measures 20 × 5 mm. Anterior and posterior suckers are present. Clitellum is not prominent. Body is yellowish green in colour. Body bears black spots in dorsal and ventral region.

Table 1 : Showing comparission of *Haemadipsa kodairensis* sp. nov. with other five species of the genus *Haemadipsa* in India.

	<i>H. sylvestris</i>	<i>H. dussumieri</i>	<i>H. montana</i>	<i>H. ornata</i>	<i>H. moorei</i>	<i>Haemadipsa kodairensis</i> sp. nov.
Stripe	Complete, black, number of stripe three	No stripe	Complete, black, number of stripe three	Complete, cream coloured, number of stripe three	Complete, black, chain stripe, from the bottom of first pair of eyes to the base of posterior sucker	Incomplete, black one third of the body length, at dorso anterior region of the body
Marginal stripe	Complete, bright orange	Absent	Complete, pale yellow coloured	Complete, cream	Complete, yellow coloured	Pseudo cream coloured
Colour	Blakish brown	Yellowish, mot- led with black	Dark	Velvately	Dark	Yellowish green
Body length	–	–	–	–	–	20 mm
Breadth	–	–	–	–	–	5 mm
Breadth of anterior sucker	–	–	–	–	–	2 mm
Breadth of posterior sucker	–	–	–	–	–	4 mm
Clitellum	Prominent	Prominent	Prominent	Prominent	Prominent	Not prominent
Breeding season	May-July; eggs 13–15	–	June-July; eggs 5–7	June-July; eggs 3–7	–	–
Stomach	–	One chambered	–	–	–	Three chambered
Caeca	–	Three pairs short on the crop	–	–	–	One pair long beside the stomach
Crop	–	Almost unbranched	–	–	–	Posteriorly branched
Vaginal stalk	–	Long	–	–	–	Short
Distribution	Uttar Pradesh West Bengal Assam, Aruna- chal Pradesh	South India	West Bengal, Sikkim, Aruna- chal Pradesh, Tamil Nadu	West Bengal, Assam	South India, Western Ghats	Tamil Nadu (Kodair forest, District : Tirunelveli)
Altitude	1500-2000 mts	1200 mts	3000 mts	3000 mts	1500–1800 mts	1200 mts
Reerence	Blanchar, 1894	Blanchard, 1917	Moore, 1927	Moore, 1927	Sanjeva Raj and Gladstone, 1981	Present authors

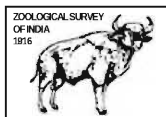
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The authors are thankful to the Director, ZSI for giving permission to one of the authors (CKM) for faunistic survey at Tamil Nadu. Thanks are also due to the Officer-in-Charge, General Non-Chordata Section Z.S.I., Kolkata and H.O.D., Zoology Department, Kalyani University for necessary permission and assistance to carry out the research work. The authors are extending their gratitude to Chief Wild Life Warden Tamil Nadu and the Director, Kalakand Mundanthurai tiger reserve for necessary facilities during collection in the Upper Kodair forest region.

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Rec. zool. Surv. India, **106** (Part-1) : 39-42, 2006

A NOTE ON THE FIRST REPORT OF *MACROBRACHIUM JOSEPHI* JAYACHANDRAN, 2001 OUT OF THE TYPE LOCALITY

K. VALARMATHI AND M. B. RAGHUNATHAN

Southern Regional Station, Zoological Survey of India, Chennai-28

INTRODUCTION

While examining the freshwater prawns deposited in the Southern Regional Station of the Zoological Survey of India, the authors have come across *Macrobrachium josephi* Jayachandran, 2001 (Plate-1), which is known to occur only in Kerala. From earlier reports it is known that nearly 10 species of the freshwater prawns of the genus *Macrobrachium* are available in Tamil Nadu (Raghunathan and Valarmathi, 2005). The species reported are *Macrobrachium aemulum* (Nobili), *Macrobrachium australe* (Guerin-Meneville, 1838), *Macrobrachium canarae* (Tiwari, 1958), *Macrobrachium lamarrei lamarrei* (H. Milne Edward, 1952), *Macrobrachium malcolmsonii* (Milne Edward, 1837), *Macrobrachium nobilii* (Henderson and Matthai, 1910), *Macrobrachium rosenbergii* (de Man, 1879), *Macrobrachium rude* (Heller, 1862), *Macrobrachium scabriculum* (Heller, 1862), *Macrobrachium indicum* Jaychandran et Joseph, 1986. The present study yields one more species of *Macrobrachium* to Tamil Nadu.

MATERIAL EXAMINED

3G and 3E from a rock pool, Medavakkam, Chennai, Tamil Nadu, 09-VII-2004, Coll. : K. Valarmathi.

DIAGNOSTIC CHARACTERS

Rostrum with slight basal crest raised above the orbit and is longer than the antennular peduncle but falls short of the antennal scale. The upper margin of the rostrum is provided with 10 to 13 teeth of which 2 or 3 are located on the carapace, and the lower margin of the rostrum possesses 5–6 teeth. The structure and the arrangement of spines on the rostrum are similar to *Macrobrachium malcolmsonii*. The length of the rostrum is shorter than the carapace (rostrum 0.57 to 0.6 times of

the Carapace). In larger adult males the carapace is scabrous due to the presence of minute prickles. But in females and smaller males the carapace is smooth. Sexual dimorphism is observed based on the II cheliped. In male the second cheliped is very strong and well developed with thick tubercles but in females it is short, slender and smooth. The second cheliped in larger adult males are longer than the total body length (cheliped 1.63 to 1.66 times of the total body length). The fingers are dissimilar, the movable finger is slightly shorter than the immovable finger and is covered with dense pubescence except in the tip, but the immovable finger lacks such pubescence. Both the fingers are slightly curved at the tip and they oppose each other when closed. Both the fingers have two small tubercles which fix when the fingers are closed. Fingers are distinctly shorter than palm (Fingers 0.45 to 0.72 times of the palm). Carpus longer than the finger, palm, merus and ischium but shorter than the chela and the combined length of the merus and ischium. Merus shorter than the palm and carpus but longer than the finger and ischium.

Appendix masculina of the male II pleopod reaches half of the endopod and provided with setae on its entire length.

**COMPARISION OF *MACROBRACHIUM JOSEPHI* AND
MACROBRACHIUM MALCOLMSONII :**

The following table shows the difference between the *Macrobrachium josephi* and *Macrobrachium malcolmsonii*.

<i>Macrobrachium josephi</i>	<i>Macrobrachium malcolmsonii</i>
1. Carapace 1.49–1.73 times longer than the rostrum.	1. Carapace 1.11–1.55 times longer than the rostrum.
2. Carapace of the adult males scabrous due to the presence of minute prickles.	2. Carapace of the adult males smooth.
3. II Cheliped of the adult male. a) Total length of the II cheliped is 1.63–1.66 times of the total body length. b) Finger/Palm = 0.45–0.72. c) Chela/Carpus = 7.35–11.92 d) Movable finger is very densely pubescent. e) Entire cheliped is with well developed strong tubercles. f) Maximum size recorded 193mm (Male)	3. II Cheliped of the adult male. a) Total length of the II cheliped is 0.75–1.09 times of the total body length. b) Finger/Palm = 0.67–0.87. c) Chela/Carpus = 5.98–8.67. d) Movable finger is slightly pubescent. e) Entire cheliped is with poorly developed weak tubercles. f) Maximum size recorded 230 mm (Male)

g) Length of the various proportion of the II cheliped of 184.5 mm male. Finger = 34mm Palm = 76mm Chela = 110mm Carpus = 87 mm Merus = 65 mm Ischium = 36mm Total length of the cheliped = 300. 8mm h) The average % of various proportion of male second cheliped. Finger = 13.86% Palm = 23.01% Carpus = 26.38% Merus = 20.44% Ischium = 14.42% i) The average % of various proportion of female second cheliped. Finger = 13.23% Palm = 18.75% Carpus = 26.53% Merus = 20.89% Ischium = 20.60%	g) Length of the various proportion of the II cheliped of 184.5 mm male. Finger = 34.5m Palm = 47.5mm Chela = 82mm Carpus = 52 mm Merus = 42 mm Ischium = 32mm Total length of the cheliped = 208mm h) The average % of various proportion of male second cheliped. Finger = 16.78% Palm = 21.86% Carpus = 24.96% Merus = 19.96% Ischium = 16.41% i) The average % of various proportion of female second cheliped. Finger = 13.23% Palm = 16.76% Carpus = 28.12% Merus = 21.03% Ischium = 20.89%
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DISTRIBUTION

Veli Lake (Type locality), Kulathoor rivulet (Kerala, India).

REMARKS

Earlier *Macrobrachium josephi* was described by Jayachandran (2001) from Kerala and the maximum size of the species recorded by him is 185 mm. In his account on the Biodiversity, Taxonomy, Biology and Management of Palaemonid prawns Jayachandran (2001) has differentiated *Macrobrachium josephi* from other larger species like *Macrobrachium birmanicum* and *Macrobrachium malcolmsonii*. For the first time *Macrobrachium josephi* is recorded outside Kerala from Tamil Nadu. Also it is worthy to mention that the maximum size recorded during the present study is 193 mm. this will form the largest specimen of the species so far reported.

ACKNOWLEDGEMENT

The authors are thankful to the Director, Zoological Survey of India and the Officer-in-Charge Southern Regional Station, Zoological Survey of India Chennai for encouragement and facilities. We gratefully thank Dr. K. V. Jayachandran for critically going through a draft of manuscript and giving valuable suggestions. Also thanks are due to Mr. G. Shankar, Photographer, Southern Regional Station, Zoological Survey of India, Chennai.

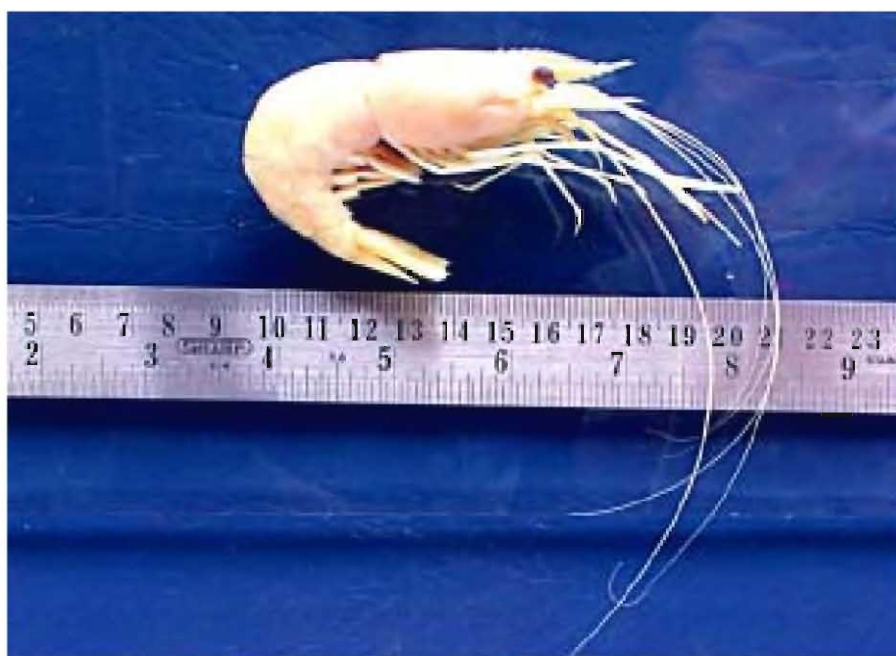
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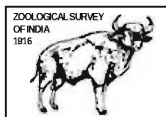
PLATE



Macrobrachium josephi Jayachandran, 2001 (Male)



Macrobrachium josephi Jayachandran, 2001 (Female)



Rec. zool. Surv. India, **106** (Part-1) : 43-48, 2006

TWO NEW SPECIES OF *PSEUDOTORYMUS* MASI (HYMENOPTERA : TORYMIDAE) FROM INDIA

T.C. NARENDRAN, P. GIRISH KUMAR, S. MANICKAVASAGAM*, SABU. K. THOMAS**
AND R. KANAGARAJ*

*Systematic Entomology Laboratory, Department of Zoology,
University of Calicut, Kerala-673 635*

INTRODUCTION

Members of the genus *Pseudotorymus* Masi are parasitic on gall midges and weevil larvae. They are distributed in Palaearctic, Afrotropical, Nearctic and Oriental regions. From the Oriental region only five species are so far reported. These five species are *P. leguminosae* (Risbec), *P. indicus* (Mani), *P. salemensis* Narendran, *P. harithavarnus* Narendran and *P. amuthae* Narendran (Narendran, 1994, Grissell, 1995 and Noyes, 2004). In this paper two new species are described from South India. Type specimens are deposited in Systematic Entomology Laboratory, Department of Zoology, University of Calicut (DZUC) for the time being but eventually will be transferred to the Western Ghats Regional Station, Zoological Survey of India, Kozhikode (ZSIK).

The following abbreviations are used in the text : DZUC–Department of Zoology, University of Calicut; F1-F7–Funicular segments 1 to 7; MV–Marginal vein; OOL–Ocellocular distance; PMV–Postmarginal vein; POL–Postocellar distance; SMV–Submarginal vein; STV–Stigmal vein; T1–Gastral tergite 1; ZSIK–Western Ghat Regional Station, Zoological Survey of India, Kozhikode.

***Pseudotorymus annamalaicus* Narendran sp. nov.**

(Figs. 1-4)

Holotype : Female : Length 4.51 mm. Liver brown with metallic violet blue and green reflections on head, dorsum of mesosoma and parts of gaster; eyes brick red; ocelli reflecting pale yellow; antenna with scape and pedicel pale yellow, remaining segments slightly darker; all tibiae and tarsi

* *Department of Entomology, Faculty of Agriculture, Annamalai University, Tamil Nadu-608 002*

** *Department of Zoology, St. Joseph's College, Devagiri, Calicut, Kerala-673 008*

pale yellow; ovipositor sheath pale brown; ovipositor pale yellow. Wings hyaline, veins pale yellow; pubescence silvery.

Head : Width in dorsal view (Fig. 3) a little wider than 3.3x its median length; its width in anterior view (Fig. 2) about 1.2x as wide as its length; frons and vertex rugoso-reticulate, with moderately dense pubescence; scrobe rugulose-shine, reaching front ocellus, deep, margins ecarinate; interantennal projection with pubescence; area below antennal toruli with a broad median ridge. Occipital carina distinct, its lateral edges extending down to hypostoma; POL 3.33x OOL; clypeal margin entire; malar sulcus complete. Antennal formula 11173 (Fig. 1); scape not reaching front ocellus. Relative length : width of antennal segments : scape = 30:7; pedicel = 12:8; F1 = 8:9; F2 = 8:9.5; F3 = 8:9; F4 = 8:9.2; F5 = 9:10.5; F6 = 9:12; F7 = 7.8 : 12.5; clava = 20:13.

Mesosoma : (Fig. 1) Length subequal to metasoma; dorsum strongly punctate and reticulate; prepectus smooth; mesepisternum reticulate; mesepimeron smooth and shiny with a median transverse groove; median length of pronotum a little more than half length of mesoscutum; notauli distinct and complete; scutellum a little shorter than mesoscutum, a little longer than its maximum width, apex rounded; frenal line distinct; frenal area similarly sculptured as that of scutellum; propodeum with weak median carina, surface weakly reticulate, spiracle oval, spiracular sulcus indistinct. Forewing length a little more than 2x its maximum width. Relative lengths of forewing veins : SMV 75; MV 55; STV 8; PMV 13. Hind coxa dorsally reticulate with a few widely spaced dorsal setae; hind femur (Fig. 4) with dorsal and ventral margins subparallel, length a little more than 3x its maximum width, ventral margin slightly and faintly serrate; hind tibia with two distinct straight spurs at apex.

Metasoma : (Fig. 1) posterior margin of T1 sinuate medially; length of ovipositor 2x length of gaster.

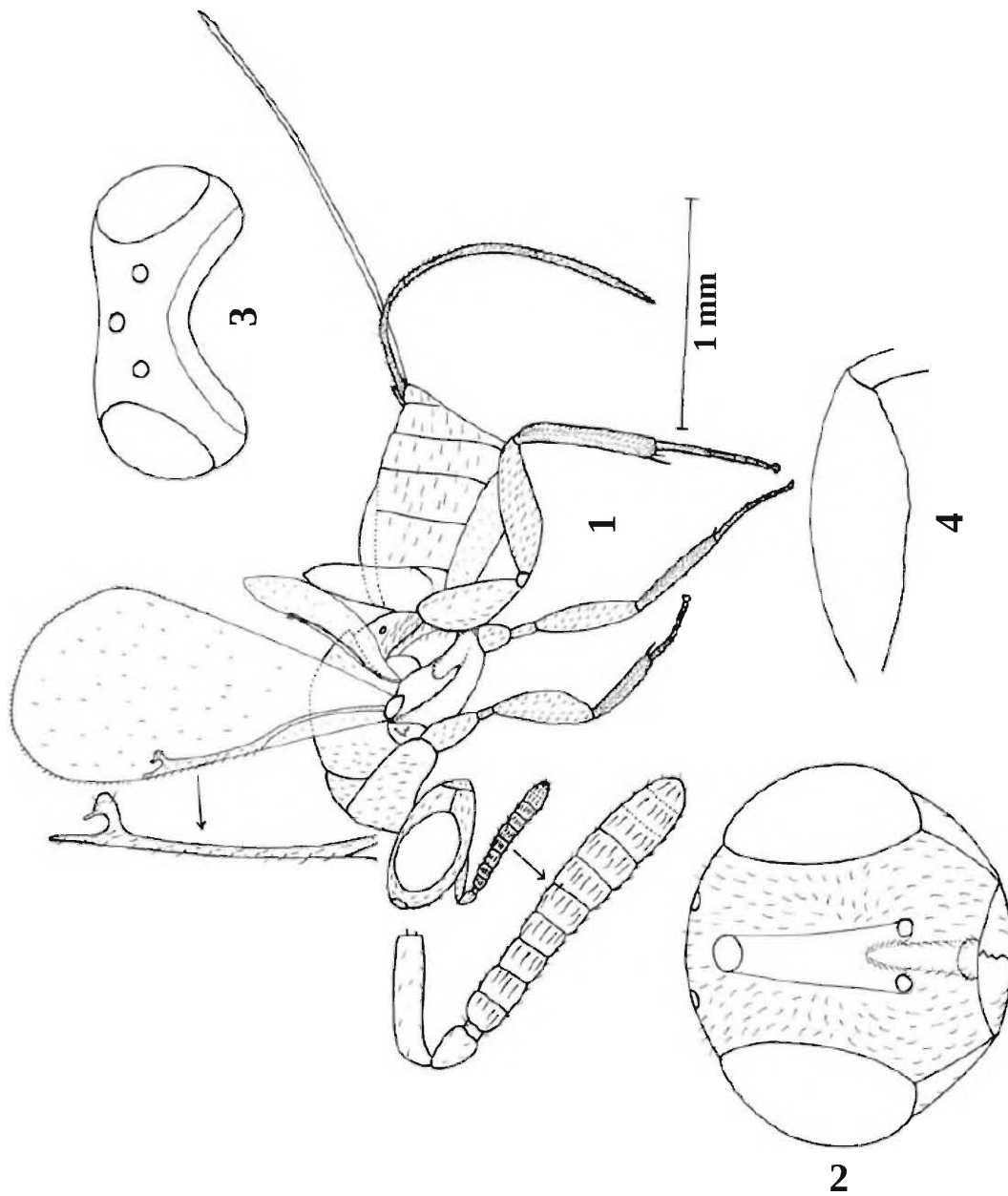
Male : Unknown.

Host : Unknown.

Holotype : Female, INDIA : Tamil Nadu, Annamalai (12°18' N; 79°4' E), 10.X.2000, Coll. R. Kanagaraj (DZUC).

Etymology : The species is named after its collection locality.

Discussion : This new species does not fit in the key to species of *Pseudotorymus* published by Narendran (1994). *Pseudotorymus amuthae* Narendran comes near this new species in general appearance but differs from it in having : (1) length of ovipositor 1.1x length of gaster (in *P. annamalaicus* length of ovipositor 2x length of gaster); (2) scutellum wider than its length (in *P. annamalaicus* scutellum longer than its width); (3) metallic green colour well pronounced (not well pronounced in *P. annamalaicus*); (4) MV about 2.4x as long as PMV (in *P. annamalaicus* MV 4.23x as long as PMV) and in several other features.



Figs. 1-4. : *Pseudotorymus annamalaicus* Narendran sp. nov. Female;

1. Body profile;
2. Head front view;
3. Head dorsal view;
4. Hind femur.

***Pseudotorymus grisselli* Narendran and Girish Kumar sp. nov.**

(Figs. 5-8)

Holotype : Female : Length 2.65 mm; head and mesosoma brownish black with metallic green reflections, gaster brown with blackish brown and green reflections on dorsum; eyes blackish brown, ocelli reflecting yellowish brown; antenna with scape yellowish brown, pedicel and anellus blackish brown, remaining segments darker; all coxae concolourous with mesosoma, all trochanters and femur blackish brown, fore and mid tibia pale brown, paler towards apex, hind tibia and all tarsi except apices pale brownish white, apical tarsi and claws pale brown; ovipositor sheath dark brown; ovipositor pale yellowish brown with apices brown. Wings hyaline, forewing veins pale yellowish brown except marginal vein yellow; pubescence silvery.

Head : Width in dorsal view (Fig. 7) 3.23x its median length; its width in anterior view (Fig. 6) about 1.34x as wide as its length; frons and vertex rugose-reticulate, with scattered pubescence; scrobe rugulose-shiny, not reaching front ocellus, basal region deep, margins not carinate; interantennal projection with pubescence; area just below antennal toruli with a slight ridge; occipital carina not distinct; POL 3.5 × OOL; clypeal margin with a faint notch in middle; malar sulcus complete. Antennal formula 11173 (Fig. 5); scape not reaching front ocellus. Relative length : width of antennal segments : scape = 27:5.5; pedicel = 10:5; F1 = 10:10; F2 = 9.5:11; F3 = 9:11; F4 = 7.5:11; F5 = 7.5:11; F6 = 6.5:12; F7 = 6:12; clava = 21.5:12.

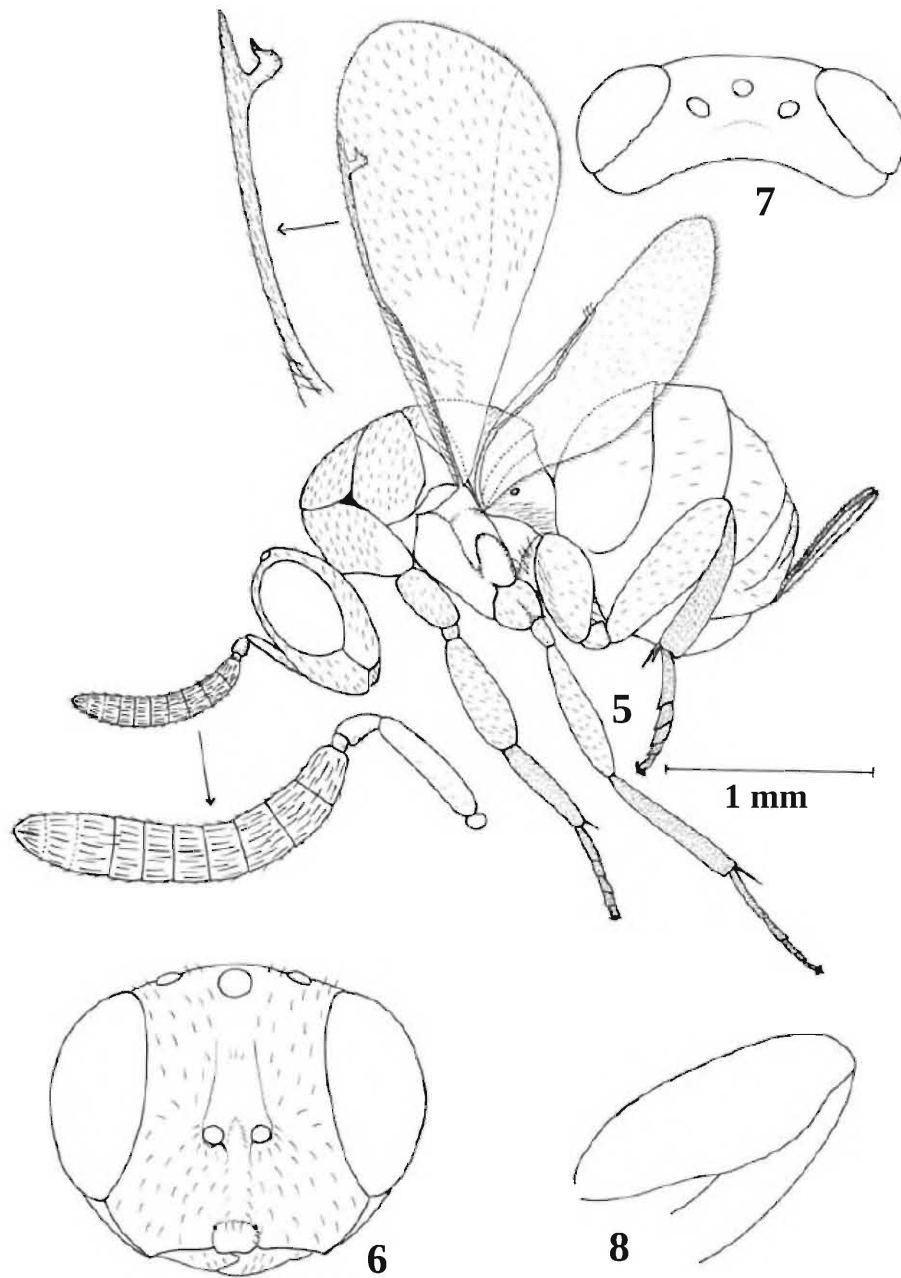
Mesosoma : (Fig. 5) length subequal to metasoma; dorsum strongly punctate and reticulate; prepectus and mesepisternum reticulate; mesepimeron with a median transverse groove, smooth and shiny except lateral sides of lower half near to mesepisternum reticulate; median length of pronotum 0.14x mesoscutum; notauli distinct and complete; scutellum 0.73x shorter than mesoscutum, 0.86x longer than its maximum width, apex rounded; frenal line distinct, frenal area similarly sculptured as that of scutellum; propodeal surface finely reticulate, spiracle oval, spiracular sulcus indistinct. Forewing length 2.11x its maximum width. Relative lengths of forewing veins : SMV 41; MV 27; STV 6; PMV 6.5. Hind coxa strongly reticulate dorsally with a few widely spaced dorsal setae. Hind femur (Fig. 8) with dorsal and ventral margin subparallel, length 3.4x its maximum width, ventral margin slightly and faintly serrate; hind tibia with two distinct straight spurs at apex.

Metasoma : (Fig. 5) posterior margin of T1 sinuate medially; length of ovipositor 0.61x length of gaster.

Male : Unknown.

Host : Unknown.

Holotype : Female, INDIA : Kerala, Wayanad Dt., Thirunelli (11°41'N; 76°16'E), shola forest, 17.xii.2003, Coll. Sabu K. Thomas (DZUC).



Figs. 5-8. : *Pseudotorymus grisselli* Narendran and Girish Kumar sp. nov. Female;

- 5. Body profile;
- 6. Head front view;
- 7. Head dorsal view;
- 8. Hind femur.

Etymology : The species is named after Dr. E.E. Grissell, US Department of Agriculture, National Museum of Natural History, Washington D.C., USA for his significant contributions to the study of Chalcidoidea.

Discussion : This species does not fit in the key to species of *Pseudotorymus* published by Narendran (1994). *Pseudotorymus indicus* (Mani) comes near this new species but differs from it in having : (1) hind femur with subapical tooth distinct (in *P. grisselli* hind femur without subapical tooth); (2) propodeum smooth (in *P. grisselli* propodeum finely reticulate); (3) ovipositor almost equal in length to that of gaster (in *P. grisselli* ovipositor distinctly shorter than that of gaster (0.61x) and in several other features.

SUMMARY

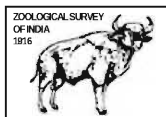
Two new species of *Pseudotorymus* Masi viz., *P. annamalaicus* Narendran sp. nov. and *P. grisselli* Narendran and Girish Kumar sp. nov. are described from India and their affinities are discussed.

ACKNOWLEDGMENTS

We are grateful to the authorities of University of Calicut for facilities.

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Rec. zool. Surv. India, **106** (Part-1) : 49-54, 2006

**DESCRIPTION OF TWO NEW SPECIES OF SPIDERS OF THE
GENUS *POECILOTHERIA* SIMON (ARANEAE : THERAPHOSIDAE)
AND *TMARUS* SIMON (ARANEAE : THOMISIDAE) FROM
NALLAMALAI HILLS, EASTERN GHATS, ANDHRA PRADESH, INDIA**

K. THULSI RAO, D.B. BASTAWADE*, S.M. MAQSOOD JAVED AND I. SIVA RAMA KRISHNA

*Ecological Research & Monitoring Laboratories, Nallamalai Hill Ranges, Eastern Ghats,
Project Tiger Circle, Srisailem-518 102, Kurnool Dist., Andhra Pradesh*

1. *Poecilotheria nallamalaiensis* sp. nov.

(Plate-I, figs. 1-8)

General : Body large, fully covered with thick hairs and setae throughout, carapace longer than wide with truncate anterior margin, narrowed posteriorly, all eyes clubbed on median portion of anterior sub-marginal area. Body colour greyish brown to blackish except dorsal median longitudinal greyish band on abdomen, legs striped with whitish-grey to brownish transverse bands. Chelicerae and ventral portion of body completely black.

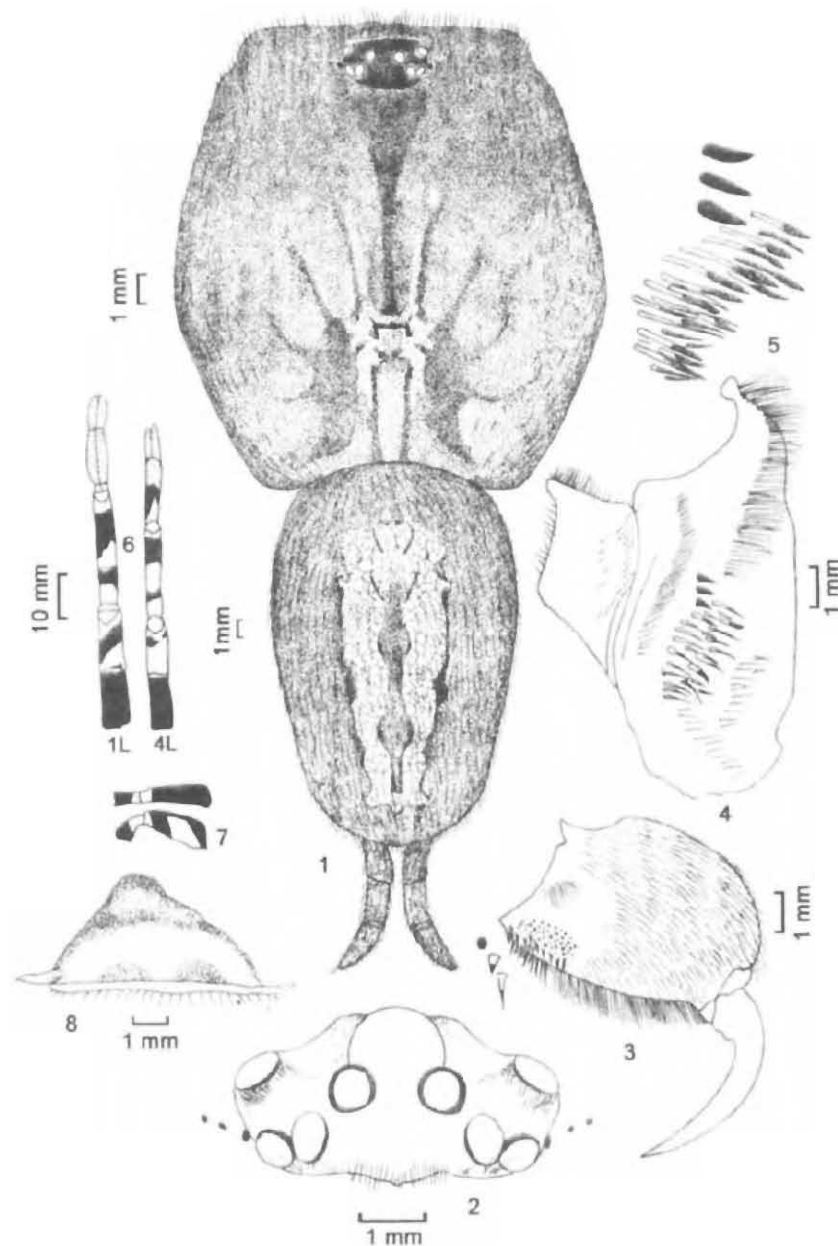
Measurements (in mm) : Total length 38.50. Carapace 21.50 long and 18.25 wide; abdomen 17.00 long and 10.75 wide.

Cephalothorax : Slightly longer than wide, widest in middle portion, narrowing anteriorly as well as posteriorly but more narrowed on posterior portion, anterior margin truncated and fringed with longer and shorter setae, eyes clubbed on sub-median portion of anterior margin, ocular tubercle wider than long, slightly raised, smooth, and with few erect setae on posterior portion, anterior row of eyes procurved and medians larger and directed upwards while laterals directed anterio-lateral wards; posterior row slightly recurved, medians shifted near to laterals, medians directed upwards while laterals to postrio-lateral directions (Fig. 2); ocular tubercle continued posteriorly into a median smooth and obsolete stripe and ending into a median transverse fovea; median

E-mail : ermlabs_srisailem@yahoo.co.in

*Zoological Survey of India, Western Regional Station, Pune-411 044, Maharashtra

PLATE I



Figs. 1-8 : *Poecilotheria nallamalaiensis* sp. nov. 1. Female dorsal view (legs omitted). 2. Median ocular area, dorsal view. 3. Chelicera, inner view showing arrangement of teeth. 4. Prolateral face of the maxillae (Coxa of pedipalp) showing arrangements of stridulating organ. 5. Stridulating organ, close view. 6. First and fourth leg, ventral view. 7. Femur, lateral and dorsal view. 8. Internal genitalia, dorsal view.

portion slightly raised and sloping down to lateral margins with few moderate radial furrows. Labium small, almost as long as wide, rounded anteriorly and thickly scopulate; maxillae (coxae of palps) smooth ventrally, profusely scopulate on prolateral margin, prolateral face with irregularly placed bacilliform as well as pointed setae and also with 3 distally placed black, blunt peg like tubercles (Fig. 4 & 5) (placed closer to each other than in any known species of *Poecilotheria*). Cephalothoracic sternum longer than wide, narrowed posteriorly and with a pair of elongated brownish sigillae on posterior portion. Chelicerae totally black, profusely hairy and hairs longer and tougher on dorsal portion, outer face clear, smooth on 1/3 proximal lower portion except a bunch of delicate and elongated whitish setae on upper portion (Fig. 3), stridulating organ situated at lower basal portion with few (5-6) short, stout pointed tubercles and group of granules forming rough portion unlike in any other *Poecilotheria* species. Palpal coloration : Trochanter whitish on dorsal portion while black on ventral, femur whitish on dorsal and outer portions with elongated smooth brown hairless streak mark, but ventral portion darker; patellae whitish with a black patch on ventral anterior portion; tibiae whitish dorsally but darker ventrally; tarsi black with thick Peacock greenish blue pad ventrally. Legs I-IV : I & IV coloration as on {Figs. 6 (1L & 4L) & 7} II & III almost similar to I in coloration, but short, metatarsi and tarsi fully scopulate, poorly divided in middle with sparsely placed longer setae, scopulae with shining Peacock-greenish-blue color to source of light, legs IV scopulate 2/3 distally, medially divided; tarsi fully scopulate weakly divided medially with longer setae placed sparsely; tarsi I-IV provided mid dorsally with longer brownish setae directed outwards and distally.

Abdomen : Longer than wide with a typical light greyish to black foliage on mid-dorsal portion but without transverse darker lines (Fig.1), with longer brownish setae on lateral portion, totally black on ventral portion. Spermathecae single undivided roughly dome shaped, unlike in other *Poecilotheria* species, 1/3 anterior portion thickened and with pair of half spherical structures at base (Fig. 8).

Type-Specimen : *Holotype* : 1E in spirit, genitalia dissected and kept in separate vial, Coll. K. Thulsi Rao & S.M. Maqsood Javed, 26.7.2003.

Type-Locality : Nallamalai Hills, Eastern Ghats, Nagarjunasagar Srisailem Tiger Reserve, Prakasam Dist., Andhra Pradesh, INDIA.

Discussion : *Poecilotheria nallamalaiensis* sp. nov. shows close resemblance to *Poecilotheria formosa*, *P. fasciata* and *P. miranda* but differs from these as :

1. It resembles with *P. formosa* in color pattern on Legs I & IV but it differs in having 3 black, blunt tubercles on prolateral face of maxillae instead of 1 and also the stridulating organ on outer face of chelicerae with few short pointed tubercles and remaining with granular beaded structure unlike in *formosa*.

2. It resembles with *P. miranda* in having 3 black blunt tubercles on prolateral face of maxillae but differs in not having same color pattern on Legs I & IV and also a different shape of spermathecae.
3. It resembles with *P. fasciata* in having undivided spermathecae but it differs in having different type of stridulating organ and different number and placement of peg like bacilliform setae.

Poecilotheria nallamalaiensis sp. nov. in general differs in having different pattern of abdominal color and Peacock-greenish-blue color tarsal scopulae on legs I & IV and posterior median eyes larger than posterior laterals.

All these characters show distinction from all known *Poecilotheria* species known from India.

Etymology : The new species has been named after the type locality noun Nallamalai adding *ensis* as suffixe i.e., *Nallamalaiensis*.

2. *Tmarus srisailamensis* sp. nov.

(Plate-II, figs. 1-5)

General : Female, Cephalothorax brownish black with sub lateral black band, legs yellowish-black, abdomen greyish with few black stripes.

Measurements (in mm) : Total length 8.5, Cephalothorax 3.5 long, 2 wide, Abdomen 5 long, 3 wide, 2 high.

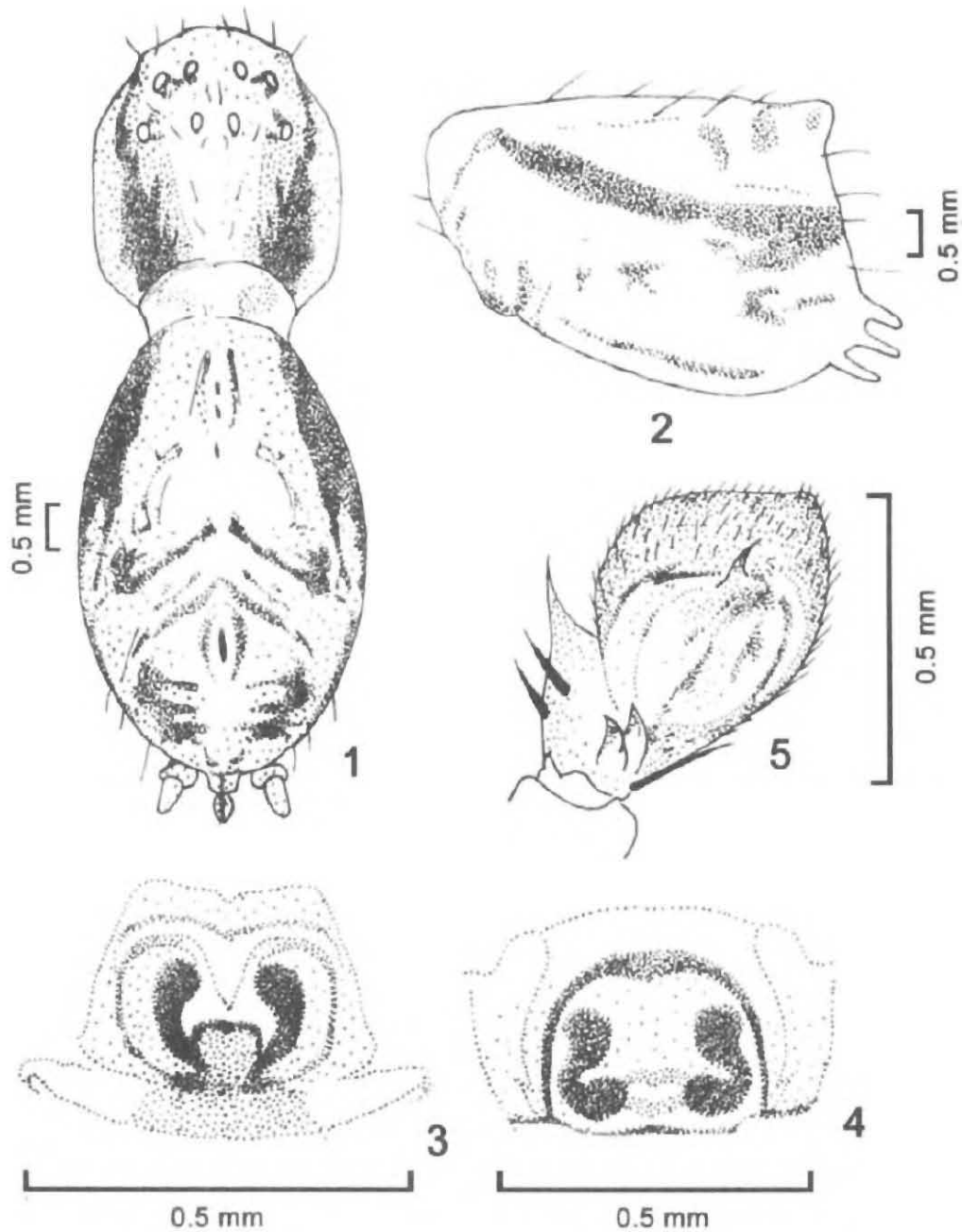
Cephalothorax : Longer than wide, clypeus narrowed and slightly high and margin armed with 7 spines, median portion upward, directed, others forwardly, Cephalic region moderately raised, both rows recurved, lateral eyes larger and situated on stalk, ocular quadrangle longer than wide, anterior medians smaller than posterior, median ocular area, wider anteriorly than behind (Fig. 1), legs formula 2143 tibiae I and II armed with 4 and 3 pairs of ventral spines.

Abdomen : High, pointed behind (Fig. 2), almost pentagonal viewed dorsally, broadest behind the middle, not much narrowed posteriorly; armed with backwardly directed spines; anterior lateral black patch prominent, two pairs of lateral transverse blackish bands faint. Epigyne (Fig. 3) different than from known Indian species as in text (fig. 4).

Male : Much smaller than female total length 5 mm, Cephalothorax 2 mm long, abdomen 3 mm long, male palp with a pair of inner apophysis and strong apophysis, cymbium rounded with a spine at anterior portion (Fig. 5).

Type Specimen : *Holotype* : 1E, *Allo-paratype* : 1Γ in spirit, female genitalia has been dissected and kept in separate vial., *Paratypes* 12EE, 18IT. All specimens have been collected from nest of dauber wasp.

PLATE II



Figs. 1-5 : *Tmarus srisailamensis* sp. nov. 1. Female dorsal view (legs omitted). 2. Abdomen, lateral view. 3. Epigyne, dorsal view. 4. Internal genitalia, dorsal view. 5. Dorso-lateral view of palpal organ of male.

Type locality : Sundipenta and Srisailam, Nagarjunasagar Srisailam Tiger Reserve, Kurnool Dist., Andhra Pradesh, India.

Discussion : Only five species of *Tmarus* Simon known from India. *Tmarus srisailamensis* sp. nov. resembles with *Tmarus kotigeharus* Tikader but it differs from it as :

1. In having the less raised posterior portion of abdomen and raised portion ends into a blunt tubercular form instead of plain hump.
2. Lateral portion of abdomen with a continuous black stripe which is almost faint and broken in the case of *Tmarus kotigeharus*.
3. Genitalia provided with a pair of dark “comma” marks joining on posterior portion where as it is an inverted “E” shape in *Tmarus kotigeharus*.

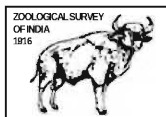
Etymology : The specific name of species has been derived from the type locality Srisailam adding ensis as suffixed i.e., *Srisailamensis*.

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Rec. zool. Surv. India, **106** (Part-1) : 55-61, 2006

ODONATA (INSECTA) OF THE UNION TERRITORY OF PONDICHERRY, INDIA

K.G. EMILIYAMMA AND C. RADHAKRISHNAN

*Western Ghats Field Research Station, Zoological Survey of India,
Calicut-670 002, Kerala, India*

INTRODUCTION

The Union Territory of Pondicherry, India comprises of four coastal regions, viz. Yanam, Pondicherry, Karaikal and Mahe. While Yanam, Pondicherry, and Karaikal are situated along the Coromandel Coast on the eastern side of India, Mahe lies along the Malabar Coast on the Western side of the country. Put together, the Union territory of Pondicherry covers an area of 492 sq.km.

There has been no reference to the Odonate fauna pertaining to the union territory of Pondicherry in scientific literature (Fraser, 1931, 1933, 1934, 1936; Prasad & Varshney, 1995). The present study is based on the collections made by the Scientists of Zoological Survey of India, Southern Regional Station, Chennai during 1991, 1992 and 1994. In this paper 15 species of Odonata (Insecta) are reported for the first time from the Union territory of Pondicherry. The materials studied are deposited in the faunal depository of the Zoological Survey of India, Southern Regional Station, Chennai.

SYSTEMATIC LIST

Order ODONATA

Suborder ZYGOPTERA

Family COENAGRIONIDAE

1. *Agriocnemis pygmaea* (Rambur)
2. *Ceriagrion cerinorubellum* (Brauer)
3. *Ceriagrion coromandelianum* (Fabricius)
4. *Ischnura aurora aurora* (Brauer)
5. *Ischnura senegalensis* (Rambur)

Family PLATYCNEMIDIDAE

6. *Copera marginipes* (Rambur)

Family CALOPTERYGIDAE

7. *Vestalis apicalis apicalis* Selys
8. *Vestalis gracilis gracilis* (Rambur)

Suborder ANISOPTERA

Family LIBELLULIDAE

9. *Brachydiplax chalybea chalybea* Brauer
10. *Brachythemis contaminata* (Fabricius)
11. *Diplacodes trivialis* (Rambur)
12. *Neurothemis tullia tullia* (Drury)
13. *Orthetrum pruinsum neglectum* (Rambur)
14. *Orthetrum sabina* (Drury)
15. *Rhyothemis variegata variegata* (Linnaeus)

SYSTEMATIC ACCOUNT

1. *Agriocnemis pygmaea* (Rambur)

1842. *Agrion pygmaeum* Rambur, *Ins. Nevrop.*, : 272.

Material examined : 2 males, Thirunallar (Karaikal), 5.iii.1991; 1 female, Kakayanthopu (Pondicherry), 8.iii.1991; 3 males, 1 female, Mullaiyar river bank (Karaikal), 5.iii.1991, Coll. K.V. Lakshminarayana; 2 males, near Kollidam (Karaikal), 24.iii.1992; 1 male, 1 female, Vedapurinatham farm (Pondicherry), 26.iii.1992; 1 male, 1 female, Uttayanpet (Karaikal), 25.iii.1992; 4 males, 3 females, Thirunallar (Karaikal), 22.iii.1992; 6 exs., Vellaikulam (Karaikal), 23.iii.1992, Coll. K.R. Rao.

Diagnosis : In male, labrum metallic blue, pterostigma pale yellow in forewings, black in hindwings; anal appendages brick red colour; female robust than male, labrum non-metallic; pterostigma pale yellow in both wings.

Distribution : Throughout India.

2. *Ceriagrion cerinorubellum* (Brauer)

1865. *Pyrhosoma cerinorubellum* Brauer, *Verh. zool.-bot. Ges. Wien*, **15** : 511.

Material examined : 2 males, Edannoor (Mahe), 2.ix.1994, Coll. P.T. Cherian.

Diagnosis : In male, abdomen bright red at base and anal ends, black on dorsum in between; in female, abdomen similar to the male, but the end segments usually a duller brownish red.

Distribution : Throughout India; always-found near ponds, streams and water bodies.

3. *Ceriagrion coromandelianum* (Fabricius)

1798. *Agrion coromandelianum* Fabr., *Ent. Syst. Suppl.*, : 287.

Material examined : 2 males, Kakayanthoppu (Pondicherry), 8.iii.1991, Coll. K.V. Lakshminarayana; 1 male, Kakayanthoppu (Pondicherry), 19.iii.1992, Coll. K.R. Rao; 1 female, Botanical garden (Pondicherry), 20.iii.1992, Coll. K.R. Rao.

Diagnosis : In male, abdomen bright citron-yellow, without markings; in female, abdomen uniformly olivaceous, with an ochreous or golden brown tint on dorsum.

Distribution : Throughout India; breeds in weedy ponds and tanks.

4. *Ischnura aurora aurora* (Brauer)

1858. *Agrion delicatum* Hagen, *Verh. zool.-bot. Ges. Wien*, Vol. viii, : 479.

Material examined : 1 male, Sedarpet (Pondicherry), 9.iii.1991, Coll. K.V. Lakshminarayana; 1 male, 1 female, Thirunallar (Karaikal), 22.iii.1992, Coll. K.R. Rao.

Diagnosis : Wings with pterostigma kite-shaped, rose-red for its proximal half, hyaline for the distal in forewing, in hind-wing, much smaller than forewing, uniform pale grey, almost colourless, segments 1 to 6 of abdomen, citron-yellow, extreme base of segment 7 and 8 to 10 entirely azure blue on dorsum, segment 10 with a broad black spot and a bifid dorsal apical tubercle.

Distribution : Throughout India.

5. *Ischnura senegalensis* (Rambur)

1842. *Agrion senegalensis* Ramb., *Ins. Nevrop.*, p. 276; 1850. Selys, *Rev. Odon.*, : 186.

Material examined : 1 male, Kakayanthoppu (Pondicherry), 19.iii.1992, Coll. K.R. Rao.

Diagnosis : Wings with pterostigma in fore-wing, oblique, diamond shaped, black, outer angle and costal border white, tinted with blue on upper surface of wings, pterostigma of hind-wings smaller than that of fore-wings, uniform pale brown framed in heavy black nervures, second abdominal segment metallic blue on dorsum, segments 3 to 7 citron-yellow at the sides, black on the dorsum, segment 8 azure blue, narrow black at base, 9 and 10 black on dorsum.

Distribution : Throughout India.

6. *Copera marginipes* (Rambur)

1842. *Platycnemis marginipes* Ramb., *Ins. Nevrop.* : 240.

Material examined : 1 female, Edannoor (Mahe), 2.ix.1994, Coll. P.T. Cherian.

Diagnosis : In male, legs bright orange, the posterior two pairs of tibiae moderately broadly dilated; superior anal appendages one-fourth the length of inferiors; in female, legs brownish white or carneous, tibiae not dilated; posterior lobe of prothorax without spines.

Distribution : Throughout India.

7. *Vestalis apicalis apicalis* Selys

1873. *Vestalis apicalis* Selys, *Bull. Acad-Belg.* (2) vol. xxxvi, 612.

Material examined : 1 male, 3 Kms. from Mahe on Thalassery road (Mahe), 3.ix.1994, Coll. P.T. Cherian.

Diagnosis : Thorax and abdomen brilliant metallic green coloured, labrum yellow, marked with black; tips of wings black; pterostigma absent in all wings.

Distribution : Throughout India.

8. *Vestalis gracilis gracilis* (Rambur)

1842. *Calopteryx gracilis* Rambur, *Ins. Nevrop.* : 224.

Material examined : 1 female, Edannoor (Mahe), 2.ix.1994, Coll. P.T. Cherian.

Diagnosis : Wings hyaline, two rows of cells between Cu₁ and IA veins. Other characters are same as in *V. apicalis*.

Distribution : Throughout India.

9. *Brachydiplax chalybea chalybea* Brauer

1868. *Brachydiplax chalybea* Brauer, *Verh. Zool.-bot. Ges. Wien*, vol. xviii, : 173, 725.

Material examined : 1 male, 3 Kms. from Mahe on Thalassery road (Mahe), 3.ix.1994, Coll. P.T. Cherian.

Diagnosis : Frons above and vertex metallic blue; occiput black with a germinate yellow spot behind; thorax heavily pruinose white on dorsum; wings hyaline, bases of all wings with golden brown spots at the level of second antenodal and extending nearly to tornus in hind-wing.

Distribution : Assam, West Bengal and Kerala.

10. ***Brachythemis contaminata*** (Fabricius)

1793. *Libellula contaminata* Fabricius, *Ent. Syst.*, vol. ii, : 382.

Material examined : 2 males, fish seed farm at Kanniyakoil (Pondicherry), 26.iii.1992, Coll. K.R. Rao.

Diagnosis : Wings with reddish nervures and bright orange fascia extending from base to near pterostigma in forewing and hind-wing in male; in female, the bright orange fascia seen in the male absent, hind wing very palely tinted with yellow at extreme base.

Distribution : Throughout India.

11. ***Diplacodes trivialis*** (Rambur)

1842. *Libellula trivialis* Rambur, *Ins. Nevrop.* : 115.

Material examined : 1 male, Karasur (Pondicherry), 9.iv.1991, Coll. K.V. Lakshminarayana.

Diagnosis : Adults black marked with yellow or pruinosed blue, legs black in males, in subadults, thorax and legs, greenish yellow with black markings, wings hyaline, cuia in hind-wing widely separated from posterior angle of discoidal cell; female similar with sub adult male; anal appendages creamy white.

Distribution : Throughout India.

12. ***Neurothemis tullia tullia*** (Drury)

1773. *Libellula tullia* Drury, III. *Exot. Ins.* vol. ii, pl. xlvi, fig. 3, : 85.

Material examined : 2 males, Edannoor (Mahe), 2.ix.1994, 2 females, Pandakkal (Mahe), 2.ix.1994, 2 males, 2 females, 3 Kms. From Mahe on Thalassery road (Mahe), 3.ix.1994, Coll. P.T. Cherian.

Diagnosis : Bases of wings in male broadly black and the black basal area edged outwardly with an opalescent white band; base of wings in female as far as two or three cells distal to node bright amber-yellow and sub basal space from base of wing to node blackish brown broadening at node into a very large blackish brown spot which traverses wings nearly to posterior border.

Distribution : Throughout India.

13. ***Orthetrum pruinsum neglectum*** (Rambur)

1842. *Libellula neglecta* Rambur, *Ins. Nevrop.* : 86.

Material examined : 1 male, 3 kms. from Mahe on Thalassery Road (Mahe), 3.ix.1994, Coll. P.T. Cherian.

Diagnosis : Frons brown or blue black anteriorly; thorax reddish brown; wings hyaline, with a reddish brown basal marking at base of hind-wing; abdomen purple red in adults, vermilion red in sub adults; in female, frons yellowish brown; thorax reddish brown; abdomen, dull ochreous.

Distribution : Throughout India.

14. *Orthetrum sabina sabina* (Drury)

1770. *Libellula sabina* Drury, III. *Exot. Ins.* vol. i, pl. xlvi, fig. 4, pp. 114, 115.

Material examined : 1 male, Edannoor (Mahe), 2.ix.1994, Coll. P.T. Cherian.

Diagnosis : Abdomen enormously swollen dorsoventrally as well as laterally from segment 1 to 3; thorax and abdomen greenish-yellow with black markings.

Distribution : Throughout India.

15. *Rhyothemis variegata variegata* (Linnaeus)

1763. *Libellula variegata* Linnaeus, *Amoenitates Acad.* vol. vi, p. 412.

Material examined : 2 females, fish seed farm at Kanniyakoil (Pondicherry), 26.iii.1992, Coll. K.R. Rao.

Diagnosis : In male, the whole of wings tinted yellow, fore-wings with spots at node, discoidal cell, apex and at middle of Riii; hind-wing with similar dark spots and two broad longitudinal basal bands; in female, fore-wing hyaline from node to apex, basal half with broad black markings, hind-wing with broad irregular markings to as far distal as pterostigma, apex hyaline.

Distribution : Throughout India.

SUMMARY

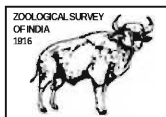
The present paper deals with 15 species and subspecies of Odonata recorded for the first time from the Union Territory of Pondicherry, India.

ACKNOWLEDGEMENTS

The authors are grateful to the Director, Zoological Survey of India, Kolkata and the Officer-in-charge, Southern Regional Station, Zoological Survey of India, Chennai, for facilities and encouragement.

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Rec. zool. Surv. India, **106** (Part-1) : 63-67, 2006

A NEW GENUS OF PTEROMALIDAE FROM SRI LANKA WITH A NOTE ON SYNONYMY (HYMENOPTERA : CHALCIDOIDEA)

P.M. SURESHAN

*Estuarine Biological Station, Zoological Survey of India,
Gopalpur-on-Sea, Orissa-761 002*

INTRODUCTION

Pteromalid fauna (Hymenoptera : Chalcidoidea) of India and the adjacent countries is not isolated from other parts of the world and many interesting taxa are being collected from this part of Asia. As part of the studies on the collection of Pteromalidae received from Bohart Museum of Entomology, University of California, Davis, USA (Sureshan & Narendran, 2004, Sureshan, 2004, Sureshan & Narendran (in press)), I have found an interesting species from Sri Lanka which is found to belong to an undescribed genus. The genus belongs to the subfamily Pteromalinae and tribe Pteromalini showing character states intermediate between *Lyubana* Boucek and *Halticopterella* Girault & Dodd.

While revising *Halticopterella*, I have examined the type of *Lyubana* Boucek and synonymised it under *Halticopterella* (Sureshan, 2001). But later examination of additional specimens of *Halticopterella* and *Lyubana* species revealed that this synonymy is erroneous due to the following reasons. *Lyubana* possesses a neat arched propodeal costula connecting ends of plicae and hence readily reminds *Halticopterella*. *Lyubana* also has the antenna with 3 anelli and 5 funicular segments with flagellum hardly clavate, lower clypeal margin with two teeth, pronotal collar anteriorly carinated, mesoscutum with incomplete notauli *etc.* which are also shared by *Halticopterella*. While synonymising *Lyubana* with *Halticopterella* I had overlooked some of the important character states in *Lyubana* by which it can be readily segregated from *Halticopterella*. Unlike *Lyubana*, in *Halticopterella* the scutellum has a small bare area without pilosity mesoposteriorly, callus of propodeum ending posteriorly by a sharp tubercle, antennae with strip of micropilosity reaching base of second claval segment and gaster with T1 not arcuately produced. In *Lyubana* whole thorax is covered with dense but shorter pubescence without any bare area on

scutellum, propodeal callus ending roundly without any tubercle, micropilosity strip of clava reaching only upto base of third segment and gaster with T1 arcuately produced. Hence *Lyubana* Boucek is maintained here as valid genus (Stat. Rev.) invalidating my former synonymy of it under *Halticopterella*. *Lyubana* Boucek is now known for 4 valid species from the world viz. *L. slavica* Boucek from Yugoslavia, *L. liaoi* Xiao & Huang, *L. longa* Xiao & Huang and *L. prolongata* Xiao & Huang, all from China.

***Neolyubana* gen. nov.**

Type species : Neolyubana noyesi sp. nov.

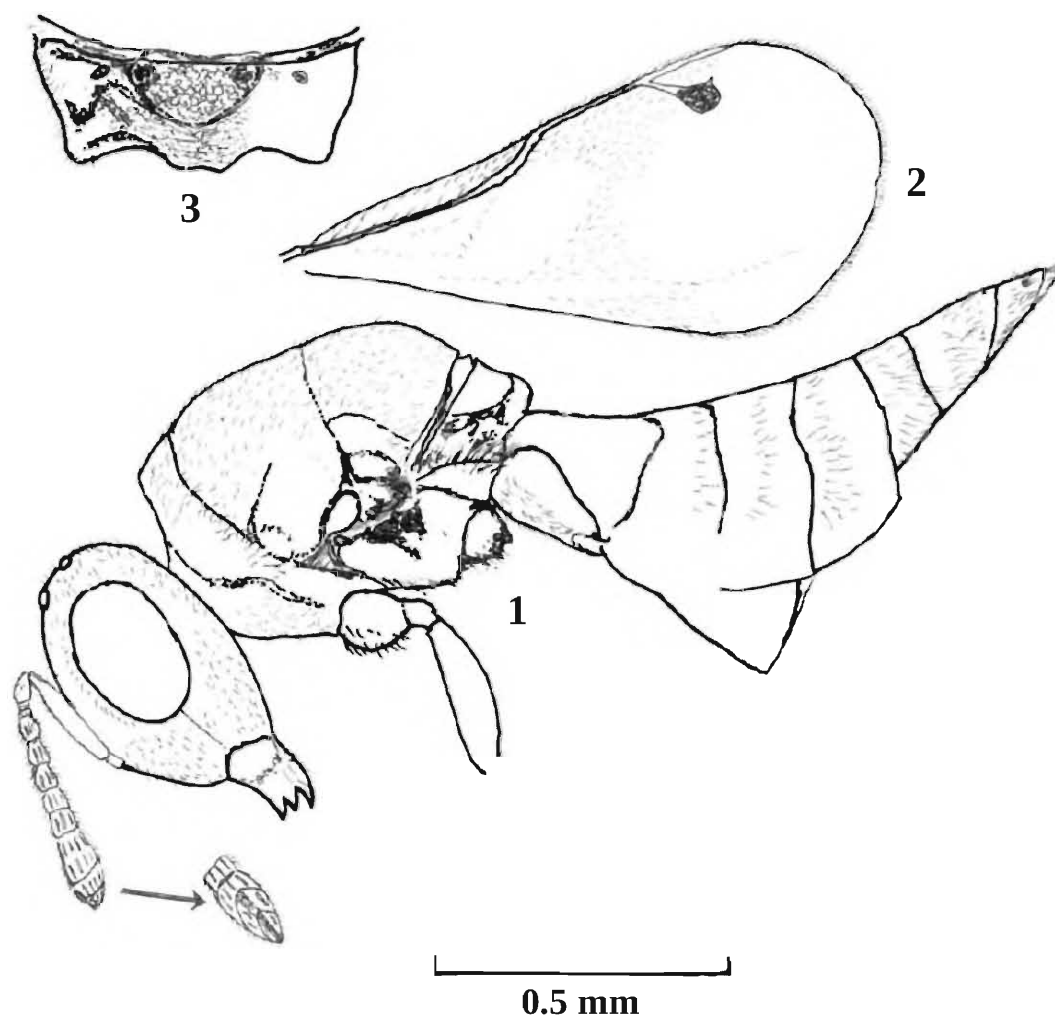
Head and thorax reticulate. Occiput immargined, sharply receding. Clypeal and adjacent areas finely striate, anterior margin of clypeus weakly emarginated. Posterior margin of gena sharp but without carina. Eyes bare. Antennae inserted below middle of face, little above lower margin of eyes; formula 11353; third anellus little wider than others; flagellum distinctly clavate, funicular segments slightly nodose, covered with moderate pubescence each with single row of long sensillae; clava with sutures oblique, micropilosity strip extending upto base of second claval segment.

Thorax : Pronotal collar anteriorly with fine carina, without a smooth strip posteriorly. Mesoscutum with notauli complete, fine and groove like. Scutellum without frenal line. Dorsellum narrow, almost shiny. Propodeum (Fig. 3) constricted to a nucha; plicae distinct, but turning mesad as arcuate costula before reaching nucha, anteriorly inside of each plicae a smooth, elongate fovea; no median carina; post spiracular sulcus shallow; supra coxal flange narrow, arcuate, situated very low. Prepectus as long as tegula, finely reticulate except on margins. Upper mesepimeron and subalar area shiny. Metapleuron shiny, upper and lower margins marked with a transverse elongate fovea. Forewing (Fig. 2) not densely pilose, apical fringe present, basal hair line weakly indicated by few scattered hairs, basal cell with few scattered hairs, speculum open below, cubital setal line distinct, stigma distinctly capitate, almost rectangular. Legs moderately slender but hind coxa broad, dorsally bare, hind tibia with two unequal spurs.

Gaster : Sessile, lanceolate, in dried specimen T1 collapsed and strongly narrowed due to loose attachment laterally to T2; hind margin of T1 distinctly angulate.

***Neolyubana noyesi* sp. nov.**

Holotype : Female : Length 2.5 mm. Head and thorax dark metallic blue, head more blackish; gaster brown with metallic blue reflection; antennae with scape and pedicel testaceous, remainder pale brown; eyes pale chocolate brown; ocelli whitish brown; pubescence on head and thorax white. Tegulae brown, wings hyaline, veins testaceous with stigmal knob brown; pubescence brown. Coxae concolorous with thorax, remainder brown with tarsi testaceous. Mandibles brown.



Figs. 1-3. : *Neolyubana noyesi* sp. n.

Female : 1. Body in profile; 2. Forewing; 3. Propodeum in dorsal view.

Head : Head and thorax with extensive, but short subdecumbent pilosity, individual hairs curved, whitish. Head uniformly and finely reticulate, reticulation coarser on area below median ocellus and parascrobal area. Genae almost shiny. Scrobe moderately deep; toruli separated by their individual diameter; right mandible with 4 and left with 3 teeth; malar sulcus sharp, fine; POL 1.8x OOL. Head 2x as broad as long in dorsal view; temple length 0.4x eye length; eye length 1.4x breadth in profile; malar space almost half of eye length in profile. Antennae with scape not reaching median ocellus, 0.8x as long as eye; pedicel distinctly longer than F1; F1 slightly shorter than F2; F2 and F3 almost equal; F4 and F5 slightly shorter than F3 and as long as F1; clava as long as 3 preceding segments combined.

Thorax : Moderately reticulate. Pronotum 0.87x as wide as mesoscutum. Mesoscutum 1.7x as wide as long. Scutellum as long as broad, similarly sculptured as on mesoscutum. Propodeum (Fig. 3) 2.8x broader than median length, area inside plicae moderately reticulate, except on an anterior strip shiny; nucha finely striate reticulate; spiracle moderate, elongate, close to metanotal border; post spiracular sulcus shallow; callus convex, ending in a blunt conical projection, covered with moderate dense pilosity. Forewing (Fig. 2) 2.11x as long as wide, basal cell with few scattered hairs. Relative lengths SMV 18, MV 11, PMV 9, STV 5.5.

Gaster : Little longer than head and thorax combined (in profile); hind margins of T2 and T3 subangulate, hind margin of T2–T4 with median indentation; hypopygium ending before middle of gaster.

Male and biology not known.

Holotype : Female : Sri Lanka : Central Province, Kandy Dist. Vict. Randenigala Rantembe Sanctuary, N 07°13' E 080°57', 23-30.viii.1999, Coll. MT. M.&J. Washbauer (deposited in Bohart Museum of Entomology, University of California, Davis, USA).

Etymology : *Neolyubana* name from *Lyubana*, owing to the close resemblance of this genus to *Lyubana* Boucek. Name gender is feminine. The species is named in honour of Dr. John. S. Noyes, Natural History, Museum, U.K.

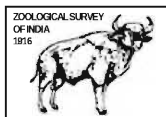
Remarks : This genus closely resembles *Lyubana* Boucek in having a propodeum with neat arched costula connecting ends of plicae, and sharing many other character states like general habitus, body sculpture, pilosity *etc.*, but differs in having a well capitate stigma of forewing, clypeus without teeth, genae posteriorly not carinate, antennae inserted well below center of face which is distinctly clavate, F1 shorter than pedicel with single row of sensillae, clava with sutures distinctly oblique with micropilosity strip down to base of second claval segment, pronotal collar without smooth strip on hind margin, propodeum with adpetiolar margin not thin, nucha finely striate reticulate and no median carina., gaster with T1 distinctly angulate and T2 and T3 subangulate. In the nature of propodeum it also resembles some species of *Halticopterella* but differs from it in the nature of antenna, body pilosity (without a bare strip dorsomedially on scutellum), antennae with micropilosity strip on clava reaching down to second segment.

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Rec. zool. Surv. India, **106** (Part-1) : 69-80, 2006

ZOOPLANKTON OF A SUB-TROPICAL FISH POND OF HIGH RAINFALL REGION OF MEGHALAYA (N. E. INDIA) : COMPOSITION AND ECOLOGY

B. K. SHARMA AND D. WANSWETT

Department of Zoology, North-Eastern Hill University, Shillong-793 022, Meghalaya

INTRODUCTION

Limnological studies in India began nearly one century ago but little is so far known about composition and ecology of zooplankton of sub-tropical aquatic environs of this country in general and that of North-Eastern India in particular. The related works from the state of Meghalaya of the later region are limited to those in an impoundment (Alfred and Thapa, 1995) and two reservoirs (Sharma, 1995; Sharma and Lyngskor, 2003), and fish-pond communities remain unexplored. The present study is, therefore, of special importance in view of the stated lacuna. Besides, it is a pioneering endeavor on zooplankton synecology of a lentic biotope of Cherrapunjee—an interesting place that experiences heaviest rainfall and is yet the wettest desert of India. This communication deals with temporal variations in composition and abundance of zooplankton and their constituent groups with reference to species composition, community similarity, diversity, dominance, evenness and correlations between abiotic and biotic factors.

MATERIALS AND METHODS

The observations were undertaken (May, 1993–April, 1995) in a fish-pond located at Cherrapunjee (Lat. 25°17' N; long. 91°47' E, altitude 1300 m ASL), West Khasi Hills district, Meghalaya. The sampled pond (area : 5000 sq. m), mainly fed with rainwater, is stocked with *Cyprinus carpio* and is devoid of any aquatic vegetation while the marginal plants consist of *Eriocaulon* sp., *Rotala rotundifolia*, *Schaenoplectus* sp., and *Polygonum hydropiper*. Water and plankton samples were collected at regular monthly intervals; the former were analyzed for various abiotic parameters following APHA (1992). Qualitative and quantitative plankton samples, obtained

by a nylobolt plankton net (No. 25) and preserved in 5% formalin, were analyzed for identification of zooplankton and their abundance. Community similarities (Sorensen's index), diversity (Shannon's index), dominance (Berger-Parker's index), and evenness (E I index) were calculated following Ludwig and Reynolds (1988) and Magurran (1988). The significance of temporal variations of plankton was established by ANOVA. Ecological relationships were based on computation of correlation coefficient (r), multiple regression and step-wise regression between biotic and abiotic parameters.

RESULTS AND DISCUSSION

Temporal variations in abiotic factors (Table 1) indicate subtropical nature of the sampled pond, low transparency, moderate dissolved oxygen (saturation : 40.5–75.1, $58.3 \pm 10.4\%$), low free CO₂ and lack of organic pollution (low chloride). This biotope is characterized by low electrolyte content, soft-waters (Ca > Na > Mg > K) and lower nutrient concentrations; such salient features are attributed to leached nature of soil and weathered condition of rocks caused by heavy rainfall (Sharma, 2001) and general degraded environmental nature of the Cherra plateau.

Table 1. : Temporal variations of Abiotic factors

Factors	Range	Mean $\pm$ SD
Rainfall (mm)	8.4–3444.3	1091 $\pm$ 1209.4
Water Temperature (°C)	13.9–21.3	18.5 $\pm$ 2.3
Transparency (m)	0.3–1.0	0.68 $\pm$ 0.20
pH	6.9–8.3	7.6 $\pm$ 0.5
Specific Conductivity (μ S/cm)	30.5–112.0	63.3 $\pm$ 24.7
Dissolved Oxygen (mg/l)	4.4–8.8	6.6 $\pm$ 1.4
Free CO ₂ (mg/l)	2.0–10.4	7.0 $\pm$ 2.0
Alkalinity (mg/l)	12.5–43.5	26.7 $\pm$ 9.2
Hardness (mg/l)	20.8–50.8	32.0 $\pm$ 10.7
Calcium (mg/l)	3.7–12.7	7.6 $\pm$ 2.5
Magnesium (mg/l)	3.7–9.3	5.9 $\pm$ 1.6
Sodium (mg/l)	2.0–11.0	5.9 $\pm$ 2.5
Potassium (mg/l)	1.5–9.0	3.6 $\pm$ 1.7
Chloride (mg/l)	3.8–8.3	6.5 $\pm$ 1.2
Sulphate (mg/l)	0.35–2.35	1.3 $\pm$ 0.7
Phosphate (mg/l)	0.05–0.33	0.16 $\pm$ 0.07
Nitrate (mg/l)	0.04–0.14	0.09 $\pm$ 0.02
Silicate (mg/l)	0.18–1.25	0.58 $\pm$ 0.28

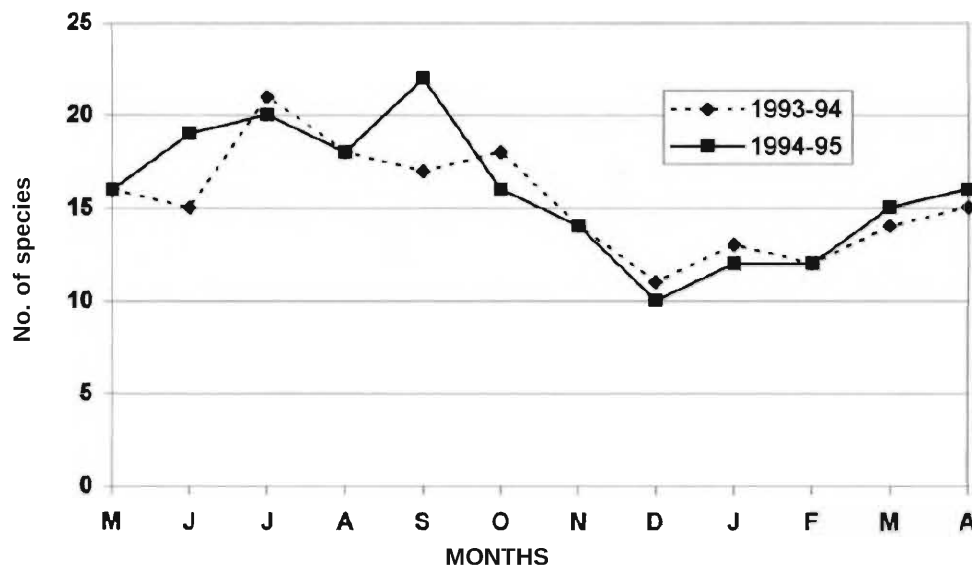


Fig. 1. : Zooplankton richness.

The zooplankton communities (Table 2) of the Cherra pond are less speciose (28 species); these are represented by Rotifera > Cladocera > Rhizopoda > Copepoda > Ostracoda and exhibit dominance of the first two groups. Their lower monthly richness (15 ± 3 species) registers significant differences between months ($F_{11,23} = 8.631$, $p < 0.001$) but records insignificant variations between two annual cycles ($F_{1,23} = 0.702$); the latter aspect is also affirmed by nearly identical annual ranges (Table 2). Zooplankton follow broadly multimodal richness patterns (Fig. 1) in two annual cycles of the study period respectively, exhibit peak values during July, 93 and September, 94 and minima during December. In general, higher richness is noticed during monsoon and lowest during winter. Overall qualitative diversity concurs with the report of Sharma and Lyngskor (2003) but is higher than records from other subtropical biotopes of India (Negi and Pant, 1982; Patil and Gouder, 1985; Alfred and Thapa, 1995; Sharma, 1995). The present results record notable temporal variations in species composition of zooplankton. This conclusion is supported by 43.2–97.1% community similarity (*vide* Sorensen's index) which, in turn, follows almost identical annual ranges (43.2–97.1 and 47.4–93.7%) and shows > 70% similarity in 77.9% instances included in the similarity matrix.

The sampled pond is characterised (Table 2) by lower zooplankton abundance (78–165; 107 ± 24 n/1) with insignificant variations between two annual cycles ($F_{1,23} = 1.549$) and between months ($F_{11,23} = 1.998$) as well as broadly identical annual and mean values. The zooplankton comprise an important component ($40.2 \pm 6.9\%$) of net plankton and significantly influence ($r = 0.664$) their temporal periodicity. The recorded densities are, however, lower than the reports of Bhattacharya and Saha (1986, 1990), Alfred and Thapa (1995) from N. E. India but are relatively higher than

Table 2. : Temporal variations of Zooplankton

	1st annual cycle	2nd annual cycle	Study period
Net Plankton (n/l)	174–372 (282±73)	174–331 (260±48)	174–372 (271±61)
Qualitative : 28 species; Rotifera > Cladocera > Rhizopoda > Copepoda > Ostracoda = Nematoda			
Species richness	11–21	10–22	10–22 (15±3)
% Similarity	43.2–97.1	47.4–93.7	43.2–97.1
Quantative : Copepoda > Rotifera > Cladocera > Rhizopoda > Ostracoda = Nematoda			
Abundance (n/l)	79–165 (113±25)	78–154 (103±22)	78–165 (107±24)
Percentage	29.3–46.7 (40.6±5.4)	25.3–55.0 (39.8±8.4)	25.3–55.0 (40.2±6.9)
Copepoda (n/l)	24–67 (46±13)	33–76 (46±13)	24–76 (46±13)
Percentage	28.6–65.5 (41.9±11.7)	37.6–62.8 (44.4±7.1)	28.6–65.5 (43.2±9.4)
Rotifera (n/l)	13–69 (37±15)	15–68 (32±14)	13–69 (34±14)
Percentage	12.0–45.6 (32.5±10.9)	14.8–44.2 (30.3±18.4)	12.0–45.6 (31.4±9.7)
Cladocera (n/l)	11–46 (26±13)	13–29 (21±6)	11–46 (23±10)
Percentage	11.7–35.4 (22.4±8.9)	13.6–32.2 (21.3±9.5)	11.7–35.4 (21.9±9.2)
Rhizopoda (n/l)	1–10 (3±3)	1–5 (2±2)	1–10 (2±3)
Percentage	0–9.3 (2.4±2.9)	0–5.0 (2.3±1.8)	0–9.3 (2.4±2.2)
Ostracoda (n/l)	2–4 (1±1)	1–6 (1±2)	1–6 (1±1)
Percentage	0–3.7 (0.6±1.1)	0–5.9 (0.8±1.7)	0–5.9 (0.7±1.4)
Nematoda	2–3 (1±1)	1–3 (1±1)	1–3 (1±1)
Percentage	0–2.5 (0.3±0.8)	0–3.0 (0.9±1.3)	0–3.0 (0.6±1.0)
Species Diversity	1.60–2.39 (1.99±0.2)	1.60–2.31 (2.0±0.3)	1.60–2.39 (2.0±0.3)
Evenness	0.65–0.8 (0.74±0.1)	0.55–0.84 (0.73±0.1)	0.55–0.88 (0.74±0.1)
Dominance	0.11–0.29 (0.18±0.1)	0.11–0.28 (0.17±0.1)	0.11–0.29 (0.18±0.1)

the results of Sharma (1995) and Sharma and Lyngskor (2003). The present study registers broadly tri-modal annual patterns of temporal variations and relatively higher zooplankton densities (Fig. 2) during early monsoon and winter season, with peak during October 1993. In addition, they show insignificant direct relationship with phytoplankton ($r = 0.345$), thereby, indicating lack of any grazing impact; this feature, in general, may also be due to lower abundance of the former during the study period.

Of the abiotic factors monitored during this limnological survey, zooplankton interestingly register significant inverse relationship only with free CO_2 ($r = -0.601$). On the other hand, multiple correlation ($R^2 = 0.791$) depicts significant cumulative (nearly 79%) influence of eighteen parameters on their quantitative abundance. The step-wise regression ($R^2 = 0.608$) with twelve abiotic factors

(rainfall, water temperature, conductivity, alkalinity, hardness. Calcium, Magnesium, Chloride, Sulphate, phosphate, nitrate and silicates) restricts their influence to > 60%. Subsequent reduction in number of abiotic attributes, however, significantly lowers their overall ecological impact while five basic factors namely rainfall, water temperature, conductivity, alkalinity and hardness) depict only about 30% influence.

Copepoda, represented by *Mesocyclops* sp. and *Heliodiaptomus* sp., are mainly comprised of the cyclopoids and their nauplii while the calanoids register poor abundance in the examined samples. The copepods constitute a dominant quantitative component of zooplankton ($43.2 \pm 9.4\%$) and, hence, correspond with the reports of Alfred and Thapa (1995), Das *et al.*, (1996), Sharma and Hussain (2001) and Sharma and Lyngskor (2003). Their abundance ranges (Table 2) between 24–76 (46 ± 13) n/l, registers insignificant variations between two annual cycles ($F_{1,23} = 0.024$) and between months ($F_{11,23} = 2.156$) and follows irregular pattern of monthly variations (Fig. 3) with peak abundance in November 1994 and minima in February. On the other hand *Mesocyclops* sp. (18–59; 32 ± 13 n/l) significantly influences temporal variations of this group; it depicts (Table 3) trimodal but different annual patterns and shows peak abundance during autumn (November) in each annual cycle. Occurrence of nauplii throughout the present study period indicates an active reproductive phase as also reported by Das *et al.*, (1996), Sharma and Hussain (2001) and Sharma and Lyngskor (2003). The nauplii register density between 2–34 (11 ± 7 n/l) and exhibit indefinite periodicity of abundance. The Copepoda exert a distinct influence on net

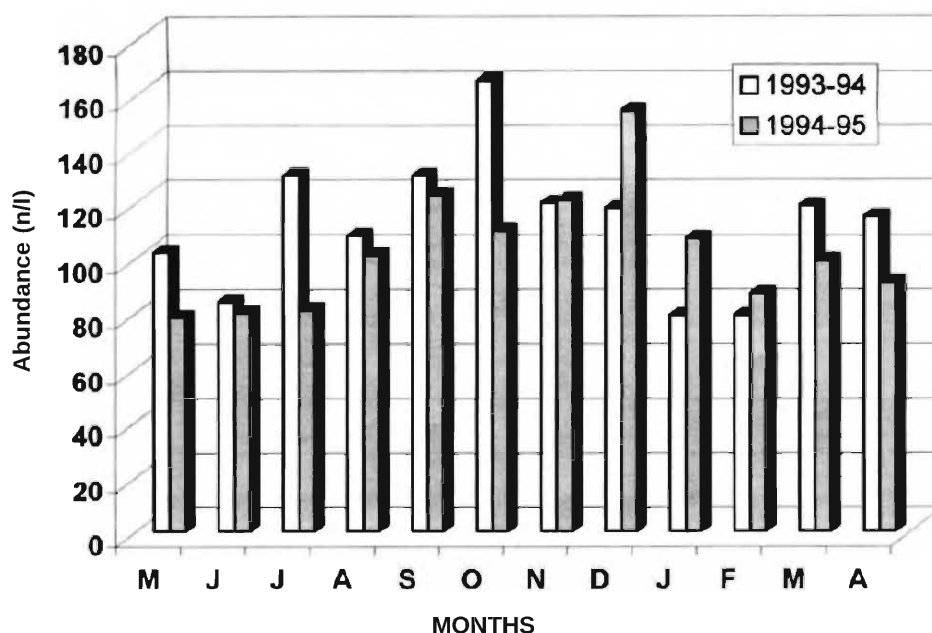


Fig. 2. : Zooplankton abundance.

Table 3. : Monthly variations in Zooplankton abundance (n/l).

	1993								1994												1995			
	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A
ROTIFERA																								
<i>Brachionus angularis</i>	–	–	–	–	–	–	18	30	17	6	13	7	–	–	–	–	–	3	16	46	11	4	10	6
<i>B. quadridentatus</i>	–	–	–	–	–	–	–	–	1	8	2	1	–	–	–	–	–	–	–	1	2	–	–	–
<i>Keratella cochlearis</i>	22	5	–	–	10	54	14	17	10	12	21	8	8	1	4	–	14	18	2	21	15	16	15	15
<i>K. tropica</i>	–	–	–	–	1	–	–	–	–	–	–	–	–	–	1	–	2	–	–	–	–	–	–	–
<i>Euchlanis dilatata</i>	–	–	1	2	–	1	–	–	–	–	–	–	–	1	3	2	–	–	1	–	–	–	–	–
<i>Colurella obtusa</i>	–	–	1	–	–	–	–	–	–	–	–	–	2	–	–	–	1	2	–	–	–	–	1	–
<i>Lepadella patella</i>	–	–	–	2	–	–	1	1	–	–	–	–	–	–	1	2	1	1	1	–	–	–	–	–
<i>Lecane bulla</i>	5	7	4	4	14	–	–	–	1	4	7	5	4	7	4	–	6	–	1	–	2	2	4	5
<i>L. curvicornis</i>	–	–	8	1	7	–	–	–	2	–	–	–	–	3	–	–	–	–	–	2	–	1	–	–
<i>L. lunaris</i>	–	–	4	–	2	3	–	1	1	–	–	–	1	–	1	5	1	1	1	–	–	–	–	–
<i>Trichocerca cylindrica</i>	–	–	5	–	–	2	–	–	–	–	–	–	1	1	2	–	1	–	–	–	–	–	–	–
<i>T. similis</i>	–	2	1	–	1	1	1	–	–	–	–	–	–	–	–	1	2	1	2	–	–	–	–	–
<i>Pleosoma lenticulare</i>	4	–	3	2	–	3	–	–	–	5	2	3	2	–	–	1	6	1	1	–	4	–	2	–
<i>Pompholyx sulcata</i>	–	–	–	–	1	–	–	–	1	1	–	–	–	–	–	1	1	2	–	1	–	–	–	–
<i>Philodina</i> sp.	3	2	3	2	4	5	4	1	–	–	6	4	9	4	8	3	4	–	1	–	2	1	5	9
CLADOCERA																								
<i>Ceriodaphnia reticulata</i>	–	–	2	9	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–
<i>Macrothrix rosea</i>	–	–	–	1	–	1	–	–	–	–	–	–	–	–	4	–	1	2	–	–	–	–	–	–
<i>Alonella excisa</i>	2	1	1	8	9	1	–	–	–	2	2	5	2	2	–	4	2	–	–	–	3	4	1	3
<i>Bosmina longiristris</i>	10	4	2	7	4	32	6	12	14	6	15	16	10	3	2	4	15	14	15	17	13	9	5	7

Table 3. : (Cont'd)

	1993								1994												1995			
	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A
CLADOCERA																								
<i>Chydorus sphaericus</i>	2	3	15	11	33	9	8	4	3	11	14	19	1	12	11	14	11	12	4	4	12	15	11	5
<i>Pleuroxus similis</i>	–	3	–	–	–	–	–	–	–	–	–	–	–	1	2	–	–	–	–	–	–	–	–	–
COPEPODA																								
<i>Mesocyclops</i> sp.	40	43	29	25	23	32	52	44	24	18	27	36	25	20	21	48	28	29	59	52	37	20	33	26
<i>Heliodiaptomus</i> sp.	3	1	4	2	5	–	3	4	2	–	–	–	3	3	2	–	–	4	1	–	–	2	3	3
<i>Nauplii</i>	9	11	34	18	12	17	10	4	2	6	7	10	8	15	10	4	19	17	16	12	5	11	4	9
RHIZOPODA																								
<i>Diffugia oblonga</i>	–	1	3	–	–	–	1	–	–	–	–	–	–	–	2	–	1	–	–	–	–	–	–	1
<i>Centropyxis aculeata</i>	–	–	4	5	–	1	–	–	–	–	–	–	–	2	1	3	–	2	–	–	–	–	–	–
<i>Arcella vulgaris</i>	2	1	2	5	2	3	1	–	1	–	–	1	2	2	1	1	4	1	–	–	–	1	1	1
OSTRACODA																								
<i>Cypris</i> sp.	–	–	2	4	2	–	–	–	–	–	–	–	–	1	–	6	2	–	–	–	–	–	–	–
NEMATODA																								
<i>Nematoda</i>	–	–	2	–	–	–	–	–	–	–	3	–	–	2	–	2	1	–	–	1	–	–	3	1
ZOOPLANKTON	102	84	130	103	130	165	120	118	79	79	119	115	78	80	81	101	123	110	121	154	107	87	99	91

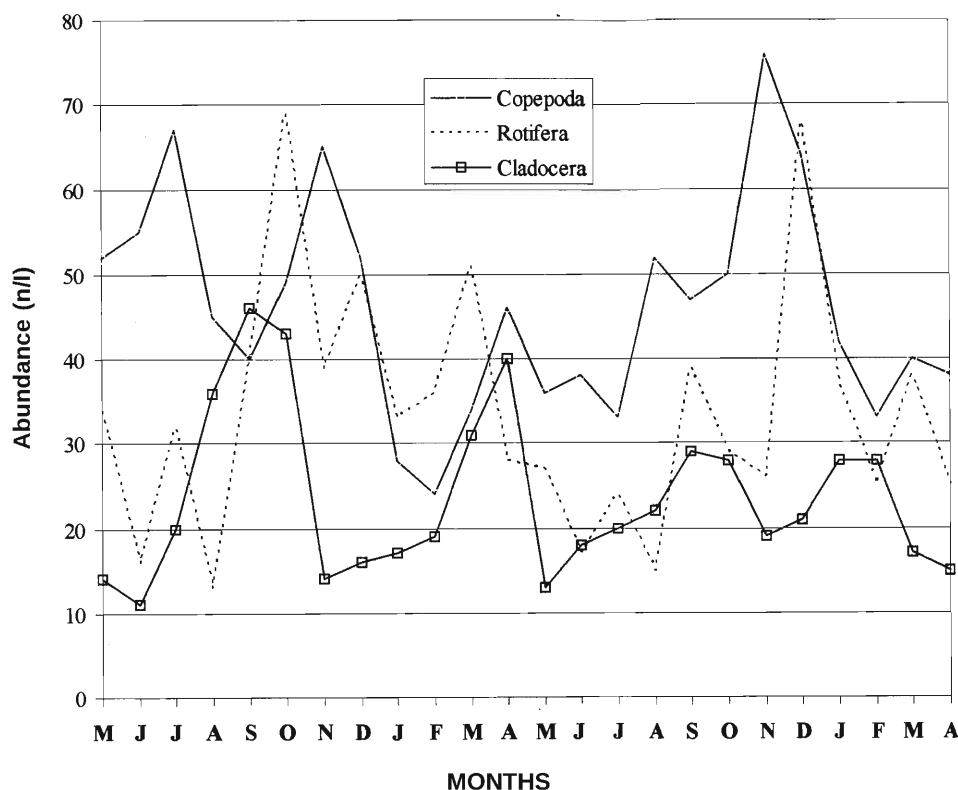


Fig. 3. : Abundance of zooplankton groups.

plankton ($r = 0.419$) and zooplankton ($r = 0.709$) periodicity while this group shows an insignificant direct and inverse relations with Rotifera and Cladocera, respectively. The last aspect indicates lack of resource sharing or competition with the stated two biotic components because of their relatively lower population densities. Among the recorded abiotic factors, high copepod production concurs with the periods of low free CO_2 content ($r = -0.517$) while this group records an inverse correlation with specific conductivity ($r = -0.405$).

Rotifera (Table 2 & 3) show qualitative dominance (15 species) and thus correspond with the results of Zutshi *et al.*, (1980). Their richness is relatively higher than other subtropical water bodies of Meghalaya (Alfred and Thapa, 1995; Sharma, 1995; Das *et al.*, 1996). The present study does not depict any definite trend but in general higher number of species are recorded during monsoon and low during winter. The rotifers depict lower abundance (34 ± 14 n/l) with nearly identical annual ranges and mean abundance. They constitute a sub-dominant quantitative component ($31.4 \pm 9.7\%$) of zooplankton. The rotifers register significant density differences between months ($F_{11,23} = 3.448$, $p < 0.02$) and insignificant temporal variations between two annual cycles ($F_{1,23} = 2.193$). This group, however, does not depict any distinct monthly trend of abundance

which is in contrast to trimodal pattern reported earlier by Sharma (1995). The peak rotifer densities are observed in October 1993 and December 1994 while lowest abundance is noticed during August 1993. Of the documented species, only two species namely *Keratella cochlearis* (13 ± 11 n/1) and *Brachionus angularis* (8 ± 11 n/1) notably influence the rotifer production while *Lecane bulla*, *Pleosoma lenticulare* and *Philodina* sp. are other important taxa. All the stated species, however, exhibit indefinite patterns of occurrence and abundance (Table 3). *K. cochlearis* contributes primarily to the rotifer peak during October, 93. *B. angularis* > *K. cochlearis* result in the rotifer winter maxima (December) in the second annual cycle; the former brachionid is noted in the second half of each year of the study period and shows peak abundance during December (winter) in each year.

The rotifers contribute significantly to temporal variations of zooplankton ($r = 0.709$) but show insignificant influence on net plankton periodicity. They record direct correlation with Dinophyta ($r = 0.554$) and an inverse relationship with Euglenophyta ($r = -0.412$) in the sampled pond. Their insignificant positive relationship with Cladocera indicates lack of competition and is apparently the result of lower densities of these two biotic communities. Among the recorded abiotic factors, the Rotifera exhibit significant direct correlations with dissolved oxygen ($r = 0.614$), magnesium ($r = 0.433$), sulphate ($r = 0.574$) and nitrate ($r = 0.429$) and inverse relationships with rainfall ($r = -0.555$) and free CO_2 ($r = -0.621$).

The Cladocera (6 species), another sub-dominant component (23 ± 19 n/1), depict insignificant variations between two annual cycles ($F_{1,23} = 1.348$) and between months ($F_{11,23} = 1.604$). These micro-crustaceans comprise about 11.7–35.4 (21.9 ± 9.2)% of zooplankton and influence their abundance ($r = 0.528$) as well that of net plankton ($r = 0.520$). The recorded cladoceran density is relatively higher than the reports by Sharma (1995), Das *et al.*, (1996) and Sharma and Lyngskor (2003). This group does not depict any regular pattern of monthly variations but higher density is recorded in October 1993 and minima is noticed in June 1993. This aspect is in contrast to higher density during summer and lower during winter reported earlier from Meghalaya (Sharma and Lyngskor, 2003). The present study does not indicate any significant correlation between the cladocerans and abiotic factors. Among the documented species, only *Bosmina longirostris* (2–32; 10 ± 7 n/1) and *Chydorus sphaericus* (2–33; 10 ± 7 n/1) indicate quantitative importance. These two cladocerans exhibits indefinite periodicity and record their peak densities in October and September respectively during the first annual cycle. In addition, *Alonella excisa* (1–9 n/1) shows limited qualitative importance.

The Rhizopoda, represented by *Arcella vulgaris*, *Centropyxis aculeata* and *Diffugia oblonga* indicate very low abundance (2 ± 3 n/1) but show positive correlations with rainfall ($r_1 = 0.535$) and water temperature ($r_1 = 0.627$). *Cypris* sp., the sole representative of the Ostracoda as well as nematodes exhibit extremely low densities and occasional occurrences.

The zooplankton record lower diversity (1.60–2.39; 2.0 ± 0.3) which, in turn, is apparently influenced by the copepod abundance and that of fewer species of Rotifera and Cladocera. The recorded diversity range is marginally higher than earlier results from Meghalaya (Sharma, 1995; Sharma and Lyngskor, 2003). Highest species diversity is recorded during July 1993 while lower values are recorded during November 1993, August 1994 and December 1994. The present study indicates higher zooplankton evenness (0.74 ± 0.10) which can be attributed to lesser temporal variations in abundance of individual taxa and equitable densities of majority of species. The evenness varies between 0.55 (August 1994) – 0.88 (February 1994) and follows an indefinite pattern. In addition, this study depicts low dominance with mean annual values of 0.18 ± 0.1 .

In general, the present study highlights aspects of lower species richness, lower abundance and lack of definite periodicity of occurrence and abundance of zooplankton communities. In fact, only three of the documented 28 zooplankton taxa occur throughout the study period while only 4–5 species exert quantitative importance. These aspects may be due to habitat instability caused due to heavy precipitation in the study area which in turn experiences heaviest rainfall of the country. Sharma (2001) earlier indicated significant inverse influence of rainfall on majority of abiotic factors (thirteen) in the sampled pond. Such an influence cannot be ruled out on plankton communities as well. The rainfall presently depicts an inverse correlation only with Rotifera but its resultant indirect effect on other groups cannot be overlooked. This point is further asserted by little influence of other abiotic factors on zooplankton and their constituent groups. Further investigations are desired to analyse in detail interesting direct or indirect influence of heavy rainfall on water bodies of this region and their aquatic communities.

SUMMARY

The zooplankton (28 species : Rotifera > Cladocera > Rhizopoda > Copepoda > Ostracoda) indicate lower monthly richness (15 ± 3 species) with significant variations between months and insignificant between two annual cycles. They depict 43.2–97.1% community similarity (*vide* Sorensen's index) and follow almost identical annual ranges (43.2–97.1 and 47.4–93.7%). The zooplankton are characterized by lower abundance (78–165; 107 ± 24 n/1) and insignificant temporal variations between two annual cycles and between months. They contribute an important component ($40.2 \pm 6.9\%$) of net plankton and exhibit broadly trimodal annual patterns of temporal variations. Copepoda (46 ± 13 n/1), dominant quantitative component of zooplankton ($43.2 \pm 9.4\%$), register insignificant variations between two annual cycles and between months and follow irregular pattern of monthly variations. Rotifera (34 ± 14 n/1), constitute a sub-dominant quantitative component ($31.4 \pm 9.7\%$) of zooplankton and register significant density differences between months and insignificant between two annual cycles. The Cladocera (23 ± 19 n/1), another sub-dominant component depict insignificant variations between two annual cycles and between months and

comprise $21.9 \pm 9.2\%$ of zooplankton. The Rhizopoda, Ostracoda and Nematoda are quantitatively insignificant. The zooplankton communities are characterised by moderate species diversity (2.0 ± 0.3), higher evenness (0.74 ± 0.10) and low dominance (0.18 ± 0.1). Multiple regression of zooplankton with eighteen abiotic parameters indicates higher cumulative impact and individual factors register limited influence on zooplankton and their constituent groups.

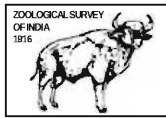
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Rec. zool. Surv. India, **106** (Part-1) : 81-82, 2006

**OCCURRENCE OF *RANA HUMERALIS* BOULENGER, 1887
IN ARUNACHAL PRADESH AND ASSAM AND NOTES
ON *RANA NIGROVITTATA* (BLYTH, 1855)
(AMPHIBIA : ANURA : RANIDAE) IN ASSAM**

ROSAMMA MATHEW AND NIBEDITA SEN

Eastern Regional Station, Zoological Survey of India, Shillong

INTRODUCTION

Rana humeralis is a large sized frog with a maximum recorded snout-vent length (SVL) of 76 mm for males and 82 mm for females (Meren Ao *et al.*, 2003). Originally described from Upper Burma by Boulenger in 1887, this species was subsequently reported as new record for India from Nagaland by Meren Ao *et al.*, in 2003.

In a recent collection (May-June, 2005) of amphibians from Nameri in Sonitpur district of Assam, the authors came across 4 examples of *Rana humeralis* (all males) with a maximum SVL 73 mm (Regd. no. V/A/ERS/573). Another 2 males were collected from Namsai in Lohit district of Arunachal Pradesh (SVL 54-55 mm) (Regd. no. V/A/ERS/574).

The specimens are having well developed humeral glands which are mottled. The dorso-lateral glandular folds are paler, upper lip white. Dorsum is yellowish green with dark markings (Plate I, A, B, C).

We collected 16 examples of *Rana nigrovittata* from Nameri, Assam comprising of 15 males with a maximum SVL 76 mm and 1 female (SVL 81 mm). These specimens are light to dark brown above with or without darker spots. A dark olive lateral band from behind the tympanum to groin. Upper lip prominently white ending in a glandule. The white upper lip border continue to the groin along the dark olive lateral band. The males have external vocal sacs unlike reported earlier (Boulenger, 1920; Schleich and Kastle, 2002) (Plate II, A, B, C).

Dutta (1997) and Frost (2002) reported the distribution of *Rana nigrovittata* as Assam in N.E. India, Myanmar and Yunnan. Schleich and Kastle (2002) reported the distribution outside

Nepal as N.E. India, Myanmar, Thailand, China (South Yunnan), Vietnam, Malaysia. Further, Boulenger (1920) and Schleich and Kastle (2002) reported *R. nigrovittata* to have internal vocal sacs. Our specimens (15 exs.) have external vocal sacs as seen in the (Plate II, C).

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PLATE I



A



C

B



Plate I. *Rana humeralis*. A. Lateral view, B. Dorsal view, C. Showing external vocal sac and mottled humeral gland.

PLATE II



A

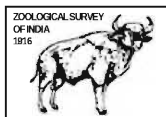


B



C

Plate II. *Rana nigrovittata*. A. Female, Lateral view in live condition, B. Lateral view of the same in preserved condition, C. Showing external vocal sac and humeral gland.



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DIPTERA FAUNA OF PUNJAB AND HIMACHAL SHIWALIK HILLS

P. PARUI, BULGANIN MITRA AND R. M. SHARMA*

Zoological Survey of India, Kolkata

INTRODUCTION

The Shiwaliks form the southernmost belt of the Himalayan range (the lower and upper Himalayas being the other two) and have an average elevation of 900–1200 m. At present, the Shiwaliks include the entire southwestern foothills of Himalayas from Indus River in the Northwest to the Brahmaputra River in the Northeast. The Shiwalik eco-region extends from about 29°33' N latitude and 74°80' E longitude. These ranges represent the southern most zone of about 8–40 km width and about 800 km length of Himalayas. The Shiwaliks of Northwest States spread over an area of more than three million hectares and represent most fragile ecosystem of the country. In the north, these hills fall in the districts of Udhampur, Kathua, Jammu and ultimately merging with Reasi and Poonch districts of Jammu & Kashmir. They extend in the southwest to across parts of Chamba, Kangra, Bilaspur, Una, Hamirpur, Solan and Sirmour districts in Himachal Pradesh; Guradaspur, Hoshiarpur, Nawashahar and Roopnagar in Punjab; Union territory of Chandigarh; Ambala, Panchkula, Yamunanagar in Haryana; Dehradun, Haridwar, Udham Singhnagar in Uttaranchal and Saharanpur and Rampur in Uttar Pradesh. Out of three million hectares, Punjab Shiwaliks accounts for 0.14 million hectares where as Himachal 1.14 million hectares.

The Shiwalik ranges or the outer Himalayas gradually rise from the Indo-Gangetic Plains with a gentle slope of about 3–4 degrees till they touch a rugged topography and bare steep slopes up to an altitude of about 1000 m. In this tract, some hill ranges run roughly parallel to each other for long distances and converge at places, meet and diverge again giving rise to small longitudinal spindle shaped plateau or duns between them. With torrential rainfall during monsoon, the area is subject to soil erosion, hazards due to undulating topography, poor vegetation cover and coarse

**Zoological Survey of India, Solan (HP)*

medium texture of sedimentary material. Based on weathering and erosion, two major land forms are of common occurrence in the area besides the hills. The gently roiling, worn out hill lands and the fan shaped deposits at the foot of hills brought about by streams. The lithology of the Shiwaliks suggests that they are chiefly water worn debris of the granitic core of the central Himalaya, deposited in the long and broad valley of the Shiwalik River (Pilgrim, 1913). Natural vegetation along the foothills of Shiwaliks comprises thorny bushes like *Acacia*, *Zizyphus*. The Shiwaliks have been identified as one of the eight most degraded rain-fed agro ecosystems of the country. The climate of the Shiwaliks is warming subtropical. It is very hot in summer and markedly cold in winter.

The present study was conducted in the parts of Punjab and Himachal Shiwaliks and resulted in the enumeration of 34 species belonging to 29 genera under 13 families.

SYSTEMATIC ARRANGEMENT OF DIPTERA OF PUNJAB AND HIMACHAL SHIWALIKS

Family TIPULIDAE

1. *Nephrotoma serricornis* (Brunetti)
2. *Conosia irrorata* (Wiedemann)

Family BIBIONIDAE

3. *Plecia (Plecia) dispersa* Hardy

Family TABANIDAE

4. *Hybomitra subcallosa* (Ricardo)
5. *Tabanus (Tabanus) orientis* Walker
6. *Tabanus (Tabanus) oxyceratus* (Bigot)

Family ASILIDAE

7. *Lobus martini* Joseph & Parui
8. *Stichopogon tomentosa* Oldroyd
9. *Michotamia aurata* (Fabricius)
10. *Promachus duvaucelli* (Macquart)

Family BOMBYLIIDAE

11. *Thyridanthrax (Exhyalanthrax) rescus* (Francois)
12. *Exoprosopa (Exoprosopa) insulata* (Walker)

Family SYRPHIDAE

13. *Betasyrphus serarius* (Wiedemann)
14. *Episyrphus balteatus* (De Geer)
15. *Ischiodon scutellaris* (Fabricius)
16. *Melanostoma orientale* (Wiedemann)
17. *Paragus (Paragus) serratus* (Fabricius)
18. *Paragus (Pandasyophthalmus) rufiventris* Brunetti
19. *Messembrius bengalensis* (Wiedemann)
20. *Messembrius quadrivittatus* (Wiedemann)
21. *Syrirta orientalis* Macquart
22. *Syrirta pipiens* (Linnaeus)

Family CONOPIDAE

23. *Archiconops erythrocephala* (Fabricius)

Family DIOPSIDAE

24. *Diopsis indica* Westwood
25. *Sphyracephala hearseiana* (Westwood)

Family OTITIDAE

26. *Physiphora aenea* (Fabricius)

Family SEPSIDAE

27. *Sepsis rufa* Macquart
28. *Australosepsis frontalis* (Walker)

Family MUSCIDAE

29. *Orthellia timorensis* (Robineau-Desvoidy)
30. *Stomoxys calcitrans* (Linnaeus)

Family CALLIPHORIDAE

31. *Idiella mandarina* (Wiedemann)
32. *Stomorhina discolor* (Fabricius)

Family SARCOPHAGIDAE

33. *Parasarcophaga (Liosarcophaga) dux* (Thomson)
34. *Parasarcophaga (Parasarcophaga) orchidea* (Boettcher)

SYSTEMATIC ACCOUNT

Key to the families

1. Adult antennae having more than 5 segments which are not fused into a solid structure 2
 - Adult antennae either fewer than 5 segments (generally 3) or with segments of flagellum fused into a solid structure, and surmounted by a style or arista 3
2. Thorax with a V-shaped suture on mesonotum; ocelli absent TIPULIDAE
 - Thorax without V-shaped suture; ocelli present BIBIONIDAE
3. Adult head without a frontal lunule or a ptilinum 4
 - Adult head with a distinct frontal lunule and ptilinum 7
4. Wings with a spurious vein between veins R and M; antennal arista usually dorsal SYRPHIDAE
 - Wings without any spurious vein; antennal arista, if present, invariably terminal 5
5. Arolium pad-like, nearly or quite as large as two pulvilli; mid tibia invariably with spur TABANIDAE
 - Arolium replaced at least by a rudimentary hair-like empodium 6
6. Flies with dense hairs or scales; vertex between eyes a little depressed; proboscis usually long but not adapted for piercing BOMBYLIIDAE
 - Flies with long bristles; vertex markedly excavated between eyes; proboscis stout and adapted for piercing ASILIDAE
7. Antennal segment 2 above without a distinct external groove; theca not developed at the base of proboscis 8
 - Antennal segment 2 above with a distinct external groove; theca developed at the base of proboscis 11
8. Wing with Cu₂ long and reaching or nearly reaching wing margin 9
 - Wing with Cu₂ short and not reaching wing margin or absent 10
9. Cell Cu₂ pointed OTITIDAE
 - Cell Cu₂ bulbous CONOPIDAE
10. Eyes and antennae carried out on a short or long stalk; scutellum with 2 long spines DIOPSIDAE
 - Ant like flies, eyes and antennae normally located; vibrissae present SEPSIDAE
11. Hypopleura without a row of strong bristles below spiracle MUSCIDAE
 - Hypopleura with one or more vertical series of bristles below spiracle 12
12. Arista of antennae pubescent or with feathering not extending much beyond middle; body dull black or striped grey and black SARCOPHAGIDAE
 - Arista feathered to tip; body entirely metallic blue or green CALLIPHORIDAE

Family TIPULIDAE

The family Tipulidae is the largest in the Diptera as presently known, with approximately 14000-recorded species in the world. Alexander & Alexander (1973) recorded over 1300 species under 60 genera from India in 'A Catalog of Diptera of the Oriental region'. The members of the family are commonly known as Crane flies or Daddy long-legs. Adults are free living. Their larvae live among decaying vegetation, grass roots, *etc.*, or are aquatic. They can be recognised by the long six or more segmented antennae, absence of ocelli, mesotergum with a V-shaped transverse suture, long and slender legs, presence of discal cell, and valvular, horny ovipositor.

Key to the subfamilies

1. Terminal segment of maxillary palpus elongate, with-lash like; nasus usually distinct; antennae usually with 13 segments; wing with Sc₁ usually atrophied, vein cu₁ constricted at m-cu, latter usually at or close to fork of M₃₊₄ TIPULINAE
- Terminal segment of maxillary palpus short; nasus not distinct, antennae usually 14 or 16 segments; wing with Sc₁ present, vein cu₁ straight, not constricted at m-cu, latter placed before fork of M₃₊₄ LIMONIINAE

Subfamily TIPULINAE

Genus *Nephrotoma* Meigen

1803. *Nephrotoma* Meigen, *Magazine, Insektkde*, **2** : 262. Type-species : *Nephrotoma dorsalis* Fabricius.

Diagnosis : Antennae 13 jointed; thorax yellow with black marks; wing with 1 marginal cell, 2 submarginal cells and 5 posterior cells as in *Tipula*, lower branch of fourth longitudinal veins, forks at base of discal cell, normally a little before, so that the posterior cross vein placed exactly at this fork.

1. *Nephrotoma serricornis* (Brunetti)

1912. *Pachyrhina serricornis* Brunetti, *Fauna Brit. India Dipt. Nematocera* : 341.

Material examined : 1G, Bella village, Una dist, H.P., 5.iii.2002, Coll. A.R. Lahiri.

Diagnosis : Head lemon yellow to orange yellow with streak on vertex; proboscis yellowish orange; antennae yellowish up to first flagellar joint, rest black; thorax bright chrome-yellow; legs yellow with tips of femora and tarsi narrowly black; wings pale grey; abdomen yellowish with dorsal black stripe composed of elongated spots of each segment.

Distribution : Bihar, Himachal Pradesh, Sikkim and West Bengal. *Elsewhere* : None.

Subfamily LIMONIINAE

Genus *Conosia* van der Wulp

1880. *Conosia* van der Wulp, *Tijdschr. Ent.*, **23** : 159. Type-species : *Limnobia irrorata* Wiedemann.

Diagnosis : Occiput produced backward in an obtuse form, the vertical hump also continued backward to the hinder part of head; antennae as long as head, its shape long, thick and cylindrical; pedicel shorter and broader; dorsum of thorax anteriorly produced forward over prothorax; scutellum small; legs long and slender; wing very short compared to abdomen, wing with 2 submarginal cells and 5 posterior cells, third longitudinal vein insinuate, anterior cross vein situated beyond discal cell and posterior cross vein before its middle; abdomen long, 4 times as long as thorax.

2. *Conosia irrorata* (Wiedemann)

1828. *Limnobia irrorata* Wiedemann, *Aussereurop. zweifl. Insekt.*, **1** : 574.

Material examined : 2GG, 1E, Bella village, Una dist., H.P., 5.iii.2002, Coll. A.R. Lahiri.

Diagnosis : Antennae with flagellar segment 1 obconical, larger than other segments; wings with subcostal vein ending a little before tip of R₁ vein; discal cell cylindro- conical; anterior branch of M₁₊₂ forked half way between discal cell and wing margin.

Distribution : Arunachal Pradesh, Assam, Bihar, Himachal Pradesh, Uttar Pradesh and West Bengal.

Elsewhere : Borneo, China, Java, Katosho Island, Malaya, Nepal, Simuulue Island, Sri Lanka, Taiwan; Africa, Australia, Israel, Japan and New Guinea.

Family BIBIONIDAE

The family of "march flies" comprises 39 species under 4 genera of 2 subfamilies in India. Adults often enormously frequent meadows, grassy hillsides or decaying vegetation and predominantly feed on decaying vegetable matter. Larvae are known to feed gregariously on roots and tubers of a wide variety of crops.

Subfamily PLECIINAE

Genus *Plecia* Wiedemann

1882. *Pleacia* Wiedemann, *Aussereurop. zweifl. Insekt.*, **1** : 72. Type-species : *Hirtea fulvicollis* Fabricius.

Diagnosis : Antenna normally 12 jointed, may be 10 jointed also with last joint shaped like a flattened core; frons with obtuse ridge; fore femur without spine or teeth; third longitudinal vein forked; fourth longitudinal forked some distance beyond the posterior cross-vein.

3. *Plecia (Plecia) dispersa* Hardy

1958. *Plecia dispersa* Hardy, *Pacif. Ins.*, **12** : 196. (n. name *confusca* Malloch).

Material examined : 1G, Anandpur, Naina Devi Road, Punjab, 22.ix.02, Coll. P. Parui.

Diagnosis : Antennae 12 jointed, reddish brown to black, sometimes this colour varies; proboscis and palpi black with short black pubescence; thorax wholly orange including scutellum; legs black, coxae and trochanters yellowish to brownish yellow; wings pale brown, darker anteriorly; stigma absent; abdomen black with short black pubescence.

Distribution : Andhra Pradesh, Nicobar Islands, Punjab and Tamil Nadu.

Elsewhere : Nepal, Pakistan and Sri Lanka.

Family TABANIDAE

The gnats, horse flies or deer flies as they are commonly known, are haematophagous and some of them are mechanical carriers of Surra, a trypanosomal disease of equines. An extensive family of moderate to large sized flies. They are more or less flattened insects and as a rule, mottled brown, tawny or grey in colour. In India nearly 200 species of 12 genera under 3 subfamilies are reported so far.

Key to the genera

- 1. Eyes bare *Tabanus* Linnaeus
- Eyes hairy *Hybomitra* Enderlein

Genus *Hybomitra* Enderlein

1922. *Hybomitra* Enderlein, *Mitt. zool. Mus. Berl.*, **10** : 347. Type-species : *Hybomitra solox* Enderlein.

4. *Hybomitra subcallosa* (Ricardo)

1911. *Tabanus subcallosa* Ricardo, *Rec. Indian Mus.*, **4** : 227.

Material examined : 1G, P.W.D. Rest house, Kotari Bangla, Himachal Pradesh, 4.x.2000, Coll. M.L. Thakur & Party.

Diagnosis : Face with white pubescence, forehead with two separate transverse calli; thorax black with grey tomentum and black pubescence; scutellum black with grey tomentum; abdomen with white haired bands on each segment laterally; legs black, tibia yellowish white, black at apices; wings hyaline, sides and base of wing with long white pubescence.

Distribution : Himachal Pradesh and Uttar Pradesh.

Elsewhere : None.

Genus ***Tabanus*** Linnaeus

1758. *Tabanus* Linnaeus, *Syst. Nat. Ed.*, **10** : 601. Type-species : *Tabanus bovinus* Linnaeus.

Subgenus ***Tabanus*** Linnaeus

Diagnosis : Head hemispherical; vertex smoothly flat or slightly concave; postocular ring present; banding on eyes often present; frons usually much narrow; antennal scape rarely as long as wide, hairy.

Key to the species

1. Abdomen black with narrow white haired segmentations and small triangular spots; hind femur with white pubescence, anterior ones with black pubescence *oxyceratus* Bigot
- Abdomen reddish yellow, darker apex, with narrow yellowish white segmentations and median spots; all femora with yellowish white pubescence *orientis* Walker

5. *Tabanus (Tabanus) orientis* Walker

1848. *Tabanus orientis* Walker, *List Dipt. Colln. Br. Mus.*, **1** : 152.

Material examined : 2EE, Ramgarh, Punjab, 4.x.2000, Coll. M.L. Thakur & Party.

Distribution : Punjab and Uttar Pradesh.

Elsewhere : China, Myanmar, Nepal, Pakistan, Taiwan and Japan.

6. *Tabanus (Tabanus) oxyceratus* (Bigot)

1892. *Atylotus oxyceratus* Bigot, *Mem. Soc. zool. Fr.*, **5** : 652.

Material examined : 1G, 1E, P.W.D. Rest house, Kotari Bangla, Himachal Pradesh, 4.x.2000, Coll. M.L. Thakur & Party.

Distribution : Himachal Pradesh and Uttar Pradesh.

Elsewhere : Myanmar.

Family ASILIDAE

Asilidae (robber flies) is one of the biggest in terms of species and most abundant family of Diptera. They are world wide in distribution and include well over 5000 described species of about 400 genera. Of these only 59 genera over 475 species are known from India and adjacent countries.

Key to the subfamilies

1. Palpus one segmented 2
- Palpus two segmented; first flagellomere spindle shaped with apical microsegment; females usually with circle of spines on acanthophorites DASYPOGONINAE

2. Elongate and excessively slender species; marginal cell open, alula absent; first flagellomere short, ovoid with long bristle-like arista LEPTOGASTERINAE
3. Less slender or robust bristly species, marginal cell closed; first flagellomere long and slender with short bristle bearing microsegment ASILINAE

Subfamily LEPTOGASTERINAE

Tribe LEPTOGASTERINI

Genus ***Lobus*** Martin

1972. *Lobus* Martin, *J. Kansas. ent. Soc.*, **45** : 8. Type-species : *Leptogaster pellipes* Janssens.

Diagnosis : Very narrow elongate flies; first flagellomere short ovoid with a long style-like bristle; alula and pulvilli absent.

7. ***Lobus martini*** Joseph & Parui

1983. *Lobus martini* Joseph & Parui, *Bull. Zool. Surv. India*, **5**(1) : 67.

Material examined : 4E, 2G, Nangal, FRH, Punjab, 23.ix.2002, Coll. A.R. Lahiri.

Diagnosis : Head and antenna black, style of antenna nearly as long as the adjacent segment; thorax black, grey tomentose, hind border with 2 or 3 rows of pale or dark brown short bristles; femora and tibiae pale yellow basally with dark brown apex of varying extent; wing brownish tinged, posterior half lighter than anterior half; abdomen black.

Distribution : Andhra Pradesh, Kerala and Punjab. *Elsewhere* : None.

Remarks : This is the first report of this species from North India (Parui & Mitra, 2004).

Subfamily DASYPOGONINAE

Tribe STICHOPOGONINI

Genus ***Stichopogon*** Loew

1847. *Stichopogon* Loew, *Linn. Ent.*, **2** : 499. Type-species : *Dasypogon elongatulus* Wiedemann.

Diagnosis : Mystax usually of a single row of bristles above epistome; arista bare, first flagellomere short, much shorter than basal two segments together; fourth posterior cell opened.

8. ***Stichopogon tomentosus*** Oldroyd

1948. *Stichopogon tomentosus* Oldroyd, *Entomologist's mon. Mag.*, **84** : 263.

Material examined : 1G, 2E, Ropar, Barnala, Punjab, 27.ix.2002, Coll. A.R. Lahiri.

Diagnosis : Mystax white, antennal scape and pedicel with white bristly ventrally; thorax densely grey tomentose, scutum without usually mediolongitudinal stress; legs orange, fore and hind femora

black dorsally on distal two thirds; wing lightly infuscated and basally hyaline; abdomen dark brown with grey tomentum; female acanthophorites bearing a circlet of 10 spines, lamella without tuft of setae.

Distribution : Andaman Islands, Bihar, Punjab and West Bengal. *Elsewhere* : None.

Subfamily ASILINAE

Key to the tribes

1. Antennal style pulmose **Ommatini**
 — Antennal style bare **Asilini**

Tribe **Ommatini**

Genus *Michotamia* Macquart

1838. *Michotamia* Macquart, *Dipt. exot.*, **1**(2) : 75. Type-species : *Michotamia analis* Macquart.

Diagnosis : First flagellomere of antenna nearly three times than basal two segments together, arista shorter than first flagellomere and with pectinate hairs clustered at its tip.

9. *Michotamia aurata* (Fabricius)

1794. *Asilus aurata* Fabricius, *Ent. Syst.*, **4** : 387.

Material examined : 2G, 3E, Anandpur, Naina Devi Road, Punjab, 22.ix.2002, Coll. P. Parui.

Diagnosis : Mystax yellow, a tuft of yellow hairs on each side of antennae; antennal scape and pedicel yellow, first flagellomere black; scutum black with yellow humeri; abdomen yellow except fifth and sixth segments black, epandrium yellow, broad up to two-thirds and then gradually narrowed towards tip.

Distribution : Andhra Pradesh, Bihar, Delhi, Goa, Karnataka, Kerala, Madhya Pradesh, Orissa, Pondichery, Punjab, Uttar Pradesh and West Bengal. *Elsewhere* : None.

Tribe **Asilini**

Genus *Promachus* Loew

1848. *Promachus* Loew, *Linnaeus, Ent.*, **3** : 390. Type-species : *Asilus maculatus* Loew.

Diagnosis : Antennae situated well apart from each others; wing with 3 submarginal cells, radial form shorter than second posterior cell, apex of marginal cell not bulbous as *Philodicus*; in female tenth segment without spine.

10. *Promachus duvaucelii* (Macquart)

1838. *Trupanea duvaucelii* Macquart, *Dipt. Exot.*, **1**(2) : 97.

Material examined : 7G, 3E, Dalewal, Kakawal, Hoshiarpur, dist. Punjab, 19.ix.1999, Coll. T.R. Sharma.

Diagnosis : Head yellowish; mystax yellow with a few black hairs on upper part; thorax and scutellum with reddish hairs; legs black, wings yellowish with an obscure streak in the marginal and first submarginal cells; first three abdominal segments with profuse red hairs, male genitalia shining black with concolourous hairs.

Distribution : Delhi, Gujarat, Madhya Pradesh, Punjab, Uttar Pradesh and West Bengal.
Elsewhere : None.

Family BOMBYLIIDAE

The bombyliids or “bee-flies” are a group of moderate to large sized colourful and beautiful flies of super family Asiloidea under the suborder Brachycera. Knowledge of bee-flies is all the more essential as their larvae are parasitic on bees, fossorial wasps, locusts and sometimes upon noctuid larvae and pupae. Again as their bodies are clothed with a coat of soft, variegated hair, these flies are of great importance as conveyors of pollen for fertilization of plants. In India, 118 species under 24 genera of 10 subfamilies are so far reported.

Subfamily EXOPROSOPINAE

Diagnosis : Antennae widely separated at base, its style devoid of hairs at tip; metapleuron hairy; prefurca comparatively long, second longitudinal vein originates in the knee-shaped form at approximately opposite anterior cross-vein; squamae with scaly fringe.

Key to the genera

1. Wing with 2 submarginal cells; antennal style not divided by suture from its segment *Thyridanthrax* Osten-Sacken
- Wing with 3 submarginal cells; antennal style separated by a suture from its segment *Exoprosopa* Macquart

Genus *Thyridanthrax* Osten-Sacken

1866. *Thyridanthrax* Osten-Sacken, *Biologia Cent.-am (Zool)* : 123. Type-species : *Thyridanthrax selene* Osten-Sacken.

Subgenus *Exhyalanthrax* Becker

1916. *Exhyalanthrax* Becker, *Annls. Hist.-nat. Mus. natn. Hung.*, **14** : 44. Type-species : *Anthrax vagans* Loew.

Diagnosis : Antennal flagellomere one with apical stripe; pulvilli reduced and rounded in shape.

11. *Thyridanthrax (Exhyalanthrax) resculus* Francois

1968. *Thyridanthrax (Exhyalanthrax) resculus* Francois, *Bull. Et. Anns Soc. r. ent. Belg.*, **104** : 209.

Material examined : 1G, Koka Hazari, Punjab, 21.ix.2002, Coll. P. Parui.

Diagnosis : Antenne black marked; proboscis blackish brown; occiput black with small yellow scales amid minute white scaly pubescence; thorax blackish covered with very small yellow flat scales extending to the wing base, sides of thorax with small black hairs; scutellum with short flat lying yellow scales and a row of long black bristles; wing with a dark brown oblique band on the anterior margin extending nearly to the costal tip, hind margin clear; abdomen black, segment 7 bears a large fan-shaped bunch of elongate white scales on the anterior corners of the abdomen; genitalia with a circlet of reddish yellow spines.

Distribution : Punjab.

Elsewhere : Taiwan.

Genus *Exoprosopa* Macquart

1840. *Exoprosopa* Macquart, *Dipt. exot.*, **2**(1) : 35. Type-species : *Anthrax pandora* Fabricius.

Subgenus *Exoprosopa* Macquart

1840. *Exoprosopa* Macquart, *Dipt. exot.*, **2**(1) : 35. Type-species : *Anthrax pandora* Fabricius.

Diagnosis : Marginal cross-vein sinuous and recurrent, R_{2+3} vein opposite or before middle cross vein, posterior cell 1 typically open but sometimes closed; wings never fenestrate, or if so "Window pans" not hyaline; abdomen devoid of silvery bands.

12. *Exoprosopa (Exoprosopa) insulata* (Walker)

1852. *Anthrax insulata* (Walker), *Insecta Saundersiana*, **1** : 72.

Material examined : 2E, Barmla, Punjab, 27.ix.2002, Coll. P. Parui.

Diagnosis : Pleuron with dense bristles confined either to lower edge or all over except upper edge : wing mostly clear, with submarginal cells, discal cell typically short and obtuse, upper branch of cubital fork widely divergent; hind tibia usually covered with dense black bristles.

Distribution : Madhya Pradesh, Meghalaya, Punjab, Tamilnadu, Uttar Pradesh and West Bengal.

Elsewhere : Nepal and Sri Lanka.

Family SYRPHIDAE

The Syrphids or flower flies or hoverflies, as the names signify, usually hover over flowers facilitating pollination. The larval habits of syrphids are extremely varied, but one large section,

the adult of which are characterized by a sharp down curving of wing vein R_{4+5} ; generally feed on decaying organic materials in semi or entirely aquatic environments, such as sewage, liquid mud, and water filled privies. They may be phytophagous, carnivorous, saprophagous, scavengers and are natural enemies of aphids, scale insects, *etc.* 256 species under 62 genera of 2 subfamilies are so far known from India.

Key to the subfamilies

1. Pronotum bare (except few long hairs occasionally in *Baccha*) : abdomen in males with 5 pregenital segments **Syrphinae**
- Pronotum pilose; abdomen in males with 4 pregenital segments **Milesinae**

Subfamily SYPHINAE

Key to the tribes

1. Tergite 1 well developed and distinctly extended well beyond scutellum; scutellum at its posterior margin inconspicuously or strongly denticulate; abdomen robust and usually oval **Paragini**
- Tergite 1 small and practically convexed by scutellum (excepting some *Bacchini* with petiolate abdomen) : scutellum posteriorly smooth and not denticulate; abdomen usually slender 2
2. Face and scutellum entirely black; anterior flat portion of mesopleuron with only microscopic pubescence : aedeagus undivided, strongly swollen basally and slender tube-like apically **Melanostomatini**
3. Face and scutellum yellow or yellowish brown; mesopleural hairing variable; aedeagus nearly always 2-segmented, with complex associated structures **Syrphini**

Tribe SYRPHINI

Key to the genera

1. Mesopleuron at its anterior flat portion with long, fine, erect or suberect hairs at least posterolaterally; metasternum haired : male terminalia with broad and somewhat flat surstylus, superior lobe with a short stout tooth apically **Episyrphus** Matsumura & Adachi
- Mesopleuron at its anterior flat portion with only microscopic pubescence or pollinose 2
2. Eyes usually very distinctly haired; wing membrane trichose at least beyond level of end of spurious vein; hind trochanter in male without any projection **Betesyrphus** Matsumura
- Eyes bare or nearly so; wing membrane trichose anywhere : hind trochanter in males with ventral spine-like process **Ischiodon** Sack

Genus *Betasyrphus* Matsumura

1917. *Betasyrphus* Matsumura, *Ent. Mag. Kyoto*, **2** : 143. Type-species : *Syrphus serarius* Wiedemann.

13. *Betasyrphus serarius* (Wiedemann)

1830. *Syrphus serarius* Wiedemann, *Aussereurop. Zweifl. Insekt.*, **2** : 128.

Material examined : 1G, Ropar, Nangal, Punjab, 6.iii.2002, Coll. P. Parui.

Diagnosis : Eye densely haired; face orange with black tinge; antenna black, base of antennal segment 3 dull orange; mesonotum shining black, scutellum dull yellow with yellow hairs basally and rest black; grayish-pollinose abdominal markings; aedeagal base with 2 long distinct tooth-like processes on each side antero-ventrally.

Distribution : Arunachal Pradesh, Assam, Bihar, Karnataka, Meghalaya, Punjab, Sikkim, Uttar Pradesh and West Bengal.

Elsewhere : Other parts of Southeast Asia; Australia; Japan, Korea and New Guinea.

Genus *Episyrphus* Matsumura & Adachi

1917. *Episyrphus* Matsumura & Adachi, *Ent. Mag. Kyoto*, **2** : 134. Type-species; *Muscat balteata* De Geer.

14. *Episyrphus balteatus* (De Geer)

1776. *Musca balteata* De Geer, *Mem. Pour. Serv. Hist. Ins.*, **6** : 116.

Material examined : 1E, Nangal, Ropar, Punjab, 6.iii.2002, Coll. P. Parui; 1G, Bella village, Una, 5.iii.2002, Coll. A.R. Lahiri; 1G, Rampur, Una, Himachal Pradesh, 4.iii.2002, Coll. P. Parui.

Diagnosis : Eye bare; face orange with orange hairs; base of antenna with a black dot above; abdomen linear, orange, tergites 3 and 4 mostly yellow with narrow sub basal and broad apical black bands; surstylus in male terminalia straight, not more than twice as long as broad; superior lobe stout, with ventro-laterally directed tooth apically; distal portion of aedeagus not expanded apically.

Distribution : Assam, Arunachal Pradesh, Himachal Pradesh, Jammu and Kashmir, Kerala, Meghalaya, Orissa, Punjab, Sikkim, Tripura and West Bengal.

Elsewhere : China, Malaya & Other parts of Oriental region; Australia, Bonin Island; Palaearctic region.

Genus *Ischiodon* Sack

1913. *Ischiodon* Sack, *Ent. Mitt.*, **2** : 5. Type-species : *Ischiodon trochanterica* Sack (= *Scaeva scutellaris* Fabricius).

15. *Ischiodon scutellaris* (Fabricius)

1805. *Scaeva scutellaris* Fabricius, *Syst. Antliat.*, : 252.

Material examined : 1G, F.R.H., Ropar, Punjab, 16.vi.2002, Coll. B. Mitra.

Diagnosis : Eyes bare; wing with vein R_{4+5} up curved apically and ending well before wing apex; hind femur with a sub apical black ring; surstylus in male terminalia elongate, broadened beyond base, dorsally curved and serrate, ventrally straight and smooth, aedeagal base very large and strongly sclerotized.

Distribution : Punjab and Throughout India.

Elsewhere : Many parts of Southeast Asia; Australia; Hawaii, Japan, Micronesia.

Tribe MELANOSTOMINI

Genus *Melanostoma* Schiner

1860. *Melanostoma* Schiner. *Wien, Ent. Mscher.*, **4** : 213. Type-species : *Musca mellina* Linnaeus.

16. *Melanostoma orientale* (Wiedemann)

1824. *Syrphus orientale* Wiedemann, *Analecta Ent.* : 36.

Material examined : 1G, Nangal, Ropar, Punjab, 6.iii.2002, Coll. P. Parui.

Diagnosis : Eyes bare; antennae blackish, arista microscopically pubescent; proboscis blackish; thorax and scutellum all shining aenous, with soft yellowish to greyish or brownish-grey pubescence; abdomen moderately shining black : legs orange : wings pale yellowish-grey.

Distribution : Punjab, & Throughout India.

Elsewhere : Many parts of the Oriental region; Palaearctic region.

Tribe PARAGINI

Genus *Paragus* Latreille

1804. *Paragus* Latreille, *Nouv. Diet. Hist. Nat.*, **24** : 94. Type-species : *Syrphus bicolor* Fabricius.

Key to the subgenera

1. Eye with bicolourous pile, with alternating vitta of pale and dark hairs; spurious vein shorter, not extending beyond discal (r-m) cross vein *Paragus* Latreille
- Eye with unicolourous pile; spurious vein long, extending beyond discal (r-m) cross vein ...
..... *Pandasyopthalmus* Stukenberg

Subgenus *Paragus* Latreille

1804. *Paragus* Latreille, *Nouv. Did. Hist. Nat.*, **24** : 94. Type-species : *Syrphus bicolor* Fabricius.

17. *Paragus (Paragus) serratus* (Fabricius)

1805. *Mulio serratus* Fabricius, *Syst. Antliat.*, : 186.

Material examined : 3G, Nangal, F.R.H., Ropar dist., Punjab, 28.ix.2002, Coll. P. Parui.

Diagnosis : Eye with 3 vittae of white hairs; scutellum black with yellow margin, strongly denticulate posteriorly; abdomen yellow with brown markings, punctate, tergites 3 and 4 each with a whitish band on each side anteriorly broken in mid-line, tergite 5 with a similar but continuous band placed diagonally.

Distribution : Assam, Bihar, Goa, Jammu & Kashmir, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Meghalaya, Orissa, Punjab, Sikkim, Tamil Nadu, Tripura, Uttar Pradesh and West Bengal.

Elsewhere : Jakarta, Jawa, East Malaysia, Nepal, Pakistan, Sri Lanka, Africa, Papuan sub regions.

Subgenus ***Pandasyophthalmus*** Stuckenberg

1954. *Pandasyophthalmus* Stuckenberg, *Revue zool. Bot. Afr.*, **49** : 100. Type-species : *Paragus longiventris* Loew.

18. ***Paragus (Pandasyophthalmus) rufiventris*** Brunetti

1913. *Paragus rufiventris* Brunetti, *Rec. Indian Mus.*, **8** : 157.

1975. *Paragus (Pandasyophthalmus) tibialis rufiventris* Brunetti : Knutson, Thomson & Vockeroth, *A Catalog of Diptera of the Oriental region*, **2** : 328.

1983. *Paragus (Pandasyophthalmus) rufiventris* Brunetti : Datta & Chakarborti, *Rec. zool. Surv. India*, **81** : 245.

Material examined : 4G, Nangal, F.R.H., Ropar dist., Punjab, 28.ix.2002, Coll. P. Parui.

Diagnosis : Frons shining black, hind border of eye with a fringe of white hairs; face pale lemon yellow; antenna blackish brown with third segment reddish brown below at base; thorax and scutellum covered with fine black pubescence; coxae and basal half of all femora black; apical half appears lemon yellow which extends up to basal third of tibiae and the remainder brownish yellow; wing hyaline; basal half of abdomen blue black, apical half bright reddish yellow, whole dorsum covered with white hairs.

Distribution : Assam, Bihar, Punjab, Uttaranchal and Uttar Pradesh.

Elsewhere : None.

Genus ***Mesembrius*** Rondani

1857. *Mesembrius* Rondani, *Dipterol. ital, Prodr.*, **2** : 50. Type-species : *Helophilus peregrinus* Loew.

Key to the species

1. Mid femur in males with a tooth below near base and suddenly contracted at apex; abdominal segment 4 with an inverted, widely open V-mark ***bengalensis*** (Wiedemann)
- Mid femur in males without such tooth and very gradually narrow apically; abdominal segment 4 without a V-mark ***quadrivittatus*** (Wiedemann)

19. *Mesembrius bengalensis* (Wiedemann)1819. *Eristalis bengalensis* Wiedemann, *Zool. Mag.*, **1** : 16.*Material examined* : 2G, 2E, F.R.H., Ropar, Punjab, 16.vi.2002, Coll. B. Mitra.*Distribution* : Assam, Bihar, Gujarat, Kerala, Punjab, Tripura and West Bengal.*Elsewhere* : Other parts of South-East Asia to New Guinea and Northern Australia.20. *Mesembrius quadrivittatus* (Wiedemann)1819. *Eristalis quadrivittatus* Wiedemann, *Zool. Mag.*, **1** : 17.*Material examined* : 1G, 3E, Anandpur, Naina Devi Road, Punjab, 22.x.2002, Coll. P. Parui.*Distribution* : Assam, Bihar, Gujarat, Karnataka, Madhya Pradesh, Orissa, Punjab, Tamil Nadu, Tripura and West Bengal.*Elsewhere* : Java, Moluccas, Nepal, Sri Lanka.

Subfamily MILESINAE

Genus *Syritta* Lepeletier & Serville1828. *Syritta* Lepeletier & Serville, In Latreille *et. al.*, *Encycl. Meth. (Ins.)*, **10**(2) : 808. Type-species : *Musca pipiens* Linnaeus.*Diagnosis* : Face with a central keel; anterior cross-vein situated at middle of discal cell; hind femur highly incrassate with short rigid spines below; second tergite projecting backwards at sides bearing a fringe of hairs.

Key to the species

1. Hind femur extremely incrassate with serrations on apical third below; abdominal spots in male on 2nd and 3rd segments definitely separated *pipiens* (Linnaeus)
- Hind femur not so incrassate with serrations from base to apex; abdominal spots in male on 2nd and 3rd segments normally united *orientalis* Macquart

21. *Syritta orientalis* Macquart1824. *Syritta orientalis* Macquart, *Dipt. expt.*, **2**(2) : 76 (136).*Material examined* : 3EE, F.R.H., Ropar, Punjab, 16.vi.2002, Coll. B. Mitra.*Distribution* : Bihar, Pondicherry, Punjab and West Bengal.*Elsewhere* : Bangladesh, Jawa, Myanmar, Singapore and Sikkim.22. *Syritta pipiens* (Linnaeus)1758. *Musca pipiens* Linnaeus, *Syst. Nat. Ed.*, **10** : 594.

Material examined : 2EE, F.R.H., Ropar, Punjab, 16.vi.2002, Coll. B. Mitra.

Distribution : Himachal Pradesh, Punjab, Uttar Pradesh and West Bengal.

Elsewhere : Nepal, Holarctic.

Family CONOPIDAE

Subfamily CONOPINAE

Diagnosis : Third antennal joint terminating in a distinct, 2-jointed, apical style; ocelli absent; members of this subfamily resembles more or less Wasp-like appearance.

Genus *Archiconops* Krober

1939. *Archiconops* Krober, *Ann. Mag. nat. Hist.*, (11)**4** : 381. Type-species : *Conops insularis* Krober.

23. *Archiconops erythrocephala* (Fabricius)

1794. *Conops erythrocephala* Fabricius, *Ent. Syst.*, **4** : 392.

Material examined : 1G, 1E, Patralwn, Gurudaspur dist., Punjab, 25.ix.2002, Coll. A.R. Lahiri.

Diagnosis : Head with silvery white reflection; antenna black; basal half of proboscis reddish-brown, rest black; scutum black except dull orange humerus; pleuron black with silvery white reflection and broad silvery-white stripe from behind humerus to middle coxa; fore femur reddish-brown or orange-brown except at tip, mid and hind femora black, or dark brown; wing blackish brown, violet tinged; abdomen violet black, last segment of males white dusted.

Distribution : Bihar, Gujarat, Maharashtra, Meghalaya, Punjab, Sikkim, Tamil Nadu and West Bengal.

Remarks : The specimen is fitting with the detailed description as in Fauna (1923) but there is a big difference in the male genitalia as figured in Fauna. This being a single specimen thus kept under the species.

Family DIOPSIDAE

The diopsids or “stalk-eyed flies” are represented by 8 species under 5 genera of subfamily Diopsinae in India. Adults are found on herbage about streams or pools, sometimes in large numbers and larvae are saprophagous or phytophagous.

Subfamily DIOPSINAE

Diagnosis : Face distinctly divided by a vertical median sulcus; eye-stalk medium or long; scutellar spines with or without a short bristle apically; alula of wing lacking; fifth vein ($M_3 + Cu\ 1$) present but sixth vein ($Cu_2 + 2a$) absent.

Key to the genera

1. Eye-stalk thick and short; inner orbital bristle stout *Sphyracephala* Say
 — Eye-stalk long and slender; inner orbital bristles weak *Diopsis* Linnaeus

Genus *Diopsis* Linnaeus

1775. *Diopsis* Linnaeus, *Dissert. Ent. Bigas Ins. Sistens*, etc., : 1. Type-species : *Diopsis ichneumonea* Linnaeus.

24. *Diopsis indica* Westwood

1837. *Diopsis indica* Westwood, *Trans. Linn. Soc. Lond. (Zool)*, **17** : 299.

Material examined : 1G, Thum dam site Gurudaspur, Punjab, 1.iii.2002, Coll. P. Parui.

Diagnosis : Face glossy yellowish red, with strong facial teeth; legs yellowish red; wings mainly hyaline, with a round dark spot at tip on vein 3(R₄₊₅) without touching vein 4 (M₁₊₂).

Distribution : Arunachal Pradesh, Assam, Gujarat, Meghalaya, Punjab, Uttar Pradesh and West Bengal.

Elsewhere : Bangladesh to South China, South Java.

Genus *Sphyracephala* Say

1828. *Sphyracephala* Say, *Am. Ent.*, **3** : 52. Type-species : *Diopsis brevicornis* Say.

25. *Sphyracephala hearseiana* (Westwood)

1845. *Diopsis hearseiana* Westwood, *J. Proc. ent. Soc. Lond.*, **1** : 1844 : 99.

Material examined : 1G, Barmla, Ropar, Punjab, 27.ix.2002, Coll. A.R. Lahiri.

Diagnosis : The short thick eye-stalks easily separate this species (and genus) from all other Oriental Diopsidae and its clear wing separates it from congeneric species *cothurnata* Bigot.

Distribution : Gujarat and Punjab.

Elsewhere : Bangladesh.

Family OTITIDAE

The family is known in India only by 2 species under the genus *Physiphora* under the subfamily Ulidinae. Adults are commonly found on vegetation and larvae are believed to be saprophagous.

Subfamily ULIDINAE

Diagnosis : Aedeagus bare, without bristles, hairs or denticles, tip sometimes specialized.

Genus ***Physiphora*** Fallén

1810. *Physiphora* Fallen, *Sp. ent. nov. Dip.*, : 11. Type-species : *Chrysomya splendida* Fallén.

Diagnosis : Head at most a little longer than high; medifrons bare, in upper part with four swellings; antennal segment 3 rounded apically; humeral bristle usually well developed; wing with basal cell 2 closed by straight or zigzag vein.

26. ***Physiphora aenea*** (Fabricius)

1794. *Musca aenea* Fabricius, *Ent. Syst.*, **4** : 335.

Material examined : 6GG, 4EE, Una, Rampur riverside, Himachal Pradesh, 4.ii.2002, Coll. P. Parui.

Diagnosis : Epistome, proboscis and palpi black; frontal stripe green or blue; wings with petiolate posterior cell 1; abdomen unicolorous, green, hairs on anterior corners yellowish.

Distribution : Assam, Chandigarh, Himachal Pradesh, Orissa, Punjab and West Bengal.

Elsewhere : Widespread from Seychelles to Samoa; Hawaii to Australia; North and South Americas.

Family SEPSIDAE

About 200 species of these small flies with a somewhat ant-like build are known from the world. The larvae are saprophagous and found in dung. The adults are often very abundant on the larval food and on flowers. In India 17 species under 8 genera of 2 subfamilies are so far known.

Subfamily SEPSINAE

Diagnosis : Thorax and abdomen usually shining, at least on parts of pleura; mouth opening not large; microsetae present, and often macrochaetae on abdomen; mid femur not bent on middle.

Key to the genera

1. First and second basal cells united; fronto-orbital bristles present***Australosepsis*** Malloch
- First and second basal cells separate; fronto-orbital bristles may be present or absent
..... ***Sepsis*** Fallén

Genus ***Sepsis*** Fallén

1810. *Sepsis* Fallén, *Sp. Ent. Nov. Dipt.*, : 17. Type-species : *Sepsis cynipsea* Linnaeus.

27. ***Sepsis rufa*** (Macquart)

1850. *Sepsis rufa* Macquart, *Dipt. Exot. Supp.*, **4** : 269.

Material examined : 13GG, 9EE, Dunera, Gurudaspur, Punjab, 15.ix.2002, Coll. P. Parui.

Diagnosis : The males are easily recognised by their fore femora. Body dark, second abdominal segment often with two slightly yellowish marks, dark red brown frons and posterior femora often only streaked above with black.

Distribution : Arunachal Pradesh, Assam, Bihar, Himachal Pradesh, Meghalaya, Orissa, Punjab, Sikkim, Uttar Pradesh and West Bengal.

Elsewhere : Myanmar, Nepal.

Genus *Australosepsis* Malloch

1925. *Australosepsis* Malloch, *Proc. Linn. Soc. N. SW.*, **50** : 314. Type-species : *Australosepsis fulvescens* Malloch.

28. *Australosepsis frontalis* (Walker)

1860. *Sepsis frontalis* Walker, *J. Proc. Linn. Soc. Lond. Zool.*, **4** : 163.

Material examined : 1G, Santoshgarh, Punjab, 21.ix.2002, Coll. A.R. Lahiri.

Diagnosis : Head, thorax and scutellum brownish yellow, the later with single pair of bristles at its border; legs wholly yellow, front femur of male with a row of strong bristles covering 4th of its length; wing without any infuscation at this end of R3+4 which distinguishes the only other known Oriental species *niveipennis* (Becker).

Distribution : Andhra Pradesh, Gujarat, Kerala, Maharashtra and Punjab.

Elsewhere : Borneo, Sulawasi, Lesser Sunda Islands, Malaysia, New Caledonia, Philippines, Singapore, Sri Lanka, Taiwan.

Family MUSCIDAE

Muscids are one of the most diversified and economically important groups of the Calyptrate Diptera belonging to the suborder Cyclorrhapha. Adults may be predacious, saprophagous, pollenophagous or haematophagous. Females are typically oviparous, a few are larviparous also. Larvae have varied habits being saprophagous, parasitic and phytophagous.

Key to the subfamilies

1. Arista long plumose; proboscis licking type, rather short and stout; labella well developed; usually 1 + 2 Sternopleural bristles MUSCINAE
- Arista pectinate, proboscis elongate, strongly sclerotized, adopted for piercing, tapering from a broad base to a slender apex; labella atrophied; never more than 1 + 1 sternopleural bristles STOMOXYINAE

Subfamily MUSCINAE

Genus *Orthellia* Robineau-Desvoidy

1863. *Orthellia* Robineau-Desvoidy, *Hist. nat. Dipt. env. Paris*, **2** : 837. Type-species : *Orthellia cornicina* (Fabricius).

Diagnosis : Metallic blue or green flies; supresquamal ridge with black setulose hairs on posterior part; prostigmal seta distinct, mid tibia with a strong pv seta beyond middle; bend of vein m angular or gently curved.

29. *Orthellia timorensis* (Robineau-Desvoidy)

1830. *Lucilia timorensis* Robineau-Desvoidy, *Mem. pres. div. Sav. Acad. Sci. Inst. Fr.*, **2** : 460.

Material examined : 2G, Patralwn, Gurudaspur dist., Punjab, 25.ix.2002, Coll. P. Parui.

Diagnosis : This species is abundantly attracted to bait of cow dung exposed in suitable forest areas. Both sexes feed on the dung, and females oviposit readily in the pads. Human faeces are particularly attractive to this species. All three larval instars are saprophagous. When mature the larvae migrate from the dung and pupate in the soil around.

Distribution : Andhra Pradesh, Assam, Bihar, Kerala, Punjab, Sikkim, Tamil Nadu. Tripura, Uttar Pradesh and West Bengal.

Elsewhere : Widespread in Oriental region; Japan; Papuan sub region.

Subfamily STOMOXYINAE

Genus *Stomoxys* Geoffroy

1762. *Stomoxys* Geoffroy, *Hist. abreg. Ins. Paris*, **2** : 499. 538. Type-species; *Stomoxys calcitrans* (Linnaeus).

30. *Stomoxys calcitrans* (Linnaeus)

1758. *Conops calcitrans* Linnaeus, *Syst. Nat. Ed.*, **10**, 1 : 604.

Material examined : 1E, Bella village, Una dist., Himachal Pradesh, 5.iii.2002, Coll. A.R. Lahiri.

Diagnosis : Fuscous black with whitish-grey or cinereous-grey pollinosity and some brown dust on the dark thoracic vittae and forming spots on abdomen; eyes in male separated by a quarter head-width or somewhat more, frons very slightly narrowed from vertex to middle, moderately dilated from there to lunula, interfrontalia parallel-sided; in female frons well over a third head-width at vertex; antennae fuscous-brown, apex of second and base of third segment dull reddish-orange; palpi yellowish-orange, only slightly longer than third antennal segment, not reaching fore margin of mouth; thorax with four fuscous vittae, which are somewhat brown-dusted; abdomen with a moderately broad less densely dusted and darker median vitta and similar fore and hind

margins; wings with the setulae on r4+5 not nearly reaching r-m, m strongly up curved and distinctly sinuous near apex; legs fuscous with pale testaceous knees; base of hind femur with only one long hair, which seldom reaches length of femoral diameter, often with 2–3 shorter hairs following upon the long hair, hairs of the av row somewhat stronger and more erect.

Distribution : Andhra Pradesh, Assam, Bihar, Goa, Himachal Pradesh, Kerala, Maharashtra, Orissa, Sikkim, Tamil Nadu, Tripura, Uttar Pradesh and West Bengal.

Elsewhere : Cosmopolitan.

Family CALLIPHORIDAE

The Calliphorids or blowflies or blue bottle flies are commonly found on vegetation or flowers, meat shops or fish markets, etc. The larvae are either scavengers or parasites on other insects, earthworms, snails or other animals. Some are well known for causing myiasis in man and animals.

Subfamily RHINIINAE

Diagnosis : Epistome strongly projected; antennal arista varies from microscopically pubescent to strongly biplumose; prostigmal bristles absent, the small rounded prostigmal bristle absent, the small rounded protuberance below base of wing either bare or without distinct hairs, thoracic squama bare dorsally; wing with subcostal sclerite with fine pubescence.

Key to the genera

1. Body slender and equilateral; hind tibia without a conspicuous row of anterodorsal setae but with 2–3 setae as long as or longer than tibial diameter; abdomen mostly testaceous *Idiella* Brauer & Bergenstamm.
- Body rather stout, with ovate abdomen; hind tibia with a conspicuous row of subequal anterodorsal setae longer than normal hairs, sometimes 2–3 rather strong anterodorsal setae developed among them; abdomen usually dark coloured *Stomorphina* Rondani

Genus *Idiella* Brauer and Bergenstamm

1889. *Idiella* Brauer and Bergenstamm, *Denkschr. Akad. Wiss. Wien.*, **56** : 154. Type-species : *Idia mandarina* Wiedemann.

31. *Idiella mandarina* (Wiedemann)

1830. *Idia mandarina* Wiedemann, *Aussereurop. zwifl. Insekt.*, **2** : 350.

Material examined : 1♂, Ropar, Punjab, 16.vi.2002, Coll. B. Mitra.

Diagnosis : Male frons usually broader than width of ocellar triangle : female frons one-fifth of head width : antennal segment 2 at least reddish; occipital dialation, mesopleuron and sternopleura

without distinct piliferous spots; pleura with golden hairs; mid tibia in males with 2 posterior setae and a tuft of hairs distally; wing with basicolor brown.

Distribution : Assam, Bihar, Gujarat, Haryana, Kerala, Madhya Pradesh, Maharashtra, Meghalaya, Orissa, Punjab, Uttar Pradesh and West Bengal.

Elsewhere : Bangladesh, China, Indonesia, Malaysia, Myanmar, Sri Lanka, Taiwan and Thailand.

Genus *Stomorphina* Rondani

1861. *Stomorphina* Rondani, *Dipt. Ital. Prodr.*, **4** : 9. Type-species : *Musca lunata* Fabricius.

32. *Stomorphina discolor* (Fabricius)

1794. *Musca discolor* Fabricius, *Ent. Syst.*, **4** : 320.

Material examined : 1G, Ropar, Punjab, 16.vi.2002, Coll. B. Mitra.

Diagnosis : Antennae and palpus brown; wing with cell R₅ narrowly open; abdomen yellowish, with black bands posteriorly on terga 1 & 2 and with a median longitudinal stripe.

Distribution : Arunachal Pradesh, Assam, Bihar, Kerala, Manipur, Meghalaya, Punjab, Uttar Pradesh and West Bengal.

Elsewhere : Other Parts of Oriental region, Moluccas.

Family SARCOPHAGIDAE

The members of this family are commonly known as flesh flies. Adults are generally found on vegetation, flowers, excrement or decaying plant and animal material. Larvae are saprophagous or coprophagous and live in decaying plant or animal matter or are parasites of insects and others. In India 65 species under 26 genera of 3 subfamilies are reported so far.

Subfamily SARCOPHAGINAE

Diagnosis : Arista pubescent to plumose on basal two thirds; notopleurals invariably 3 or 4; stem vein of wing setulose on posterior upper side of its basal section.

Genus *Parasarcophaga* Johnston & Tiegs

1921. *Parasarcophaga* Johnston & Tiegs, *Proc. R. Soc. Qd.*, **33** : 86, Type-species : *Sarcophaga omega* Johnston & Tiegs.

Key to the subgenera

Ventralia pedunculate *Parasarcophaga* Johnston & Tiegs
 Ventralia not pedunculate *Liosarcophaga* Enderlein

Subgenus ***Liosarcophaga*** Enderlein

1928. *Liosarcophaga* Enderlein, *Arch. Klass. Phyl. Ent.*, **1**(1) : 18. Type-species : *Cynomyia madirensis* Schiner.

33. ***Parasarcophaga (Liosarcophaga) dux*** (Thomson)

1868. *Sarcophaga dux* Thomson, *K. Svenska Fregatten Eugenies Resa. Dipt.*, **2** : 534.

Material examined : 1G, Nangal, Punjab., 6.ii.2002, Coll. A.R. Lahiri.

Diagnosis : Lateral verticals wanting; propleura bare, single pre-sutural acrostichal, posterior dorsocentral 5 the anterior 3 weak; mid femur with comb and fringe at base, hind tibia double fringed; apex of paraphallus pointed with a subapical process having bifurcated apex.

Distribution : Punjab and quite common in all the states of India.

Elsewhere : Bangladesh, China, Hainan Islands, East Malaysia, Java, Kalimantan, Ryukyu Islands, Sri Lanka. Taiwan; Australia; Hawaii, Japan, Korea, New Guinea.

34. ***Parasarcophaga (Parasarcophaga) orchidea*** (Boettcher)

1913. *Sarcophaga orchidea* Boettcher, *Annls. Hist.-nat. Mus. natn. Hung.*, **11** : 375.

Material examined : 1G, Chandigarh, Kotari Bangla, H.P., 20.x.2000, Coll. M.L. Thakur.

Diagnosis : Frons and face silver white, lateral verticals wanting; acrostichal bristles 1 : 1; mid femur with comb and sparse basal fringe; costal segment iii longer than v; apical process of paraphallus well developed.

Distribution : Common in all the states of India including Himachal Pradesh and Punjab.

Elsewhere : Andalus, Bangladesh, China, East Malaysia, Hainan Island, Jawa, Kalimantan Myanmar, Nepal, Philippines, Ryukyu Islands, Sri Lanka, Taiwan, Thailand; Afghanistan, Korea, Japan; Widespread in the Pacific Islands to new Guinea and Australia.

SUMMARY

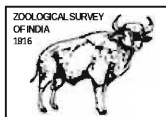
Altogether 34 species belonging to 29 genera under 13 families, so far reported from the parts of Punjab and Himachal Shiwalik hills are enumerated. Keys to recorded families, subfamilies, genera, subgenera and species are provided.

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Short Communication

OBSERVATIONS ON BUTTERFLIES FEEDING ON ROTTING JACKFRUITS

Adult butterflies feed mainly on flower nectar and other sugars, such as those contained in the sap of wounded trees and rotting fruits. Some butterflies live on pollen as well than nectar. The males of many butterfly species have additional nutritional requirements. They flock to mud puddles to sip up dissolved salts. Some butterflies also feed on animal droppings and dead animals in order to obtain nutrients such as carbon, nitrogen and amino acids. Some can even absorb human sweat that contains electrolytes that they find valuable.

Fruits attract certain butterfly species and they have been observed to use oranges, grapes, apples and bananas as food source. During July and August 2003, the authors had the opportunity to observe for a few days, a number of butterflies visiting rotting jackfruits fallen under the jack tree as well as over-ripe ones still on the jack tree. Attracted to the fruits, these butterflies were flitting on the fruits and sipping the exudation from the fruits for varying lengths of time, throughout the day. Between the sips, the butterflies left the fruits and apparently flew aimlessly around or gave chase to one another for short distances. Interestingly, on one day even while it was drizzling the butterflies were found actively sipping away the sap from the rotting jackfruits. A species-wise account of the butterflies that we found involved in this activity is given below. There is only a little work that has been done on the feeding habits and food sources of adult butterflies as compared to those of caterpillars (Kunte, 2000). Our present observations provide information on 12 species of butterflies (all belonging to the family Nymphalidae), using non-nectar food source.

1. Clipper, *Parthenos sylvia* Cramer : Though rarely found in the plains, the species frequently attended the rotting jackfruits for a brief period of time.
2. Common Baron, *Euthalia aconthea* (Moore) : Both males and females of the species regularly attended the rotting jackfruits.
3. Gaudy Baron, *Euthalia lubentina* (Cramer) : Observed only once visiting the rotting jackfruit.

4. Common Sailer, *Neptis hylas* Moore : Only once seen attending the rotting jackfruit.
5. Commander, *Moduza procris* (Cramer) : A frequent visitor to the rotting jackfruit. During the period of observation, more and more members of the species were found attracted to rotting jackfruits.
6. Grey Count, *Tanaecia lepidea* (Butler) : Found to be regular visitor of the rotting jackfruits. The species is found even attracted to the over-ripe fruits on jack trees.
7. Black Rajah, *Charaxes fabius* (Fabricius) : Occasionally found visiting the over-ripe fruits, but never visited the rotting ones.
8. Nigger, *Orsotrioena medus* (Fabricius) : A regular sipper of the over-ripe fruits and the rotting ones.
9. Common Bush Brown, *Mycalesis perseus* (Fabricius) : A regular sipper of both, over-ripe and the rotting jackfruits.
10. Common Evening Brown, *Melanitis leda* (Linnaeus) : In association with the Nigger and the Common Bush Brown butterflies, the Common Evening Brown is a regular visitor of the rotting jackfruits.
11. Common Palm fly, *Elymnias hypermnestra* (Linnaeus) : Both the males and females of the species regularly, though for a short while only, attended the rotting jackfruits.
12. Chocolate Pansy, *Precis iphita* (Cramer) : Not a regular visitor, but can be seen visiting the rotting jackfruits for very brief periods.

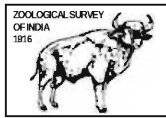
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MUHAMED JAFER PALOT
AND
C. RADHAKRISHNAN
*Western Ghats Field Research Station,
Zoological Survey of India,
Calicut-673 002, Kerala, India*



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Short Communication

A NOTE ON NON-HUMAN PRIMATES OF MURLEN NATIONAL PARK, MIZORAM, INDIA

Mizoram (Lushai Hills, the land of highlanders), formerly called Mizo district under the state of Assam. It attained statehood on 20 Feb., 1987, after being a Union Territory since 1972. As the state is basically an agrarian in nature it comes under the monsoon type of climate, where summer is warm and hot. The winter is cold and dry, average annual rainfall is about 2500 mm.

The survey of Murlen National Park was initiated to study the population trend of non-human primates in the little known northeastern state of Mizoram. The survey of the park was carried out in the month of October 1998. The park is situated in the eastern border of Mizoram with an area of 200 km² in the Champai district. Murlen, the natural habitat of the rare Hume's Bartailed Pheasant, with an area of 45 km² was initially declared as reserve forest. It was declared as National Park on 28 July 1991. Murlen National Park falls in montane sub-tropical semi-evergreen forest type. The forest consists of a mixture of numerous plant species.

There are four entry points to Murlen National Park out of which three are forest foot tracks and one point is fair weather jeepable road. The entry points are Vapar on the east, which is the only motorable road from Champai town; others are Rabung from the west, Talpui from the south and Hnallan from the northwest. Vapar is the village located just on the boundary of the Murlen National Park. Murlen village is somewhat placed at the center of the National Park (Fig. 1). There are about 50 houses with a population of approximately 200 people. Forest authorities are trying to shift the inhabitants from the park so as to rehabilitate them in other areas.

The survey team entered the park on foot from Vapar to Murlen village. This forest foot track stretches about 13 km. A thorough scan along the entire stretch from early morning could not reveal any monkey group or call of hoolock gibbons. This was later confirmed from the Forest personnel of the Park as also from villagers' that there was no monkey on this roadside forest from Vapar to Murlen village. The other three roads were also surveyed and it was noticed that stump-tailed monkeys are relatively more in numbers than other species of primates at Murlen.

Hoolock gibbon

One family of hoolock gibbon (*Bunopithecus hoolock hoolock*) was located consisted of 3 members, 1 adult male, 1 adult female and 1 juvenile. A call of gibbon was heard in close vicinity of the traced group. But there was no accessible track in the area to follow the group. Wildlife Institute of India conducted a census in January 1994 at Murlen N.P. and heard calls of two-hoolock gibbon in the core area (Chamdur) of the park (Shankar Raman *et al.*, 1995). The area was oak dominated, low canopied, and relatively open. The area from which the present sighting was made was not recorded earlier. Forest Department of Mizoram conducted a census during 1993 and recorded a total of 37 individuals of gibbon in the Murlen N.P. So, from the present survey it revealed that there is a sharp decline in their population in the last 5 years.

Capped langur

One group of Capped langur (*Trachypithecus pileatus*) consisting of 15–18 individuals was sighted from a distance. The sexes could not be identified clearly. There are only 2–3 groups of capped langur now inhabiting the park as reported by the villagers. The villagers often penetrate deep into the park for forest produce as their food items and procuring fodder for their livestock.

Stump-tailed macaque

Stump tailed macaque (*Macaca arctoides*) is fairly common in the inaccessible areas of the park, they do not approach the forest roads which is a very common feature in primates due to hunting pressure. Three groups were encountered in the park, 2 groups consisted of 37 monkeys, and the third group of 12–15 individuals was fleeing so the accurate count could not be made possible. The survey team met with a hunter with a kill of one female stump-tailed monkey (Fig. 2). On enquiry the hunter told us that during special occasion they normally try to kill monkeys though it was very difficult to trace. Survey on Murlen-Rabung foot track revealed no occurrence of primates.

CONCLUSION

The major threat to primates at Murlen National Park appears to be hunting pressure rather than shifting cultivation. Even in the forests the villagers still move with guns and monkeys are regarded as delicious meat. Traps and other indigenous devices are used for capturing monkeys, small mammals and birds. The wildlife of Mizoram is threatened, many almost to the brink of extinction due to extensive shifting cultivation and age-old practice of hunting. Wanton destruction of their habitat and hunting for sports are largely responsible of diminishing wildlife at Mizoram.

PLATE I



Fig. 1. : Murlen village inside the National Park.



Fig. 2. : Stump-tailed monkey, killed by a hunter in the N. Park.

Shifting cultivation has caused drastic changes in vegetation at Murlen N.P. At present new areas are not been jhummed, lowered reduced jhum cycles created many areas of bamboo vegetation not suitable for many primate species, especially langurs and hoolock gibbons. Many huts in the Murlen village where the survey team visited found the walls in front of the house adorned with skulls of gaur, bears, deer, serrow, rodents, porcupine, clouded leopard, pangolin and primates. Most of the houses of Vapar village, bordering the National Park on the east, are displayed with trophies of animal kills. These skulls are displayed as trophies and the villagers' boast of having maximum numbers.

So, the park now urgently needed adequate conservation and management measures to protect the remaining primate species and other wildlife.

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ATINDRA MURMU AND S. CHAUDHURI
Zoological Survey of India,
M-Block, New Alipore,
Kolkata-700 053