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DR. K. VENKATRAMAN
Director
Zoological Survey of India

AN APPEAL

In order to enrich the "*National Zoological Collection*" (NZC) and to up date information on the occurrence and distribution of animal species in India Scientists/Naturalists and researchers working on animal taxonomy/systematics are requested to deposit their identified specimens to the Zoological Survey of India at the following address:

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Kolkata-700 053

These specimens will be registered and their data will be computerised. *They are further requested to deposit their type collection positively to ZSI and use the Registration number in their publication of the new taxon.*

DR. K. VENKATRAMAN
Director
Zoological Survey of India

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DIVERSITY AND DISTRIBUTION OF BENTHIC FORAMINIFERA FROM TAMILNADU COAST, INDIA

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INTRODUCTION

The foraminiferans are the most diverse phylum of meofauna. Foraminifera are found in all marine environments, they may be plankotic or benthic in mode of life. It has been estimated that the total number of foraminiferans species might be approximately 4000 living species of foraminifera. The present paper deals with the distribution and diversity of marine foraminiferans all over Tamilnadu Coast. Foraminiferal distribution has been reported by many workers. Foraminiferans were the most abundant group of meiofauna at all the sampling sites. The number of species per station ranged from 11 to 32.

MATERIAL AND METHODS

The sediment samples were collected from intertidal areas of Tamil Nadu coast during 2006 to 2007. Twelve stations were chosen for the present study from Chennai-1 Pondicherry-2, Cuddalore-3, Karaikal-4, Nagapattinam-5, Thondi-6, Thiruchendur-7, Tuticorin-8, Mandapam-8, Pamban-10, Rameswaram-11 and Kanyakumari along the Tamil Nadu Coast. Sediment samples were collected with a plastic corer (3 cm internal diameter) up to a depth of 15 cm. Sampling was made during low tide, mostly near the mid tide level. The samples were vertically subdivided into slices of 0-2, 2-4, 4-6, 6-10 and 10-15 cm depth. Meiobenthos was extracted from sediments by decanting with tap water and washing through a 500 mm sieve suspended above a 45 µm sieve (McIntyre, 1969). Animals were stored in 5% formaldehyde solution and coloured with Rose Bengal (0.1 g in 100 ml distilled water).

History and Distribution of Foraminiferans

The recent reviews of Bhalla *et al.* (2007) and Khare *et al.* (2007) on foraminiferal studies in near shore regions of western and eastern coasts of India reveal that most of the studies are related to taxonomic and ecological aspects and palaeoenvironmental interpretations. A few studies have been undertaken along the eastern coast of India on applied aspects of Foraminifera. Taxonomic and ecological studies on foraminifera from west coast of India were carried out by some researchers. Bhalla & Nigam (1979) and Bhalla & Gaur (1987) worked on foram diversity of Calangute and Colva beach sands respectively. Bhalla & Raghav (1980) studied the ecology of Foraminifera of Malabar Coast and suggested that salinity is the chief governing factor. Raj & Chamyal (1998) studied the ecology of foraminifera of Mahi valley of Gujarat. Shareef & Venkatachalapathi (1988) reported 40 and 41 species of foraminifera from Bhatkal and Devgad islands, respectively. Nigam (2005) addressed the question as to how environmental issues can be solved through Foraminifera. Some studies were carried out on taxonomy and ecology of Forminifera from beaches and estuaries of east coast of India.

Foraminiferal diversity in relation to different ecological conditions was reported by Bhalla (1968) from Vishakhapatnam beach sands, Hamsa (1973) and Kathal & Bhalla (1998) from Palk Bay and Gulf of Mannar, Narappa *et al.*, (1981) from Godavari river system, and Kathal *et al.* (2000) from Kanyakumari, and Satyanarayana *et al.*, (2007) from Nagapattinam. Very scanty literature is available on Foraminifera of Lakshadweep (Gupta 1973; Rao *et al.* 1987; Saraswati 2007). To utilize these marine protists efficiently, adequate knowledge of their diversity and distribution pattern in modern environment is of utmost importance. Therefore, a study of intertidal forams was undertaken comparing the east and west-coast and the sensitivity of forams to monsoons. This paper presents the scanning electron photomicrographs of inter tidal forams along the Indian coast, so as to benefit researchers in diverse areas who use Foraminifera.

Foraminiferans Diversity

A total of 37 species of foraminiferans as belonging to 21 families were recorded in the present study. The list is as follows (Table-1)

Abundance of foraminiferans

The foraminiferan density ranged from 24 to 285 ind. 10 cm^{-2}, 72 to 220 ind. 10 cm^{-2}, 65 to 340 ind. 10 cm^{-2}, 20 to 210 ind. 10 cm^{-2}, 40 to 210 ind. 10 cm^{-2}, 90 to 190 ind. 10 cm^{-2}, 90 to 235 ind. 10 cm^{-2}, 15 to 140 ind. 10 cm^{-2}, 110 to 160 ind. 10 cm^{-2}, 90 to 240 ind. 10 cm^{-2}, 85 to 190 ind. 10 cm^{-2} and 50 to 150 ind. 10 cm^{-2} at stations 1-12 respectively during 2006.

Whereas during 2007, it was observed 24-151 no/10 cm^2, 90-175 no/10 cm^2, 45-180 no/10 cm^2, 50-330 no/10 cm^2, 5-90 no/10 cm^2, 80-395 no/10 cm^2, 120-495 no/10 cm^2, 20-70 no/10 cm^2, 90-155 no/10 cm^2, 90-290 no/10 cm^2, 40-180 no/10 cm^2 and 60-150 no/10 cm^2 at stations 1 - 12 respectively.

The mean density of foraminiferans ranged between 67 no/10 cm^2 and 160 no/10 cm^2 during 2006 and 32 no/10 cm^2 and 275 no/10 cm^2 during 2007. Highest densities of foraminifera were recorded at station 7 during 2006 and 2007 (Figs. 2 & 3), while lowest density was observed at stations 8 and 5 respectively during 2006 and 2007.

Species composition of foraminiferans

A total of 37 species belonging to 24 genera were identified. The number of species per station ranged between 13 to 24. The foraminiferans were dominated by *Rosalina globularis* (0.63-3.39%), *Quinqueloculina bradyana* (0.5-3.38%), *Eponides repandus* (0.67-2.26%), *Rosalina agglutinans* (0.37-2.08%) and *Triloculina* sp. (0.27-1.51%) There was only seven species, which occurred in all the 12 stations. These are *Eponides repandus, Quinqueloculina bradyana, Rosalina globularis, Rosalina agglutinans, Rosalina bradyi, Spirillina limbata and Triloculina* sp. (Table 17). The species such as *America* sp., *Cibicides lobotulus, C. refulegens, Cyclammina* sp., *Rotalia pulchella, Elphidium* sp., *Globigerinita* sp., *Neoconorbina* sp., *Nonion depressulum, Oridosalis umbonatus, Planulina* sp., *Planorbullina* sp., *Q. laevigata, Q. agglutianans, Q. oblanga, Q. lamarkiana, Spirillina lateseptata, Spiroloculina antillarum, Textularia cuneiformis, T. candiana* and *T. agglutinans* were observed occasionally.

Family composition of foraminiferans

A total of 21 families of foraminiferans were recorded. These were in order of their importance: Rosalinidae (1.89-6.23%), Hauerinidae (0.75-3.69%), Eponididae (0.67-2.26%), Rotaliidae (0.34-2.26%) and Spirillinidae (0.3-2.38). Only 5 families could be characterized as very common at all the 12 stations. These are Eponididae, Hauerinidae, Rotaliidae, Spirillinidae and Miliolidae.

The families such as Soritidae, Cibicidae, Cyclamminidae, Elphidiidae, Candeinidae, Vaginulinidae, Neoconorbinidae, Nonionidae, Heterolepidae and Planulinidae were occurred sporadically.

Diversity indices of foraminiferans

The diversity indices were lowest at stations 9 (Mandapam) and 11 (Rameswaram), which can be considered as indications of the stress at these sites. At station 11 is situated very close to

Foraminiferans of Tamilnadu (Table-1)

FORAMINIFERANS													
Family: **Ameridae**													
1.	*America* sp.	-	-	-	+	-	-	+	-	-	-	+	-
Family: **Soritidae**													
2	*Amphisorus* sp.	+	-	-	-	+	-	+	+	+	+	+	+
Family: **Bolivinidae**													
3	*Bolivina abbreviata*	+	+	+	+	-	+	+	+	+	+	-	-
Family: **Cibicidae**													
4	*Cibicides lobotulus*	+	+	+	-	-	+	-	-	-	-	-	-
5	*C. refulegens*	-	-	-	-	-	-	-	-	-	-	-	+
Family: **Cyclamminidae**													
6	*Cyclammina* sp.	-	-	-	-	-	+	-	+	-	-	-	-
Family: **Discorbidae**													
7	*Discorbis* sp.	+	+	+	+	-	+	+	+	+	+	+	-
8	*Rotalia pulchella*	+	+	+	+	+	-	+	-	-	-	-	-
9	*R. translucens*	-	+	+	-	+	-	-	-	-	-	-	-
Family: **Elphidiidae**													
10	*Elphidium* sp.	+	+	+	-	-	-	-	+	-	+	-	+
Family: **Eponididae**													
11	*Eponides repandus*	+	+	+	+	+	+	+	+	+	+	+	+
Family: **Candeinidae**													
12	*Globigerina* sp.	+	+	+	-	-	-	+	-	+	-	+	+
13	*Globigerinita* sp.	-	+	+	-	-	-	-	-	-	-	-	-

Family: **Vaginulinidae**													
14	*Legena* sp.	+	+	+	-	+	-	+	-	-	+	-	-
Family: **Neoconorbinidae**													
15	*Neoconorbina* sp.	-	-	-	-	+	-	-	+	-	-	+	+
Family: **Nonionidae**													
16	*Nonion depressulum*	-	+	+	-	-	-	+	+	-	-	-	-
Family: **Heterolepidae**													
17	*Oridosalis umbonatus*	-	-	-	+	+	-	-	-	-	-	-	-
Family: **Planulinidae**													
18	*Planulina* sp.	-	-	-	-	-	-	-	+	-	-	-	-
19	*Planorbullina* sp.	-	-	-	-	-	-	-	+	-	-	-	-
Family: **Hauerinidae**													
20	*Quinqueloculina bradyana*	+	+	+	+	+	+	+	+	+	+	+	+
21	*Q. laevigata*	+	+	+	-	-	-	+	-	-	-	-	-
22	*Q. agglutianans*	+	+	+	-	-	+	-	-	-	-	-	-
23	*Q. oblanga*	+	+	+	-	-	+	-	-	-	-	-	-
24	*Q. lamarkiana*	-	-	-	-	-	+	-	-	-	-	-	-
Family: **Rosalinidae**													
25	*Rosalina agglutinans*	+	+	+	+	+	+	+	+	+	+	+	+
26	*R. floridana*	-	+	-	-	-	-	+	-	-	+	-	-
27	*R. globularis*	+	+	+	+	+	+	+	+	+	+	+	+
28	*R. vilardeboana*	+	-	+	-	-	-	-	+	-	-	-	-
29	*R. bradyi*	+	+	+	+	+	+	+	+	+	+	+	+
Family: **Rotaliidae**													

Family: **Spirillinidae**													
31	*Spirillina lateseptata*	-	-	-	-	-	-	+	+	-	+	-	+
32	*S. limbata*	+	+	+	+	+	+	+	+	+	+	+	+
Family: **Nubeculariidae**													
33	*Spiroloculina antillarum*	-	+	-	-	-	-	-	-	-	-	-	-
Family: **Textulariidae**													
34	*Textularia cuneiformis*	+	-	-	-	-	-	-	-	-	+	-	-
35	*T. candiana*	-	-	-	-	-	-	-	-	-	-	-	+
36	*T. agglutinans*	-	+	-	+	-	-	-	+	-	+	-	+
Family: **Miliolidae**													
37	*Triloculina* sp.	+	+	+	+	+	+	+	+	+	+	+	+

Rameswaram temple. At stations 1, 2 and 3 had higher values of diversity indices although it had very high density of foraminiferans. It must be also be stated that the sediment here was fine sand. (Table-2)

The *k*-dominance curves for the foraminiferans species and stations show that in terms of dominance and diverse are similar (Fig. 4). The *k*-dominance curves were significant different from the stations. At stations 9 and 11 are the most highly dominated. Probably because at stations 11 situated very close to Rameswaram temple, which was highly disturbing by tourist. Whereas stations 2 and 3 are the more diverse. It must be also be stated that the sediment here was fine sand. Thus the foraminiferal population and diversity are highest in very fine grained sediments, while density decreases coarser grained sediments. These findings also support the results of Shannon-Wiener diversity index (H') and MDS analysis. The differences between the other stations are less amenable interpretation as the curves cross (Fig. 4)

Fig. 4. Average *k*-dominance curves derived from foraminiferans species at all the 12 stations of Tamil Nadu coast. Vertical distribution of foraminiferans.

The upper layers of 0-2 cm (20-120 ind. 10 cm-2; 4-11% of the total meiofauna at this interval) and 2-4 cm interval (10-70 ind. 10 cm-2; 3-10% of the total meiofauna at this interval) shows a high abundance of foraminiferans in muddy sediments (Fig. 5.d, e, f, g, h, j & k) whereas in sandy sediment, the maximum value of 90 ind. 10 cm^{-2} (9% of the total abundance) was recorded at 2-4 cm interval (Fig. 5.a, b, c & l)).

From 4-6 cm interval in sandy sediments, a minimum of 8 ind. 10 cm^{-2} and maximum of 45 ind. 10 cm^{-2} was recorded, whereas in muddy sediments range between 2-85 ind. 10 cm^{-2} was recorded.

The other depth intervals of sandy sediments had 4-12 ind. 10 cm^{-2} and 0-15 ind. 10 cm^{-2} at 6-10 cm and 10-15 cm intervals respectively. In muddy sediments, it's range from 0 to 10 ind. 10 cm^{-2} at 6-10 cm interval. However, it was totally absent in 10-15 cm depth interval in muddy sediments.

Foraminiferans were most important among meiofauna, probably because all sampling sites

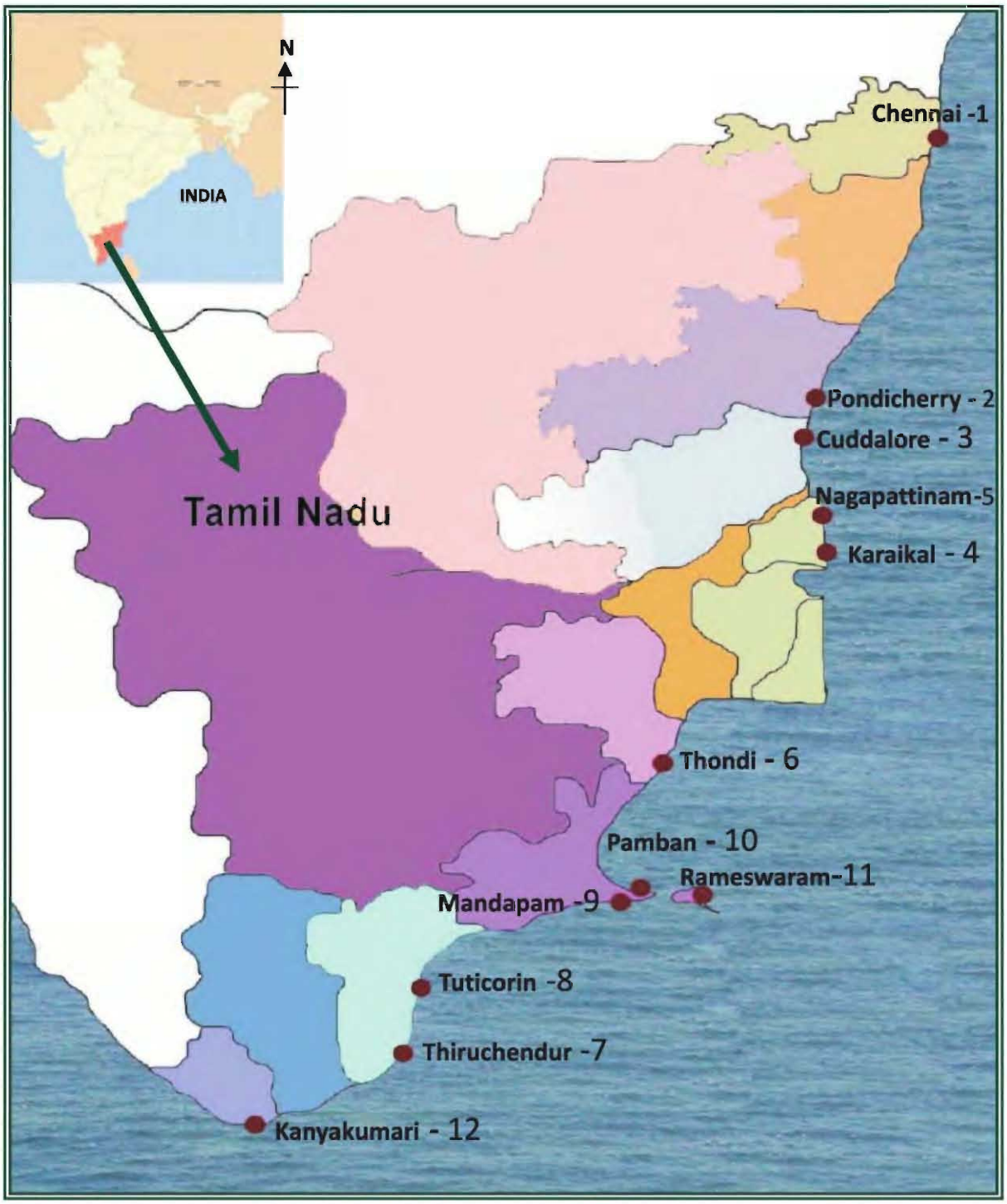

Fig. 1. Map showing the study area

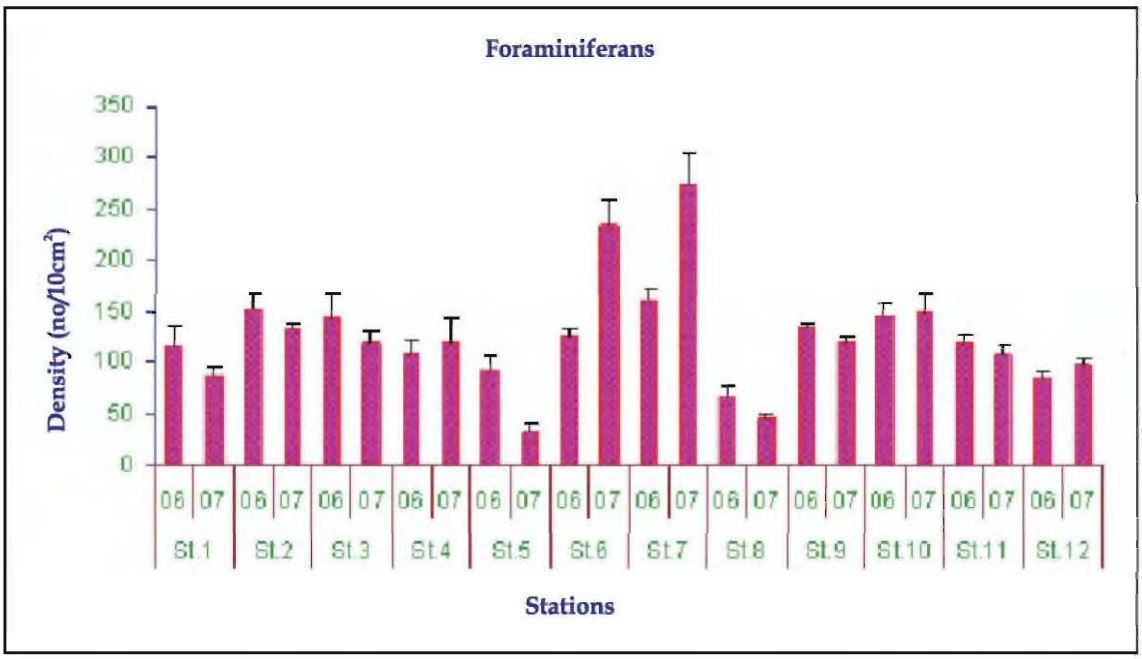

Fig. 2: Mean density of foraminiferans of Tamil Nadu coast during 2006 and 2007 (average of five replicates).

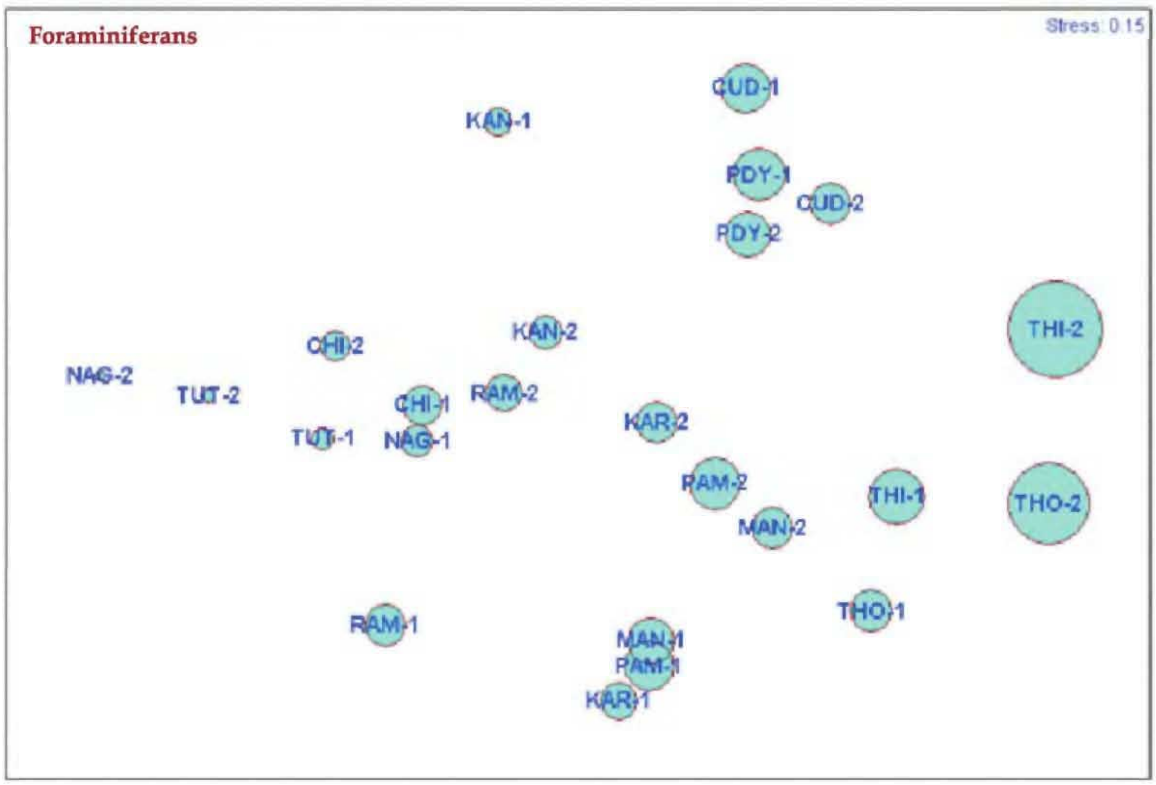

Fig-3: CHI-Chennai; PDY-Puducherry; CUD-Cuddalore; KAR-Karaikal; NAG-Nagapattinam; THO-Thondi; THI-Thiruchendur; TUT-Tuticorin; MAN-Mandapam; PAM-Pamban; RAM-Rameswaram; KAN-Kanyakumari; 1-2006: 2-2007

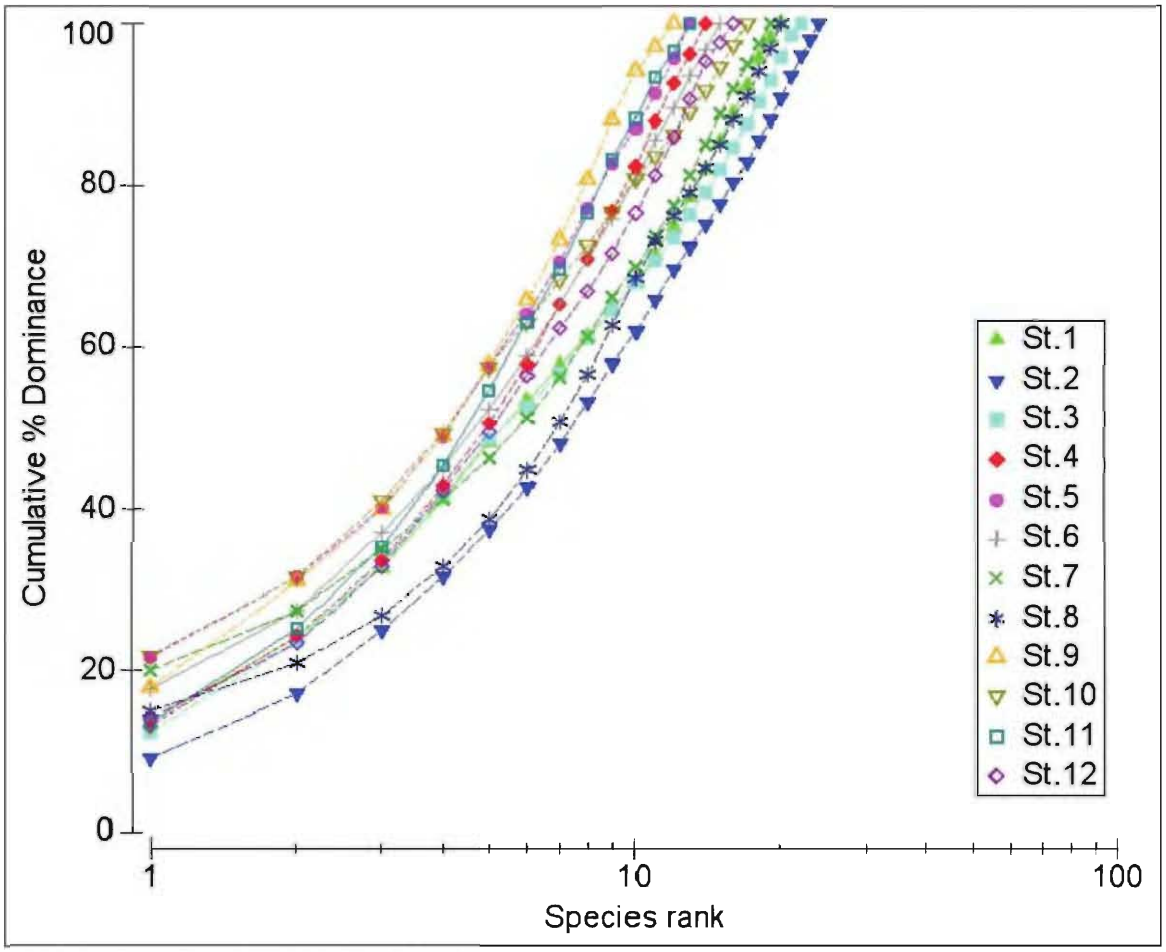

Fig. 4 : Average *k*-dominance curves derived from foraminiferans species at all the 12 stations of Tamil Nadu coast.

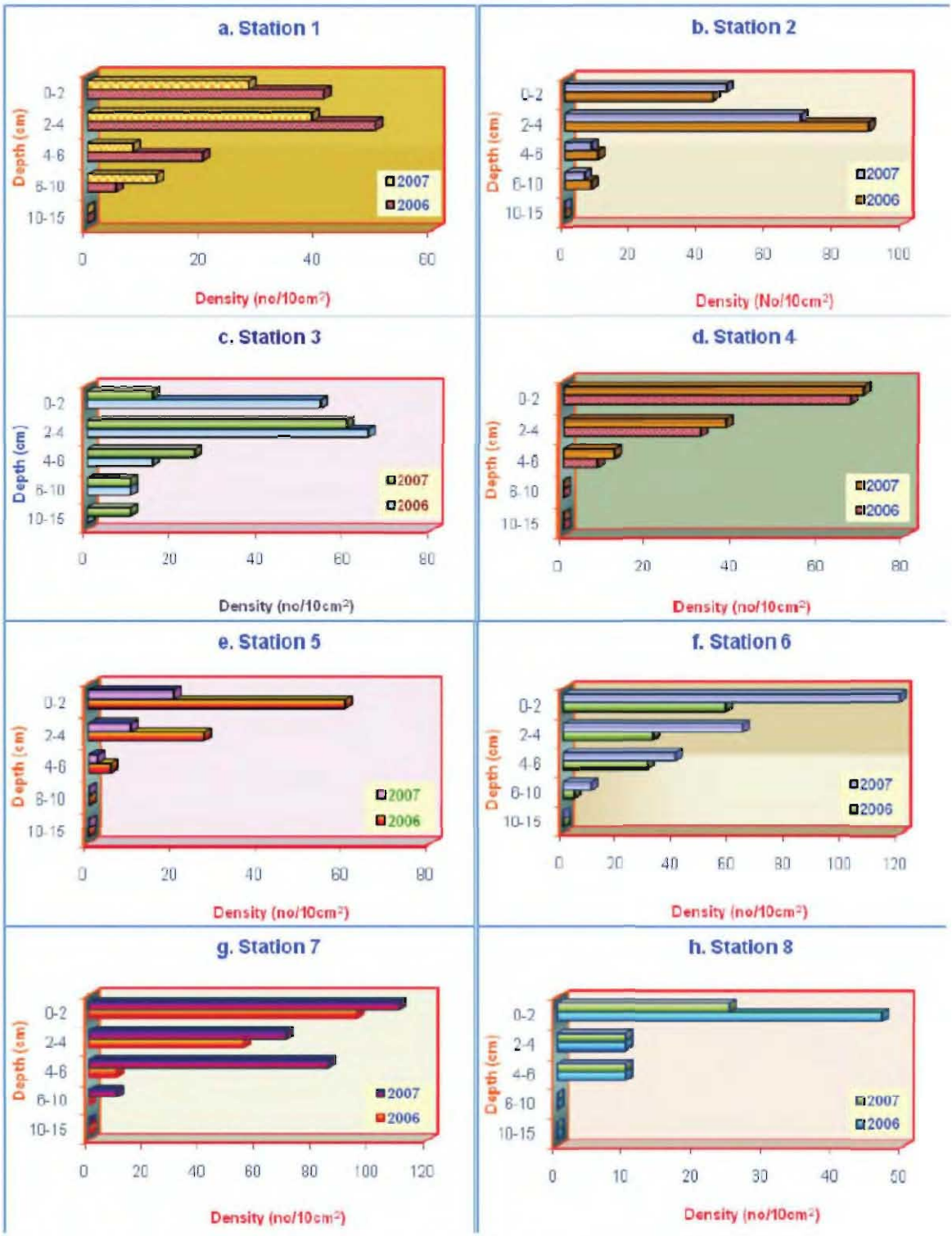

Fig. 5 : Vertical distribution of foraminiferans of Tamil Nadu coast at stations 1-12

Fig. 5 : Conted.

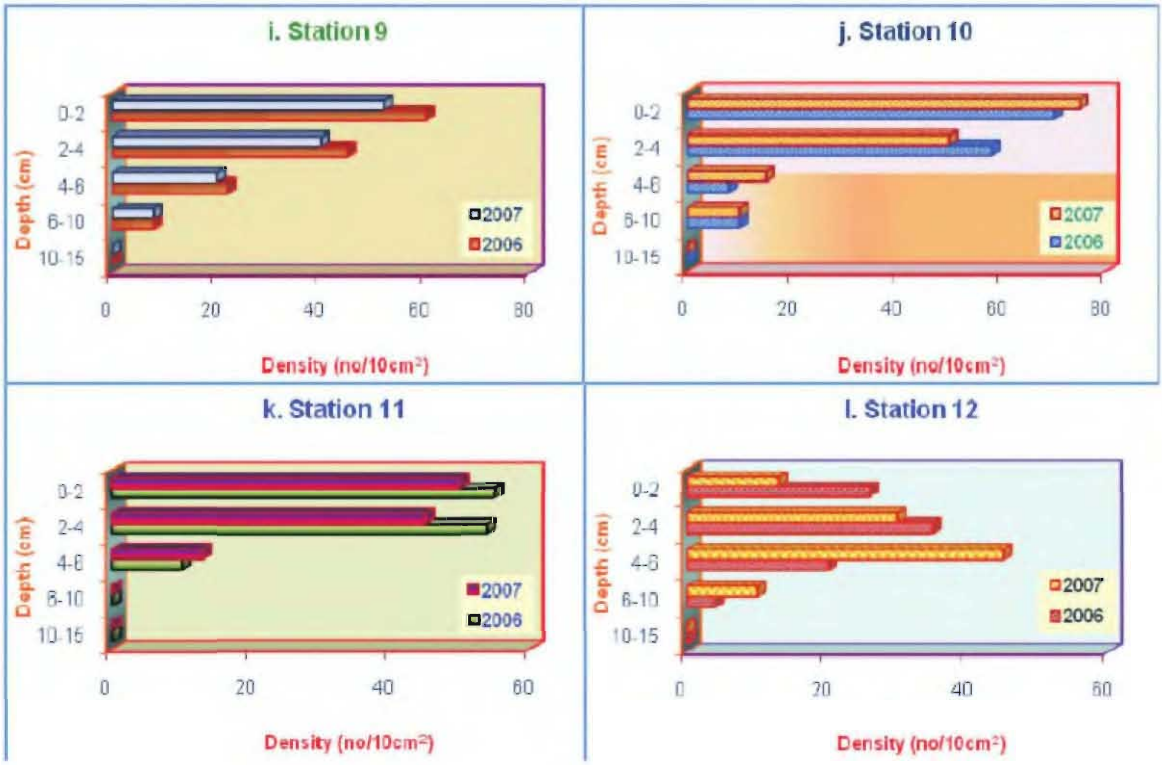
i. Station 9
j. Station 10
k. Station 11
l. Station 12
Depth (cm)
0-2
2-4
4-6
6-10
10-15
2007
2006
0
20
40
60
80
Density (no/10cm²)

Table 2: Shannon-Wiener diversity index (H') and evenness of Foraminiferans species at various stations of Tamil Nadu coast during 2006 and 2007.

Stations	S	N	D	J'	H'(log2)	1-Lambda'
1	20	116	3.997	0.9498	4.105	0.9402
2	24	152	4.578	0.9655	4.427	0.9547
3	22	144	4.226	0.9408	4.195	0.941
4	14	107	2.782	0.9743	3.71	0.9272
5	13	92	2.654	0.9489	3.512	0.9071
6	15	124	2.904	0.9558	3.734	0.9216
7	19	160	3.547	0.9416	4	0.9265
8	20	67	4.519	0.9616	4.156	0.9498
9	12	135	2.242	0.9577	3.433	0.9053
10	17	146	3.211	0.9158	3.743	0.91
11	13	119	2.511	0.9693	3.587	0.919
12	16	85	3.376	0.9622	3.849	0.9345

Table 3 : One-way ANOVA of all species of foraminiferans and different stations.

Factor	SS	Df	Ms	F(cal)		P(F<=F(cal))	F(0.05)
A (Between Groups)	246.40	11	22.40	1.002	N.S. (P>0.05)	0.443	1.811
R(A) (Within Groups)	9654.81	432	22.35				
AR (Total)	9901.21	443					

situated in the marine environment had fine sand. Similar observation was made by Varsheny *et al.* (1984) and Nigam and Chaturvedi (2000). It is well known that foraminiferans occur mostly under high saline conditions with few species penetrating into the estuarine conditions (Gooday, 1988).

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FIRST RECORD OF ANT (INSECTA : HYMENOPTERA : FORMICIDAE) FROM LAKSHADWEEP ISLANDS, INDIA

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E-mail: asokzsi@yahoo.co.in

INTRODUCTION

The formerly known Laccadive, Amini and Minicoy group of Islands in the Arabian sea were named as Lakshadweep in the year 1973 to form one of the smallest Union Territories of India. Lakshadweep archipelago consists of 12 atolls, three reefs and five submerged banks with 10 of its 36 Islands (area 32 sq.km.) being inhabited. Scientific expeditions in the area as such can never be restricted to small land mass but must cover a lagoon area of 42 sq. km., territorial waters of 20,000 km. and the exclusive economic zone of 4,00,000 sq. km.

Lakshadweep remained biologically one of the least explored regions in the Indian Ocean. Like other oceanic atolls in the circumtropical region, these coral islands are also known to support exceptionally rich and varied forms of life more in the sea round them on their land. Because of the great abundance of food fish in the Lakshadweep sea playing an important role in the economy of the islands, subsequent investigations in this region were mainly concerned with the fish and fisheries by various Scientists of the Fisheries Institutes.

The Zoological Survey of India has in the past during the years 1982–1987 also made some frequent surveys of these islands and collected materials on diverse groups of land and marine animals. The economy of the islands is solely dependant on living natural sources *viz.*, Tuna in the seawater and Coconut Palms on the land.

These islands lie irregularly scattered in the South-Arabian sea about 200–400 km. off-stretched along the south-west coast of India. They are situated between latitudes 8° and 13°N and longitude 71° and 74° E. The Lakshadweep comprises in all 36 islands, islets, reefs and sand banks distributed north to south in the Arabian sea. Ten of these islands, *viz.*, Bitra, Chetlat, Kiltan, Kalmat, Amini, Agatti, Androth, Kavaratti, Kalpeni and Minicoy are inhabitated by man. The ten inhabited islands has a land area of 28.5 sq. kms. and important because they offer suitable land and limited ground water resources for human settlement. These islands also support a rich variety of fauna in their reefs and lagoons.

Agatti island : Agatti island is the most westerly located islands lies between 10°51N and 72°11 E. It is club shaped, with a broad northern part and the narrow southern strip. The island is 6 kms. long, 1 km wide at its broadest point and 27 sq. kms. in area. As an exception, there are no storm beaches on its eastern side and clean sandy belt occur in the intertidal zone. Thick coconut growed occur on the northern side, while the southern part supports short shrub jungles ending with spiny grasses on the shore. Separated by a narrow channel in the lagoon on the southern side lies the small uninhabited islet Kalpitti, with rocks all around.

Ants have the most highly organized social life among all the insects. The major factor responsible for their ecological success is division

of labour. Ants live in highly organized and integrated units in the societies or colonies.

Bingham,s (1903) published detailed account of ants of British India, Including Ceylon and Burma under the 'Fauna of British India' series and that document is considered as the main source of knowledge of Indian ants. Zoological Survey of India has published the faunal account of Lakshadweep Island in 2005. The volume under the State Fauna Series No. 2, included the species under seven orders of class Insecta except Hymenoptera. Considering the fact while conducting a tour to Lakshadweep few ant specimens (Hymenoptera : Formicidae) comprising three species were collected from Agatti island by the second author and reported here as first record from the Island.

SYSTEMATICS OF THE STUDIED SPECIMENS

Family FORMICIDAE

Subfamily DOLICHODERINAE Forel

Genus : ***Tapinoma*** Forster

***Tapinoma (Micromyrma) melanocephalum* Fabricius**

1793. *Tapinoma (Micromyrma) melanocephalum* Fabricius, Ent. Syst., **2**:353.

1983. *Tapinoma melanocephalum* : Mathew, *Bull. zool. Surv. India*, **5** (1):125-127.

Material examined : Workers - 3 exs., Agatti island near Agriculture office, from dry litter, 2.vii.2011, coll. A. K. Sanyal. (Regd. No. 12802/H3).

Distribution : India: Uttarakhand, Rajasthan, Gujarat, Maharashtra, Meghalaya, Tripura, Chandigarh, Karnataka, Tamil Nadu, West Bengal, Orissa.

Elsewhere : Spread through both the hemispheres.

Remarks : Reported for the first time from Lakshadweep Island.

Sub-family : FORMICINAE Lepeletier

Genus : ***Paratrechina*** Motschoulsky

***Paratrechina longicornis* (Latreille)**

1802. *Formica longicornis* Latreille, *Nat. Hist. Fourmis*, 113.

1903. *Prenolepis longicornis* Bingham, *Fauna Brit. India, Hym.*, *2:326.*

1987. *Paratrechina longicornis* (Latreille) : Devi & Singh, *Entomon*, 12(4):309-313.

Material examined : Workers - 5 exs., Agatti Island near Agriculture office, from dry litter, 2.vii.2011, coll. A.K. Sanyal. (Regd. No. 12801/H3).

Distribution : India : Uttarakhand, Rajasthan, Western India, Maharashtra, Orissa, West Bengal, Uttar Pradesh, Tamil Nadu.

Elsewhere : All tropical countries, Europe.

Remarks : Reported for the first time from Lakshadweep Island.

Sub-family : MYRMICINAE Lepeletier

Genus : ***Monomorium*** Mayr

***Monomorium mayri* Forel**

1902. *Monomorium mayri* Forel, *Rev. Suisse Zool.*, **10** : 209.

Material examined : Workers - 6 exs., Agatti island near Agriculture office, from dry litter, 2.vii.2011, coll. A.K. Sanyal. (Regd. No. 12803/H3).

Distribution : India : Rajasthan, Gujarat, Tamil Nadu, Kerala.

Elsewhere : Sri Lanka, North Africa, Arabia, Myanmar.

Remarks : Reported for the first time from Lakshadweep Island.

SUMMARY

The manuscript deals with the family Formicidae comprising three subfamilies *viz.*, Dolichoderinae, Formicinae and Myrmicinae each with one genus and one species. This is the first record of the Formicidae and all the taxa under this family from Lakshadweep Islands.

ACKNOWLEDGEMENTS

The authors are grateful to Dr. K. Venkataraman, Director, Zoological Survey of India for providing all the facilities and for his kind support and encouragement during the course of this work.

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ANTS (INSECTA: HYMENOPTERA: FORMICIDAE) OF BETHUADAHARI WILDLIFE SANCTUARY, NADIA, WEST BENGAL, INDIA

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INTRODUCTION

The state of West Bengal extends from the Himalayas in the north to the Bay of Bengal in the south. It lies between 20°31' N and 27°12' N latitude and 85°50' E and 89°52' E longitude covering a geographic area of 88,752 sq. km. Just being 2.70% of the country's total geographical area. West Bengal has 5 National Parks, 15 Sanctuaries, 2 Tiger Reserves and 1 Biosphere Reserve. The state has 4064 sq. km. of forests under protected areas network which is 34% of the State's total forest area and 4.54% of the total geographical area.

Ants are the most highly organized, polymorphic, social insects of the family Formicidae, having three distinct forms- 1. the perfect and fertile female, called queen, 2. the fertile male, called drone and 3. the sterile and wingless female forming castes of workers (major or minor) and soldiers. The major factor responsible for their ecological success is division of labour, different castes performing different biological functions. The identification of ants is mainly based on the worker caste.

Ants have contribution in nutrient cycling, decomposition of organic matter, soil formation, bioturbation, and in the suppression of soil borne diseases. They are often used as biological control agents of insect pests and fungal pathogens of various tree species. According to Hölldobler & Wilson, 1990 tropical ants are predators, scavengers, and generalist foragers. Again, ants are sensitive to disturbance and rehabilitation so they are used as soil bioindicators of human impact or restoration success.

Rothney (1889) published an extensive note on ants of India. Later Forel (1900a, b, c) studied the formicidae fauna of India and Ceylon. Bingham's (1903) ant fauna of British India is the main source of knowledge of ants. Tiwari *et al.* (1993) studied extensively the ant fauna of West Bengal and later Ghosh *et al.* (2005) has worked out the ants of Ravindra Sarowar, Kolkata.

STUDY AREA

Bethuadahari Wildlife Sanctuary, geographically positioned at 23.30° N and 88.30° E, situated in Nadia district, West Bengal, which cover an area of 3,927 sq. km. and recorded forest area is only 12 sq. km. (0.30%). The sanctuary is categorized as Northern Tropical Moist Deciduous Forest- Group 3 and Subgroup C and covers an area of 0.6686 sq. km. or 66.87 Hacter or 165.15 acre and 3 villages are in the fringe of the sanctuary. This sanctuary was established under Notification No. 2772 on 19. 08.1998.

As per the Champion and Seth's classification the study area is a forest of Tropical Moist Deciduous type. The upper canopy is mainly

Key Words : Wildlife Sancturay, Taxonomic Key, Systematics, Formicidae.

comprised of Teak (*Tectona grandis*), Arjun (*Terminalia arjuna*), Siris (*Albizia lebbeck*), Sissoo (*Delbergia sissoo*), Sal (*Shorea robusta*), Mahogany (*Swietenia macrophyla*) and Ficus (*Ficus* sp.). The middle and lower canopies are not well demarcated, they comprise Jamun (*Syzigium cumit*), Minjiri (*Cassia* sp.), Bael (*Aegle marmelos*), Atha (*Annona squamosa*), Hamjam (*Polyalthia suberosa*), etc. In the partly opened up areas weeds such as *Cassia tora, Ageratum* sp., *etc.* are found to thrive as the major ground vegetations. In the water logged areas ground flora is dominated by *Polygonum* sp. and various species of *Colocasia*. Grasses like *Imperata* sp. (Ulloo grass), *Paspalum* sp., *Panicum* sp., *Cynodon* sp., *Brachiaria* sp., etc. are also occurring sparsely.

RESULTS AND DISCUSSION

Systematic Account : Systematics and description of ant species identified from this sanctuary are as follows:

Order HYMENOPTERA
Family FORMICIDAE
Sub-family **PONERINAE Lepeletier**

1. *Sphinctomyrmex taylori* Forel
2. *Anochetus graeffei* Mayr
3. *Diacamma rugosum sculptum* (Jerdon)
4. *Pachycondyla (Bothroponera) rufipes* (Jerdon)
5. *Pachycondyla (Bothroponera) bispinosa* Smith
6. *Pachycondyla (Mesoponera) melanaria* Emery

Sub-family **FORMICINAE Lepeletier**

7. *Polyrachis bicolor* Smith
8. *Oecophylla smaragdina* (Fabricius)

Sub-family **MYRMICINAE Lepeletier**

9. *Phidologeton affinis* (Jerdon)
10. *Solenopsis geminata* (Fabricius)
11. *Meranoplus bicolor* (Guerin)
12. *Myrmicaria brunnea* Saunders
13. *Monomorium pharaonis* (Linnaeus)
14. *Monomorium floricola* (Jerdon)
15. *Tetramorium (Triglyphothrix) lanuginosum* Mayr
16. *Tetramorium (Triglyphothrix) walshi* (Forel)

Sub-family **PSEUDOMYRMECINAE Emery**

17. *Tetraponera (Tetraponera) rufonigra* (Jerdon)
18. *Tetraponera (Tetraponera) nigra* (Jerdon)
19. *Tetraponera (Tetraponera) allaborans* (Walker)

Key to the sub-families of family FORMICIDAE

1. Petiole of the abdomen one jointed.....2
- Petiole of the abdomen two jointed.....3
2. A more or less marked constriction between basal two segments of abdomen....Sub-family ***Ponerinae***
- No constriction between basal two segments of abdomen.....Sub-family ***Formicinae***
3. Petiole not so elongate, the anterior node with a long petiole anteriorly and a short petiole posteriorly.....Sub-family ***Myrmicinae***
- Petiole remarkably elongate, generally the anterior node is elongated petiolate, sometimes the posterior node is also petiolate giving flexibility to the abdomen.....Sub-family ***Pseudomyrmecinae***

Family FORMICIDAE
Sub-family PONERINAE Lepeletier
Genus ***Sphinctomyrmex***

Sphinctomyrmex taylori Forel

1900. *Sphinctomyrmex taylori* Forel, *J. Bombay Nat. Hist. Soc.*, **13**: 328.

1993. *Sphinctomyrmex taylori Tiwari et al., State Fauna Series: Fauna of West Bengal*, 3(8): 243.

Material examined: 2 workers, soil, 23. xi. 2009, coll. P. Basu.

Distribution: India: West Bengal.

Remark: This is new record from Bethuadahari WLS as well as Nadia district.

Genus ***Anochetus***
Anochetus graeffei Mayr

1870. *Anochetus graeffei* Mayr, *Verh. zool.-bot. Ges. Wien*, **20**: 961.

Material examined: 3 workers, leaf litter, 27. v. 2009; 1 worker, leaf litter, 24. vi. 2009; 2 workers, leaf litter, 21. vii. 2009; 2 workers, leaf litter, 19. viii. 2008, coll. P. Basu.

Distribution : India: Karnataka, Sikkim, West Bengal.

Elsewhere: China, Fiji, Java, Myanmar, Oceania, Sri Lanka.

Remark: This is new record from Bethuadahari WLS as well as Nadia district.

Genus ***Diacamma***

Diacamma rugosum sculptum (Jerdon)

1851. *Ponera sculpta* Jerdon, *Madras J. Lit. Sci.*, **17**: 117. Worker.

1993. *Diacamma* rugosum *sculptum, Tiwari et al., State Fauna Series: Fauna of West Bengal*, **3**(8): 234.

Material examined: 3 workers, plant (Hamjam, Atha), 13. ix. 2008; 1 worker, plant (Hamjam, Sissoo), 13. vi. 2009, coll. P. Basu.

Distribution: India: Andaman & Nicobar Islands, Arunachal Pradesh, Karnataka, Kerala, Maharashtra, Sikkim, Tamil Nadu, West Bengal.

Elsewhere: Borneo, Philippines, Singapore, Sri Lanka, Taiwan.

Remark: This is new record from Bethuadahari WLS as well as Nadia district.

Genus ***Pachycondyla***

Pachycondyla (Bothroponera) rufipes (Jerdon)

1851. *Ponera rufipes* Jerdon, *Madras J. Lit. Sci.*, **17**: 119, Worker.

1911. Pachycondyla *(bothroponera)* rufipes, Emery, Genera Insect, 118: 76-77.

1993. ***Bothroponera rufipes,*** Tiwari *et al., State Fauna Series: Fauna of West Bengal*, **3**(8): 233.

Material examined: 7 workers, vegetations, 13. vi. 2009; 5 workers, leaf litter, soil, vegetation, 12. ix. 2009, coll. P. Basu.

Distribution: India: Andaman & Nicobar Islands, Assam, Karnataka, Kerala, Maharashtra, Meghalaya, Orissa, Sikkim, Tripura, Western India (from Kanara to Malabar), West Bengal.

Elsewhere: Myanmar, Sri Lanka.

Pachycondyla (Bothroponera) bispinosa Smith

1858. *Bothroponera bispinosa* F. Smith, *Cat. Hym. Brit. Mus.*, **6**: 107, Worker.

1951. *Bothroponera bispinosa,* Chapman and Capco, *Monogr. Inst. Sci. Tech.*, Manila (Check List Ants Asia), **1**: 49.

1993. *Bothroponera bispinosa,* Tiwari *et al., State Fauna Series: Fauna of West Bengal*, **3**(8): 232.

Material examined: 2 workers, leaf litter, soil, vegetation, 12. ix. 2009; 2 workers, litter, 11. x. 2008, coll. P. Basu.

Distribution: India: Assam, West Bengal.

Elsewhere: Myanmar.

Remark: This is new record from Bethuadahari WLS as well as Nadia district.

Pachycondyla (Mesoponera) melanaria Emery

1893. *Mesoponera melanaria* Emery, *Ann. Soc. Ent. Fr.:* 260, Worker.

Material examined: 4 workers, leaf litter, 04. iv. 2009; 5 workers, leaf litter, 23. v. 2009; 2 workers, leaf litter of Teak, 15. viii. 2009, coll. P. Basu.

Distribution: India: Karnataka, Kerala. *Elsewhere*: Myanmar, Singapore, Sri Lanka, Sumatra.

Remark: This is recorded for the first time from West Bengal.

Sub-family FORMICINAE Lepeletier

Genus ***Polyrhachis***

Polyrhachis bicolor Smith

1858. *Polyrhachis bicolor* Smith, *Cat. Hym. Brit. Mus.*, **6**: 65, Female.

1951. *Polyrhachis (Myrmhopla) bicolor,* Chapman and Capco, *Monogr. Inst. Sci. Tech., Manila* (Check List Ants Asia), **1**: 286.

Material examined: 3 workers, vegetations, 22. iii. 2010, coll. P. Basu.

Distribution: India: Meghalaya, West Bengal.

Elsewhere: Borneo, Java, Myanmar, Philippines, Singapore, Sumatra.

Remark: This is new record from Bethuadahari WLS as well as Nadia district.

Genus ***Oecophylla***

Oecophylla smaragdina (Fabricius)

1775. *Formica smaragdina* Fabricius, *Syst. Ent.* : 828, Worker.

1951. *Oecophylla smaragdina,* Chapman and Capco, *Monogr. Inst. Sci. Tech., Manila* (Check List Ants Asia), **1**: 220.

1993. *Oecophylla smaragdina,* Tiwari *et al., State Fauna Series: Fauna of West Bengal*, **3**(8): 277.

Material examined: 3 workers, vegetations, 13. vi. 2009, coll. P. Basu.

Distribution: India: Andaman, Assam, Gujarat, Karnataka, Kerala, Maharashtra, Meghalaya, North-West Himalayas, Orissa, Punjab, Rajasthan, Sikkim, Tamil Nadu, Uttarakhand, Uttar Pradesh, West Bengal.

Elsewhere: Australia, Java, Malaysia, Myanmar, New Guinea, South China, Sri Lanka.

Remark: This is new record from Bethuadahari WLS as well as Nadia district.

Sub-family MYRMICINAE Lepeletier

Genus ***Pheidologeton***

Pheidologeton affinis (Jerdon)

1851. *Ocodoma affinis* Jerdon, *Madras J. Lit. Sci.*, **17**: 110, Worker, Soldier.

1994. *Pheidologeton affinis*, Tiwari, *et al.*, *State Fauna Series: Fauna of West Bengal*, **5(8)**: 52.

Material examined : 10 soldier max, 5 soldier min, 60 workers, vegetation, 13. vi. 2009, coll. P. Basu.

Distribution : India: Assam, Karnataka, Kerala, Maharashtra, Manipur, Rajasthan, Tamil Nadu, West Bengal.

Elsewhere: Malaysia, Myanmar, Sri Lanka.

Remark: This is new record from Bethuadahari WLS as well as Nadia district.

Genus ***Solenopsis***

Solenopsis geminata (Fabricius)

1804. *Atta geminata* Fabricius, *Syst. Piez.*: 423, Worker.

1862. *Formica geminata*, Roger, Berl. Ent. Zeitschr., **6**: 289, Male, Female, Worker.

1993. *Solenopsis geminata*, Tiwari *et al.*, *State Fauna Series: Fauna of West Bengal*, **3**(8): 263.

Material examined : 1 worker, leaf litter, 12. ix. 2009; 2 workers, litter, 11. x. 2008, coll. P. Basu.

Distribution : India: Karnataka, Himachal Pradesh, Jammu & Kashmir, Rajasthan.

Elsewhere : Spread over both the hemispheres, Oceania, Philippines, Sri Lanka.

Remark : This is new record from Bethuadahari WLS as well as Nadia district.

Genus ***Meranoplus***

Meranoplus bicolor (Guerin)

1844. *Cryptocerus bicolor* Guerin, *Iconogr Regne. Anim. Insect*, **7**: 425.

1993. *Meranoplus bicolor*, Tiwari *et. al.*, *State Fauna Series: Fauna of West Bengal*, **3**(8): 254.

Material examined: 1 worker, plant (Atha, Hamjam), 13. ix. 2008; 1 worker, vegetation, 13. vi. 2009; 1 worker, vegetation, 18. vii. 2009, coll. P. Basu.

Distribution: India: Gujarat, Karnataka, Kerala, Maharashtra, Manipur, Orissa, Rajasthan, Tamil Nadu, Tripura, Punjab, Uttar Pradesh, West Bengal.

Elsewhere: China, Bhutan, Indonesia, Malaysia, Myanmar, Nepal, Pakistan, Singapore, Sri Lanka, Thailand.

Remark: This is new record from Bethuadahari WLS as well as Nadia district.

Genus ***Myrmicaria***

Myrmicaria brunnea Saunders

1841. *Myrmicaria brunnea* Saunders, *Trans. Ent. Soc. Lond*, **3**: 57, Male.

1903. *Myrmicaria brunnea*, Bingham, *Fauna Brit. India, Hym.*, **2**: *118*, Male, Female, Worker.

1993. *Myrmicaria brunnea*, Tiwari *et. al.*, *State Fauna Series: Fauna of West Bengal*, **3**(8): 257.

Material examined: 2 workers, leaf litter, 27. v. 2009; 1 worker, leaf litter, 24. vi. 2009; 4 workers, leaf litter, 21. vii. 2009; 3 workers, leaf litter, 19. viii. 2008; 1 worker, leaf litter, 08. ix. 2008, coll. P. Basu.

Distribution: India: Karnataka, Kerala, Meghalaya, Tamil Nadu, West Bengal.

Elsewhere: China, Indonesia, Myanmar, Sumatra, Sri Lanka.

Remark: This is new record from Bethuadahari WLS as well as Nadia district.

Genus ***Monomorium***

Monomorium pharaonis (Linnaeus)

1758. *Formica pharaonis* Linnaeus, *Syst. Nat.*, **1**: 580, Worker.

1994. *Monomorium pharaonis*, Wheeler *et. al.*, *Great Lakes Entomol.*, **26** *(4)*: *297-310.*

Material examined : 2 workers, vegetations, 24. vi. 2009, coll. P. Basu.

Distribution: India: Gujarat, Haryana, Himachal Pradesh, Karnataka, Meghalaya, Punjab, Rajasthan, Uttarakhand, Uttar Pradesh, West Bengal.

Elsewhere : Spread over the tropical region of both the hemispheres, Oceania.

Remark : This is new record from Bethuadahari WLS as well as Nadia district.

Monomorium floricola (Jerdon)

1851. *Atta floricola* Jerdon, *Madras J. Lit. & Sci.*, **17:** 107, Worker.

1987. *Monomorium floricola, Bolton, Bull. Br. Mus. (Nat. Hist.) Entomol.*, **54** (3): 309 (Syns).

1993. *Monomorium floricola,* Tiwari *et. al., State Fauna Series: Fauna of West Bengal,* **3**(8): 256.

Material examined: 2 workers, tree (Teak, Sal), 27. v. 2009; 3 workers, tree (Teak, Sal), 24. vi. 2009; 3 workers, tree (Teak), 19. viii. 08, coll. P. Basu.

Distribution: India: Andaman & Nicobar Islands, Karnataka, Kerala, Manipur, Meghalaya, Orissa, Tamil Nadu, West Bengal.

Elsewhere: Oceania, Sri Lanka.

Remark: This is new record from Bethuadahari WLS as well as Nadia district.

Genus ***Tetramorium***

Tetramorium (Triglyphothrix) lanuginosum Mayr

1870. *Tetramorium lanuginosum* Mayr, *Verh. zool.- bot. Ges. Wien,* **20**: 976, Worker.

1995. *Tetramorium lanuginosum, Bolton, New Genl. Cat. Ants World:* 410.

Material examined : 1 worker, leaf litter, 27. v. 2009; 3 workers, leaf litter, 24. vi. 2009; 1 worker, leaf litter, 21. vii. 2009; 1 worker, leaf litter, 19. viii. 2008; 1 worker, leaf litter, 08. ix. 2008, coll. P. Basu.

Distribution: India: Assam, Maharashtra, Meghalaya, Kerala, Orissa, West Bengal.

Elsewhere: Australia, Borneo, England, Germany, Japan, Java, Malaysia, Myanmar, Nepal, New Guinea, Philippines, Singapore, Sri Lanka, Sumatra.

Remark: This is new record from Bethuadahari WLS as well as Nadia district.

Tetramorium (Triglyphothrix) walshi (Forel)

1890. *Triglyphothrix walshi* Forel, *Ann. Soc. Ent. Belg.*, **34**: 107, Worker, Female.

1976. *Triglyphothrix walshi,* Bolton, *Bull. Br. Mus. Nat. Hist. (Ent.),* **34** (5): 281-379.

Material examined: 1 worker, leaf litter, 27. v. 2009; 3 workers, leaf litter, 24. vi. 2009; 1 worker, leaf litter, 21. vii. 2009; 1 worker, leaf litter, 19. viii. 2008; 1 worker, leaf litter, 08. ix. 2008, coll. P. Basu.

Distribution: India: Arunachal Pradesh, Himachal Pradesh, Karnataka, Kerala, Meghalaya, Orissa, Rajasthan, Tamil Nadu, West Bengal.

Elsewhere: China, Philippines, Singapore, Sri Lanka.

Remark: This is new record from Bethuadahari WLS as well as Nadia district.

Sub-family PSEUDOMYRMECINAE Emery

Genus ***Tetraponera***

Tetraponera (Tetraponera) rufonigra (Jerdon)

1851. *Eciton rufonigra* Jerdon, *Madras J. Lit. Sc.*, **17**: 111, Worker.

1951. *Tetraponera (Tetraponera) rufonigra,* Chapman and Capco, *Monogr. Inst. Sci. Tech., Manila* (Check List Ants Asia), **1**: 81.

1993. *Tetraponera rufonigra, Tiwari et al., State Fauna Series: Fauna of West Bengal,* **3**(8): 248.

Material examined: 1 worker, soil, 24. viii. 2008, coll. P. Basu.

Distribution: India: Gujarat, Haryana, Himachal Pradesh, Karnataka, Kerala, Manipur, Meghalaya, Orissa, Punjab, Rajasthan, Tamil Nadu, Tripura, Uttar Pradesh, West Bengal.

Elsewhere: Cambodia, China, Indonesia, Java, Myanmar, Singapore, Sri Lanka, Sumatra.

Remark: This is new record from Bethuadahari WLS as well as Nadia district.

Tetraponera (Tetraponera) nigra (Jerdon)

1851. *Eciton nigra* Jerdon, *Madras J. Lit. Sc.*, **17:** 112, Worker.

1951. *Tetraponera (Tetraponera) nigra,* Chapman and Capco, *Monogr. Inst. Sci. Tech., Manila (Check List Ants Asia),* **1**: 80.

1993. *Tetraponera rufonigra*, Tiwari *et. al., State Fauna Series: Fauna of West Bengal*, 3(8): 248.

Material examined: 1 worker, plant (Hamjam, Atha), 13. ix. 2008; 1 worker, vegetation, 11. x. 2008; 1 worker, vegetation, 08. iii. 2009; 3 workers, vegetation, 22. iii. 2010, coll. P. Basu.

Distribution: India: Andhra Pradesh, Haryana, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Meghalaya, Punjab, Sikkim, Tamil Nadu, Uttar Pradesh, West Bengal.

Elsewhere: Bangladesh, Borneo, Java, Malaysia, Myanmar, Philippines, Sri Lanka.

Remark: This is new record from Bethuadahari WLS as well as Nadia district.

Tetraponera (Tetraponera) allaborans (Walker)

1859. *Pseudomyrma allaborans* Walker, *Ann. Mus. Nat. Hist.*, **4**: 375, Male.

1951. *Tetraponera (Tetraponera) allaborans*, Chapman and Capco, *Monogr. Inst. Sci. Tech., Manila* (Check List Ants Asia), **1**: 78.

1993. *Tetraponera rufonigra*, Tiwari *et. al., State Fauna Series: Fauna of West Bengal*, 3(8): 247.

Material examined: 1 worker, leaf litter, 27. v. 2009; 1 worker, leaf litter, 24. vi. 2009; 2 workers, leaf litter, 21. vii. 2009; 2 workers, leaf litter, 19. viii. 2008; 3 workers, leaf litter, 08. ix. 2008, coll. P. Basu.

Distribution: India: Assam, Goa, Gujarat, Karnataka, Kerala, Maharashtra, Meghalaya, Orissa, Punjab, Sikkim, Tamil Nadu, West Bengal.

Elsewhere: China, Indonesia, Myanmar, Philippines, Singapore, Sri Lanka, South-East Asia to Western Australia.

SUMMARY

The manuscript deals with 19 species distributed under 13 genera of the family Formicidae. The present formicid specimens are belonged to four subfamilies namely Ponerinae with 4 genera, and 6 species; Formicinae with 2 genera and 2 species; Myrmicinae with 6 genera and 8 species and 1 genus and 3 species of Pseudomyrmecinae. Out of 19 species 17 species are new record from Bethuadahari Wildlife Sanctuary as well as Nadia District and 1 species like *Pachycondyla (Mesoponera) melanaria* Emery is new record from West Bengal.

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COLLEMBOLA (HEXAPODA) FAUNA FROM SIMBALWARA WILD LIFE SANCTUARY, HIMACHAL PRADESH, INDIA

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INTRODUCTION

Simbalwara Wildlife Sanctuary located in East-West part of Himachal Pradesh, is one of the best preserved sanctuaries in Shiwalik hills of the state. It lies between 30°24' to 30°28' N latitude and between 77°28' to 77°32' E longitude in Sirmour district of Himachal Pradesh. It is situated on right side of Nahan Ponta Sahib Road, about 6 km far from Puruwala. Ponta Sahib is about 18 km from Sanctuary. It is a small sanctuary spread over an area of 19.03 sq km with altitude ranging from 580 to 700 m above msl. The Sanctuary is triangular in shape and its southeast border is adjoined with Kaleswar National Park in the state of Haryana. The Sanctuary has subtropical climate with hot summer and severe winters. The summer temperatures touch as high as 46°C and plunges to 6°C during winters. Rain fall is heavy during monsoon of July- September. The present analysis of the composition of the species of Collembola is based on a collection made by Apterygota section of Zoological Survey of India during 2010-2011 fromSimbalwara Wild life Sanctuary, Sirmour district of Himachal Pradesh. The first Indian species of collembolan from Malabar hill regions was described by Ritter (1911). Thereafter, Imms(1912), Carpenter(1917), Handschin(1929), Bonet(1930), Mukherjee(1932),Brown(1932), Denis(1936), Baijal(1958), Salmon(1956), Choudhuri and Roy(1965), Yosii(1966), Prabhoo(1971), Mitra(1966), Hazra(1995) and Mandal(2008) contributed to the knowledge of Indian Collembola. There are about 8000 species described worldwide (FransJanessens, 2012). Indian fauna of Collembola represented by 299 species in 103 genera under 19 families (Mandal, 2010). The classification followed here after Christiansen and Bellinger (1998).

MATERIAL AND METHODS

A white enamel tray and aspirator were used. An amount of alcohol was used in the tray or the large petridish during beating the bushes, mosses or forest litters for collections collembolans in order to induce the insects to jump on these objects. Thereafter, they were picked up with fine brush and preserved in 70% alcohol. Preserved specimens were cleared in Marc Andre 1 medium. Fresh specimens were 'explode' for displaying chaetotaxy. Dark specimens were kept in Potasium hydroxide (KOH) or Hydrogen peroxide (H^2O^2) for softening the chitin. Hoyer's mounting medium was used for slide-mounting of the specimens.Identification of specimens is done using a phase contrast compound microscope following Christiansen and Bellinger (1998).

SYSTEMATIC ACCOUNT

Order COLLEMBOLA
Suborder ARTHROPLEONA
Family HYPOGASTRURIDAE

This group of genera may be best recognized by the absence of true pseudocelli and simplicity of sense organ of third antennal segment.

I. Genus ***Xenylla*** *Tullberg*

1869.*XenyllaTullberg,W. Schultz Boktryckeri, Uppsala.* 21pp.

1. ***Xenylla obscura*** Imms

1912.*Xenyllaobscura*Imms, *Proc. Zool. Soc. London:* 80-125.

1970. *Xenyllaobscura* Salmon, *R. Soc. N. Z. Biology Sci.,* **12**(13): 145-152.

Diagnosis: Body length 1.4 mm; elongate in shape; colour indigo-blue, segmental margins and ventral side pale. Antennal segment ratio as 10:12:12:14.P.A.O. absent; unguis carinate without lateral teeth but with 1, 1, 1 inner tooth near the apex; unguiculus absent.Ventral tube with 4+4 setae.Tenent hair, 2, 2, 2 very long and capitate at the end.Dentes and mucro separated, mucro short, thick about half as long as dens; dens with two long simple posterior setae.

Material examined: Kaludev river bed under stones & moss, Simbalwara Wild Life Sanctuary, 29.iii.2010, coll. G.P. Mandal, 15exs.

Distribution: INDIA: Himachal Pradesh, West Bengal, Uttar Pradesh Arunachal, Manipur, Mizoram and Nagaland.

II. Genus ***Ceratophysella*** Borner in Brohmer

1932. *Ceratophysella* Borner, *Fauna von Deutschland,* (4): 134-144.

2. ***Ceratophysella indovaria*** (Salmon)

1970. *Hypogastrura indovaria* Salmon, *Trans, Biol. Sci,* **12** (13): 149

Diagnosis: Dark brown in colour, ocelli on black fields. Body with sparse to heavy short and long curved simple setae. Antennae shorter than head, ratio 19:20, segment IV without sensory knob, but with 7-9 short, stout, bent sense rods, numerous long stout simple setae. P.A.O. very irregular, consisting of 4-12 indistinct disconnected lobes with or without central boss. Legs with claw and finely granulate unguiculus, long tenent hair never clavate. The dens with a double row setae down anterior face, each row with four setae; mucro finely granulate and spoon shaped with two distinct lamellae. Body length 0.8 mm.

Material examined: Kaludev river bed under stones & moss, Simbalwara Wild Life Sanctuary, 29.iii.2010, coll. G.P.Mandal, 20exs.

Distribution: INDIA: Himachal Pradesh, Uttar Pradesh, Sikkim, Arunachal, Assam, Manipur, Mizoram and West Bengal.

Family ENTOMOBRYIDAE

This family includes members of the Arthropleonacharcterised by reduced prothorax, without setae and postantennal segment and with scales or multilateral ciliate setae on all trunk segments, trochanteral organ, a series of short differentiated setae on the inner surface of the trochanter, fourth abdominal segment of some species much longer than the third. Without postantennal organ. Unguis and unguiculus always well-developed Furcula always well developed; Sexual dimorphism little or absent. It is distinguished by dorsal crenulatedentes and the short hook-like or bidentatemucro.

III. Genus ***Homidia*** Borner

1906. *Entomobrya* Borner, *Mitt. Naturhist. Mus. Hamburg* **23**: 147-188.

3. ***Homidia cingula*** Borner

1906. *Homidia cingula* Borner, *Mitt. Naturhist. Mus. Hamburg,* **23**: 147-188.

Diagnosis: Back ground yellowish. Body not compressed. Dentes with 33 spines. Abdominal segments III and IV with black blue pigmented transverse bands. Apical mucronal tooth smaller than anteapical.

Material examined: Kaludev river bed side under leaf litter, SimabalwaraWild Sanctuary, Sirmour dist., 29.iii.2010, coll. G.P.Mandal, 10 exs.

Distribution: INDIA: Himachal Pradesh, Uttar Pradesh, Arunachal Pradesh, Manipur, Sikkim, Mizoram, Nagaland, Orissa and West Bengal.

Family PARONELLIDAE

Members of this subfamily may be distinguished from other entomobryids by the straight unringeddentes, without spines but with a terminal bladder like projection. The mucro is short and blunt and quite different from that of other Entomobryids.

IV. Genus ***Salina*** Mac Gillivray

1894. *Salina* Mac Gillivray, *Can. Entomol.*, **26**: 105-110.

4. ***Salina indica*** (Imms)

1912.*Cremastocephalus indicus* Imms, Proc. Zool. Soc. *London*: 80-125.

1957. *Salina indica (Imms):* Salmon, Acta. Zool. Cracov. **11**(14): 313-362.

1973. *Salina indica* (Imms): Mitra, Oriental *Insects*, 7(2): 159-202.

Diagnosis: Body length 1.4 mm.Colouration: General ground colour of body pale yellow, usually devoid of any dark pigment, occassionally the tergal margins and lateral extension of abdominal segment III with faint blue pigment. Antennal segments pale yellow, segments I, II, III with a faint of diffused blue pigments or absent in some cases. Legs and furcula pale yellow without any trace of rings or bands. Clothing: General surface of body densely clothed with acuminate, stiff microchaete; flexed macrochaetaesubobliquely truncated and broadly acuminate, present on head. Thoracic segments II-III and abdominal segments I.-VI with ciliated, acuminate macrochaetae; lasiotrichia present as on abdominal segments II (2+2), III (3+3), IV (2+2).Head: Frontal spines 1+1, conspicuous ; 2 dark pigmented ocellar fields one on each side of the head, each field containing 8 ocellii, arranged in two longitudinal parallel rows; ratio of antennal segments I-IV: 36:53:40:60.Thorax: Relative length index of Thoracic segments: II: III=25:17. Unguis elongate, slightly curved with paired basal, a median and a distal unpaired teeth on inner margin, paired external basolateral teeth normal. Unguculus of truncate type, nondentate; tenent hair well developed finely ciliated, clavate, tibiotarsal lobes well developed. Abdomen: Relative length index of Abdominal segments I: II: III: IV: V: VI =13:19:6:64:10:4; rami of retinaculum each with four teeth, corpus with a single median seta; ventral tube well developed. Manubrium: mucrodens = 45:54, mucro long, narrow, superficially lobed into three teeth; dental scale appendages relatively small faintly striated.

Material examined: Kaludev river bed side under leaf litter, SimabalwaraWild Sanctuary, Sirmour dist., 29.iii.2010, coll. G.P.Mandal, 22exs.

Distribution: INDIA: Himachal Pradesh, Uttar Pradesh, Sikkim, Arunachal, Manipur, Mizoram, Tripura and West Bengal.

5. ***Salina biformis*** Mitra

1966. *Salina biformis* Mitra, *J. Ent, New Delhi*, **28**(1): 67-73.

1973. *Salina biformis* Mitra, Oriental *Insects*, 7(2): 159-202.

Diagnosis: Body length1.2 -1.4 mm. Coloration: Two types of colour dark and lighter. Head: Frontal spines 1+1Ocelli 8+8, each group in two parallel rows, ocelli G and H smaller. Clothing: Macrochaetae more or less obliquely truncated and broadly acuminate on head, thoracic segments II, III and abdominal segments I-IV; macrochaetae of Thoracic II, III/Abdominal segments I, II=23, 26/17, 4. Thorax: Unguis short, curved with outer two paired baso-lateral, a paired inner basal and two distal unpaired teeth. Trochanteral organ poor.Abdomen: Ventral tube anteriorly with 4+4 macrochaetae and 7+7 microchaetae with 9+9 micro chaetae posteriorly and a short unpaired median proximal spiny seta.

Material examined: Kaludev river bed side under leaf litter, SimabalwaraWild Sanctuary, Sirmour dist., 29.iii.2010, coll. G.P. Mandal, 8exs.;

Distribution: INDIA: Himachal Pradesh, Uttar Pradesh, West Bengal, Mizoram and Haryana.

V. Genus ***Callyntrura*** Borner

1906. *Callyntrura* Borner, *Mitt. Naturhist. Mus. Hamburg* **23**: 147-188.

6.***Callyntrura lineata*** (Parona)

1912. *Paronella borneri* Imms, *Proc. Zool. Soc. London*, pp. 80-125, new synonymy.

1912.*Paronellaphanolepis* Imms, ibid, pp. 80-125, new synonymy.

1957. *Handschinphysa lineata* Salmon, *Acta. Zool. Cracov.*, **11**(14): 313-362.

1974. *Callyntrura (Handschinphysa) lineata* Mitra, *Rev. Ecol. Biol. Sol.*, **11** (3):397-439.

Diagnosis: Coloration : Body pale yellow with variable purple to blue black pigment; head with

or without pigment thoracic I,II and abdimal segments I,II,III. Pigmented with purple to blue black pigment laterally or entirely.Clothing: Head, body and appendages clothed with setae and pseudoscales; macrochaetae flexed, obliquely truncated and ciliated (brush setae) setae on thoracic II, III and abdominal segments I, II, III. Antennae and legs clothed with darker, acuminate, cililated setae. Head: Pear shaped, frontal spines 4+4 present; ocelli, 8+8. .Head / Ant I =28/27; ratio of length of antennal segments I-IV 28:28:18:48; apex segment IV with a conspicuous sense knob encircled with setae. Thorax: Relative length index of thoracic segments II: III 52:22; unguis elongate, little curved, unguis with paired inner and 2 distal unpaired teeth; unguiculuslanceolate; tenent hair clavate. Abdomen: Relative length index of the segments 13:24:8:130:12:5; rami of retinaculum each with 4 teeth. Manubrium: mucrodens110:148; dentes stout; mucro plump with 6-9 teeth. Body length 2.5 - 4 mm.

Material examined: Kaludev river bed side under leaf litter, Simabalwara Wild Sanctuary, Sirmour dist., 29.iii.2010, coll. G.P.Mandal, 44exs.; 2 km away from Simbalwara F/R/H, SimbalwaraWild Sanctuary, Sirmour district,29.iii.2010, coll. G. P. Mandal, 72exs.

Distribution: INDIA: Himachal Pradesh, Manipur, Tripura and Uttarakhand.

VI. Genus ***Yosiia*** Mitra

1967.*Yosiia* Mitra, *Proc.Zool. Soc., Calcutta*, **20**: 43-47.

7. *Yosiia dehradunia* Mitra

1967.*Yosiia dehradunia* Mitra, *Proc. Zool. Soc. Calcutta.*, **20**: 43-47.

Diagnosis: Coloration: Pale yellow with dust of blue pigment over the body and a pair of dark blue-black patches one on each side on abdominal segments III and IV. Clothing: Scales absent; head and body clothed with setae, mostly ciliated; longer setae broad, cylindrical and blunt or slender acuminate; setae arising in clusters from the cervix and decumbent on posterior margin of head, similar setae also present anteriorly on mesotergum, head capsule and body. Head: Pear-shaped; ocelli 8+8 in pigmented ocellar fields each group of 8 ocelli arranged in two longitudinal parallel rows. Thorax: Segment I reduced; the relative length index of segments II: III= 23:11. Legs similar; each tibio-tarsus with two large tibio-tarsal lobes; unguiculus of the "truncate" type; trochanteral organ with 24 short spines. Abdomen: Relative length index of segments I: II: III: IV: V: VI=6: 15:4:67:9:6; Ventral tube short, anterior face with 4+4 long ciliated setae; rami of tenaculum each with 4+4 teeth; dens and manubrium subequal, dens crenulated; mucro vestigial; dental scale appendages greatly enlarged, dorsal in relation to dens and with longitudinal striations. Body length 1.14 mm.

Material examined: Kaludev river bed side under leaf litter, SimabalwaraWild Sanctuary, Sirmour dist., 29.iii.2010, coll. G.P.Mandal, 30 exs.

Distribution: Himachal Pradesh, Sikkim, Tripura and Uttarakhand.

VII. Genus ***Pseudosalina*** Mitra

1973.*Pseudosalina* Mitra, *Rev. Ecol. Biol. Sol., Paris*, **10**(3): 359-377.

8. *Pseudosalina multiformis* Mitra

1973.*Pseudosalina multiformis* Mitra, *Rev.Ecol. Biol. Sol., Paris*, **10**(3): 359-377.

Diagnosis: Coloration: General ground colour of head and body varies from white to pale yellow, darker patches present on Ths. II, III and anteriorly on Abd. I; a longitudinal streak on each side of Abd. III continuing anteriorly to Abd.II and posteriorly on Abd. IV. Clothing: Body clothed with micro &macrochaetae. Head: Frontal spines 1+1 reduced; ocelli 8+8 in pigmented ocellar fields, ocelli G and H smaller than the rest; relative length index of Ants. I: II: III: IV=13:8:7:18; Labrum setae 5,5,4. Thorax: Relative length index of Ths.II:III=26:17; legs all similar; unguis elongate, unguiculuslanceolate; tibio-tarsal lobe present; tenant hair finely ciliated, clavate; trochanteral organ with 26-32 spines. Abdomen: Relative length index of segments I:II :III: IV :V:VI = 14:21:8:75:7.5:7; ventral tube long, anterior face with 5+5 macrochaetae; relative length index of manubrium : mucrdens = 59:66;

mucrobidentate; dental scale appendage faintly striated. Body length 1.29-2 mm(excluding appendages).

Material examined: 2 km away from Simbalwara F/R/H, SimbalwaraWild Sanctuary, Sirmour district,29.iii.2010, coll. G. P. Mandal, 10exs.

Distribution: Himachal Pradesh and Uttarakhand.

SUMMARY

The present paper is first consolidated report of Collembola consisting of 8 species under 7 genera distributed over 3 families recorded from Simbalwara Wild Life Sanctuary, Sirmourdistrict of Himachal Pradesh. The family Hypogastruridae consists of 2 species and the family Entomobryidae consists of single species. The most dominant family represents by Paronellidae which comprises 5 species. All the species are recorded for the first time from this Sanctuary.

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Yosii, R 1966. On some Collembola of Afghanistan, India and Ceylon, collected by the Kuphe Expedition. *Res. Kyoto Univ. Sci. Exp. Karakoram and Hindukush*, **8**: 333-405.

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LIFE HISTORY OF *Musca (Byomya) emdeni* (SINHA & NANDI) (DIPTERA : MUSCIDAE), A DUNG BREEDING FLY IN THE SUNDARBANS BIOSPHERE RESERVE, INDIA

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INTRODUCTION

The dung breeding muscid fly *Musca (Byomya) emdeni* (Nandi & Sinha, 2004) are found extensively in the open pastures, near the cow sheds and in the manure pit. The adult fly is usually found on freshly deposited cow dung (Fig. 1). Cattle dung pats naturally dropped in pastures are the microhabitat for an abundant and diversified arthropod fauna (Merrit & Anderson 1977, Anderson et. al., 1984, Blume 1985, Cervenka & Moon 1991). The adults of different species of muscid fly under genera *Brontaea, Neomyia* & *Musca* in Sundarbans Biosphere Reserve are attracted to dung of different animals & the eggs are laid on freshly deposited dung of cow & buffalo in the field. *Neomyia indica* (Robineau-Desvoidy) is generally found on freshly deposited cattle dung and the larvae breed there in (Sinha & Nandi, 2005). Larvae of the dung breeding muscid utilize dung as food resources. Morphologically *Musca (Byomya) emdeni* is almost similar to *Musca (Byomya) pattoni* (Austen, 1910) but differs from it by the grayish abdomen with silvery-checkered pattern and dorsocentral bristles 2+3 (Nandi & Sinha, 2004). It is the purpose of the present paper to provide the life history details and morphological descriptions of the larval instars of *M. emdeni.*

MATERIAL AND METHODS

Fifty depositions of cow dung, not more than one hour old were collected from the open pastures of different islands in the Sundarbans Biosphere Reserve (21°31′ -21°53′ N, 88° 37′ - 89° 09′E), and brought to the laboratory for rearing. Adult flies reared from the cow dung were identified as *Musca (Byomya) emdeni.* The flies were cultured in five separate glass jars (10 X 8 cm). A single male and female fly were kept with freshly deposited cow dung in each glass jar under laboratory conditions at room temperature (26 ± 4° C) and a RH of 82 ± 4%. The mouth of the jar was covered with silken cloth, and cotton soaked in a sugar solution was applied above the silken cloth of the jar four times in a day to provide the adult flies with a sufficient and continuous energy supply. The larvae collected just after the deposition, were reared separately on cow dung to study the different larval instars. Collection of larvae was repeated at six hour intervals till the formation of puparia to study the exact duration of each instar. The collected larvae were killed by dropping them into sub boiling water and preserving them in 70% alcohol for future study. Larvae were treated in a hot 10% KOH solution for 1-3 minutes and then washed in water. After removing the internal contents, the larvae were dehydrated through an ethanol series of 30-50-70-90% and finally to absolute

alcohol. After dehydration, the larvae were cleared with clove oil and finally mounted in Canada Balsum. For studying the anterior and posterior spiracles and the cephaloskeleton, these parts were dissected out under a stereoscopic dissecting microscope with fine forceps, transferring them to a cavity block and treating them with hot KOH as described earlier. Illustrations were prepared by means of a Camera Lucida before mounting on slides with Canada Balsam.

OBSERVATION

The flies were found to mate on the second day after emergence. A female fly mated only once for her entire life. Mating was initiated by the male fly suddenly jumping onto the female and holding her body with his fore and mid legs. Each mating lasted about 26 minutes. On the 6th day of emergence, the gravid female started to deposit eggs, and the last batch was deposited on the 15th day after emergence. A total number of 105 eggs were deposited in five batches (Table 1) under laboratory conditions at room temperature (26 ± 4° C) and a RH of 82 ± 4%, with the highest number delivered in the 2nd batch on the 7th day after emergence, and then number of eggs decreased gradually (Fig. 3).

Among the total eggs deposited by a female fly, 96% of eggs hatched out. Eggs are white, tapering at both ends, with 1.2 - 1.7 mm in length and 0.4 - 0.5 mm in diameter (Fig. 2) Eggs were hatched after 4 - 6 hours of oviposition. The larva moulted from first to second instar after 4 - 6 hours, from second to third instar after 12 - 14 hours, and the third instar transformed in to a puparium after 36 - 38 hours. The pupal stage lasted for an average of 94 - 96 hours. Total time required to complete the life cycle of this species under laboratory conditions from deposition of eggs to new fly emergence is about 6 days. It was observed that the gravid female flies were never attracted to the dung deposits that were one day old. Among the Total number of larvae hatched out from the eggs deposited by the single female fly under laboratory conditions, 71% of the larvae survived up to pupation. Longevity of the male and female flies was on average 16 days and 23 days respectively. The flies could survive an average of 1 day without food after emergence. The sex ratio of males to females was 1:2.

Fig. 1: A female *Musca (Byomya) emdeni* laying egg in freshly deposited cow dung.

Fig. 2: Eggs of *Musca (Byomya) emdeni* in cow dung.

Batches	Days of emergence	Number of eggs
1st	6	12
2nd	7	38
3rd	9	31
4th	12	16
5th	15	8
		Total 105 eggs

Table 1: A total number of 105 eggs were deposited by a gravid female *Musca (Byomya) emdeni* in five batches under laboratory conditions at room temperature (26 ± 4° C) and a RH of 82 ± 4%.

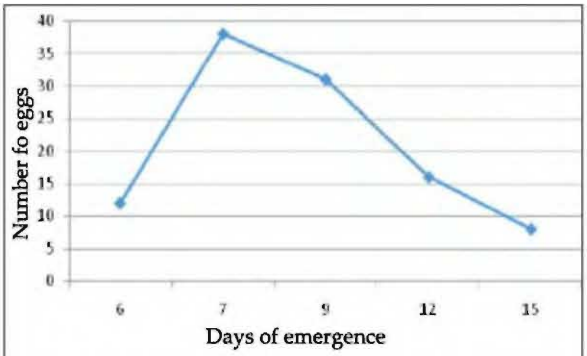


Fig. 3: Number of eggs deposited by a gravid female fly on different days of emergence.

DESCRIPTION OF LARVAL INSTARS

(Figures of the larval body parts not to scale)

First instar (Fig. 4 – 5). Length 2.5 – 3.0 mm, greatest diameter 0.3 – 0.4 mm; spines on segments 1 – 7 conspicuous; spine band on segment 1 broad ventrally; spines on segment 8 – 10 not completely developed; last segment with a pair of anal tubercle. Cephaloskeleton small, incompletely developed and not uniformly sclerotized; oral hook part not strong; dorsal and ventral cornu not well pigmented. Segment 2 with short anterior spiracles. Posterior surface of the last segment shows pigmentation; no prominent posterior spiracle.

Second instar (Fig. 6 – 9). Length 4.5 – 5 mm, greatest diameter 0.3 – 0.5 mm; segments 6 – 12 with prominent spine band on ventral surface; anal tubercle present. Cephaloskeleton lightly sclerotised; dorsal cornu smaller than ventral cornu; window absent; parastomal sclerite absent; anterodorsal process pointed. Anterior spiracles yellowish and each with 4 lobes. Posterior spiracles kidney shaped; slits sinuate; button clear and situated at inner side.

Third instar (Fig. 10 – 13): Length 7.5 – 10mm, greatest diameter 0.6 – 1.0 mm.; segments 6 – 12 with small spine bands on the anterior margin of lateral and ventral surfaces; anterior spine band present on segments 3 – 5; two rows of spine bands present on segment 10 ; anal plate more or less broad. In cephaloskeleton, mouth hook broad and horn-shaped; hook part heavily pigmented; dental sclerite triangular; ventral cornu with triangular projection on the dorsal margin; basal part of dorsal cornu poorly pigmented. Anterior spiracles with 8 lobes. Posterior spiracles kidney shaped, heavily pigmented; button clear, reddish in colour; peretreme thick and pigmented; slits strong and sinuate.

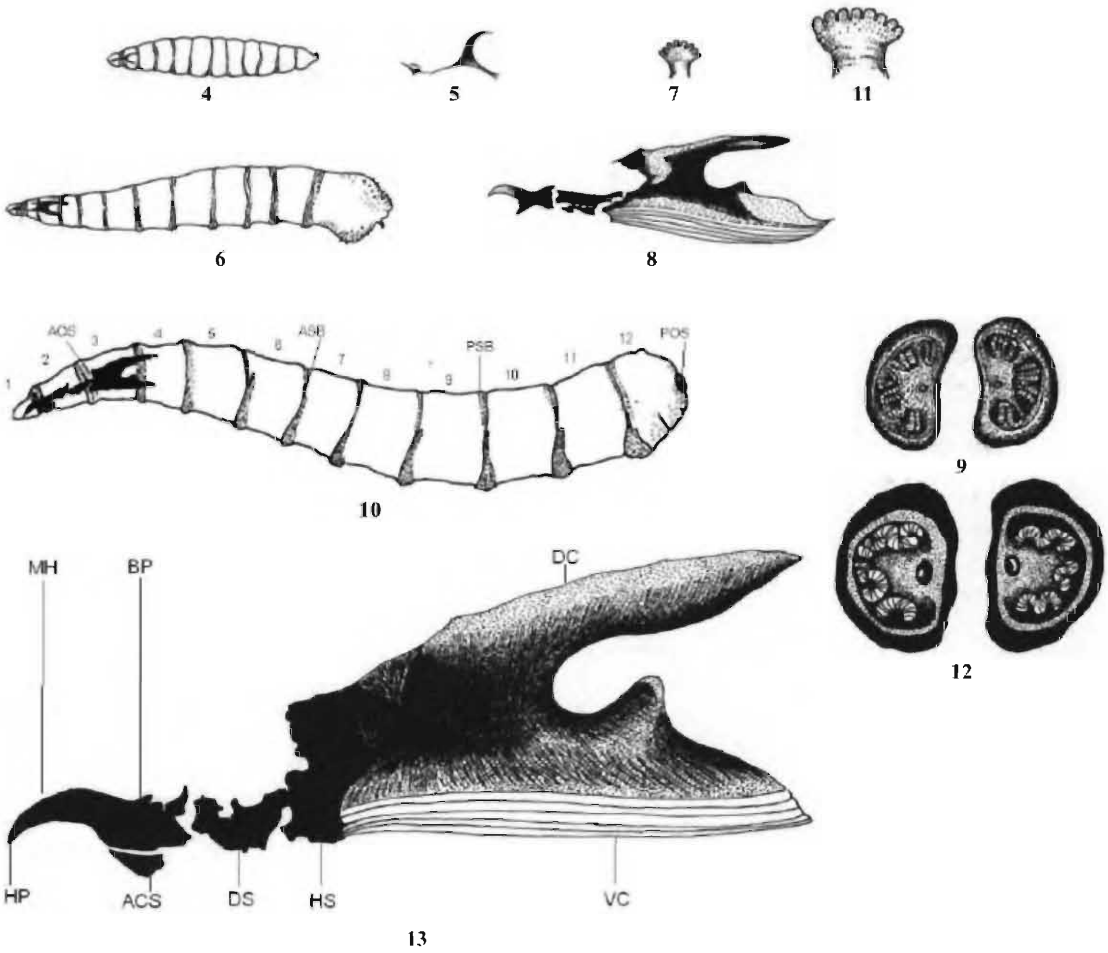
Puparium: Length 4 – 4.5 mm, greatest diameter 1.5 – 1.8 mm; cylindrical in shape; color blackish – brown; spine bands on segments prominent.

DISCUSSION

Musca (Byomya) emdeni was known only from the Sundarbans Biosphere Reserve (Nandi & Sinha, 2004), and recently collected from other parts of West Bengal, India. These are widely distributed in the Sundarbans Biosphere Reserve but had not been extensively sampled until the first author worked out on the calyptrate fly fauna in the Sundarbans. *Musca (Byomya) emdeni* completes its life cycle in cow dung. The female fly avoid laying eggs on the deposit on which other dung breeding muscoid flies (for example *Neomyia, Brontaea,* and *Musca*) already seated to lay eggs. It was found that fly population reaches its peak from June to September in a year. The life history of *Musca (Byomya) emdeni* shows an interesting resemblance to that of *Neomyia indica* (Robineau Desvoidy), considering the behavior of the flies to use freshly deposited cow dung as breeding material, and also the saprophagous nature of the larvae (Sinha & Nandi, 2005). The association and distribution of *Musca (Byomya) emdeni* strongly reflects that, it is exclusively cattle dung breeder and do not shows any coprophagous habit like some *Neomyia* and *Musca* which regularly visit human excrement and also breed there in.

SUMMARY

The life history of freshly deposited cow dung visiting muscid fly *Musca (Byomya) emdeni* (Sinha & Nandi, 2004) was studied in laboratory. The three larval instars are described in detail.



Figs. 4 – 13. Larval body parts of *Musca (Byomyia) emdeni* Sinha and Nandi

4 – 1st instar Larva
5 – Cephaloskeleton of 1st instar larva
6 – 2nd instar larva
7 – Anterior spiracles of 2nd instar larva
8 – Cephaloskeleton of 2nd instar larva
9 – Posterior spiracles of 2nd instar larva
10 – 3rd instar larva
11 – Anterior spiracles of 3rd instar larva
12 – Posterior spiracles of 3rd instar larva
13 – Cephaloskeleton of 3rd instar larva

Fig. 4-13 : not to scale

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TERMINOLOGY

ACS = Accessory sclerite, AOS = anterior spiracle, ASB = anterior spine band, POS = posterior spiracle, PSB = posterior spine band, BP = basal plate, DC = dorsal cornu, DS = dental sclerite, HP = hook part, HS = hypostomal sclerite, MH = mouth hook, VC = ventral cornu.

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DIVERSITY, DISTRIBUTION AND CONSERVATION OF FRESHWATER FISHES IN MOUNT HARRIET NATIONAL PARK, ANDAMAN AND NICOBAR ISLANDS

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INTRODUCTION

Mount Harriet national park lies between 10°43'57"N latitudes and 92°43'41" to 92°47'11" E longitudes. The area of park is about 46.62 km2 and there is also a proposal to extend the area by another 1700 hectares to include the adjacent hill ranges on Southern part and to conserve the marine ecosystem along the Eastern coast (Fig. 1). The park possesses various hill ranges, which generally lie in the north and south direction as islands. From these, numerous spurs and ridges branch out in east and west directions. The hills are steeper on the east than on west. The principal peaks are Mt. Koyob (460m, the highest peak of N.P), Mt. Hext. (424m), Mt. Harriett (422m), Mt. Godridge (377m) and Mt. Carpenter (373m). The park is covered with different types of thick green vegetation. The beaches on eastern coast are generally rocky with a few sandy patches. The park also possesses a few fresh water streams, arising from the hill ranges and draining into the east coast also in the west as small streams which fulfill the water required by the villagers and residents of Bambooflat, Stewart Gunj, Nayapuram, Wimberly Gunj, Mannarghat, Malapuram, Wrightmyo, Kallatang and Shoalbay areas. There is one impoundment as earthen dam on one of the stream at Bambooflat, has a capacity of 230 million liter was constructed in 1990 as a water storage facility. The Chief Commissioner, Andaman and Nicobar islands declare his intension to constitute the Mount Harriett national Park under subsection (1) of section 35 of Wildlife (Protection) Act 1972 (No. 53 of 1972) and was notified vide Notification No. 161/CF/HQ/12(6) 2 on Wednesday, dated 13th November 1979. The major forest types from Mt. Harriett National Park include Giant Evergreen Forest, Andaman Tropical Evergreen Forest, Andaman Semi Evergreen Forest, Andaman Moist Deciduous Forest and Littoral Forest. Mount Harriett National Park is one of the few pristine areas within the Andaman Archipelago, where, almost all the major groups of animal's characteristics of tropical rain forests are well represented. The composition of terrestrial fauna of National Park shows greater similarities with that of Myanmar and Indo-China. Some species are restricted only to Andaman and sometimes even to certain islands, while some are common to both the groups of islands. Hitherto, 529 species are known from Mount Harriett National Park, of which 149 are endemic to species/subspecies level (Kailash and Rajan, 2004). The highest endemicity has been recorded in case of butterflies, which is more than 66 per cent followed by the birds (50 per cent). These two groups have been extensively studied. Information on freshwater fishes of Mount Harriet National Park is inadequate. This research aimed at diversity and distribution of fish in Mount Harriet streams and also to assess the

status of the freshwater fishes. Nelson (2006) estimated 27,977 valid species of fishes under 62 orders, 515 families and 4,494 genera, and the eventual number of extant fish species was projected to be close to 32,500. About 11,952 species or 42.72 %, normally live in freshwater lakes and rivers that cover only 1 % of the earth's surface and account for a little less than 0.01% of its water. The secondary freshwater species number 12,457 and the remaining 3568 species are exclusively marine. Some early contributions on freshwater fish fauna were on diversity and distribution (Day, 1870, 1875-78; Hora 1925; Mukerji 1935; Herre (1939, 1940,1941) listed 112 and 490 species including shoreline, coral reef fishes and very few freshwater fishes from the streamlets of Andaman Islands; study on Gobiidae (Koumans 1940); Silas, and Dawson,1961; Sen, 1975. Rema Devi (2010) listed 23 species, of these only 8 are primary fresh water fishes and others are secondary fresh water fishes encountered in fresh water habitats and 39 species of fishes visiting fresh water.

MATERIALS AND METHODS

A short study was undertaken from May 2011 to August 2012, to assess the species diversity and composition of freshwater fishes in five tributaries of freshwater streams in the foothills of Mount Harriet National Park, South Andaman. Riverine substrate is dominated by boulders with small patch of muddy or silted areas. The banks of the streams are generally steep, with overhanging trees and assorted shrubs. At each site GPS co-ordinates were recorded on a Gramin series GPS unit. Cast nets and hand line were used for fish sampling, which was done from 8.00 a.m. to 1.00 p.m. in addition to this bamboo traps were used in the night to collect freshwater eels. Netted and trapped fishes were then stored by species in water-filled buckets. The majority of the fishes, after on field studies made, were released in the stream with no harm done. All the material studied has been deposited in the reference collections of Zoological Survey of India at Port Blair.

RESULTS

A total of 152 individuals of 24 species belonging to 6 orders, 12 families and 19 genera (Table 1) were collected from the streams of Mount Harriet National Park, South Andaman (fig.1). Brief description of the individual fish species sampled during the field visits.

Class OSTEICHTHYES

Order ELOPIFORMES

Body slender and compressed; gill openings wide; paired fins with long axillary scale; no spines in fns; ventral fins abdominal; caudal fin deeply forked; scales cycloid.

Family MEGALOPIDAE

Body somewhat compressed; slightly deep-bodied; no scutes on belly; mouth terminal, fairly large; bony gularplate located under mouth; single dorsal fin, the last ray elongated; anal fin origin slightly behind last dorsal ray; no spines in fins; scales on body large; caudal fin forked.

Genus : ***Megalops*** Lacepede, 1803

Megalops cyprinoides (Broussonet, 1782)

Clupea cyprinoides Broussonet, 1782. Ichthyol., pl. 9.

Megalops cyprinoides: Smith, 1986. in Smith & Heemstra, Smith's Sea Fishes, p. 156, fig. 37.1.

Diagnostic features: D. 18-20; A. 26-28; P. 15-16; V. 10-11; Ll. 38-40. Body fusiform; mouth superior; lower jaw projecting; a median gular bone under side of chin; upper jaw extending to hind border of eye; last dorsal ray elongated and filamentous. Body blue-green above, flanks silvery.

Habitat: Found in creeks and coastal waters. Distribution: Into-West Pacific, from east coast of Africa, Gulf of Omen, coasts of India, Andaman Is., Sri Lanka to Indonesia and Phillippines to China Sea.

Order ANGUILLIFORMES

Body snake-like with low dorsal and anal fins, continuous with caudal fin; ventral fins absent; pectoral fins present or absent; no spines in fins; gill openings narrow as a slit or hole on each side; scales absent or small, embedded; maxilla toothed.

Fish Diversity

Table 1: List of species grouped into orders and families

Order	Family	Species
ELOPIFORMES	Megalopidae	*Megalops cyoprinoides* (Broussonet, 1782)
ANGUILLIFORMES	Anguillidae	*Anguilla bengalensis bengalensis* (Gray, 1834) *Anguilla bicolour bicolour* (McClelland, 1844)
CYPRINIFORMES	Cyprinidae	*Rasbora daniconius* (Hamilton, 1822)
SILURIFORMES	Claridae Heteropneustidae	*Clarias magur* (Hamilton 1822) *Heteropneustes fossilis* (Bloch, 1794)
CYPRINODONTIFORMES	Aplocheilidae	*Aplocheilus panchax* (Hamilton,1822)
PERCIFORMES	Kuhilidae Cichlidae Gobiidae Eleotridae Anabantidae Channidae	*Kuhila mugil* (Forster, 1801) *Kuhlia rupestris* (Lacepede,1802) *Orechromis mossambicus* (Peters,1852) *Awaous grammepomus* (Bleeker,1849) *Bathygobius fuscus* (Ruppell,1830) *Glossogobius giuris* (Hamilton,1822) *Sicyopterus microcephalus* (Bleeker,1854) *Stenogobius gymnopomus* (Bleeker, 1853) *Belobranchus* sp. (new species) *Butis butis* (Hamilton,1822) *Eleotris andamensis* Herre, 1939 *Eleotris fusca* (Bloch & Schneider,1801) *Giuris margaritacea* (Valenciennes 1837) *Anabas testudineus* (Bloch,1792) *Channa gachua* (Hamilton, 1822) *Channa punctatus* (Bloch,1793)

Family ANGUILLIDAE

Body slightly robust, tail compressed; small embedded scales on body; median fins continuous around tail; dorsal fin origin mid way between pectoral base and anus; lips thick; lateral line complete with small pores.

Genus ***Anguilla*** Schrank, 1798

Anguilla bengalensis bengalensis (Gray, 1831)

Muraena bengalensis, Gray, 1831. Illust. Ndian Zool., pl. 95.

Anguilla bengalensis bengalensis: Talwar & Jhingran, 1991. *Inland Fishes of India and Adjacent Countries* 1:74

Diagnostic features: Dorsal origin nearer to anus than pectoral base; teeth a narrow band, toothless groove between innermost row and outer rows on jaws; vomerine tooth band very narrow posteriorly. Body olive-yellow, mottled with brown, lighter latreo-ventrally.

Habitat: Found in creeks and back waters.

Distribution : India, Andaman Is. and Sri Lanka.

Anguilla bicolor bicolor Mc. Clelland, 1844

Anguilla bicolor Mc Clelland, 1844. *J. nat. Hist., Calcutta,* p. 174, pl. 6, fig. 1.

Anguilla bicolor bicolor: Castle, 1986. in Smith & Heemstra, *Smith's Sea Fishes*, p. 160, fig. 39.2.

Diagnostic features: Dorsal fin origin slightly before anus; close-set broad bands of teeth on jaws and vomer; vomerine tooth band broad posteriorly. Body dark bluish-brown, lighter below from head to anus.

Habitat: Found in creeks.

Distribution: Indian Ocean, from Kenya, Madagascar, Seychellies, Mauritius, coasts of India and Andaman Islands.

Order CYPRINFORMES

Small to moderate sized fishes; mouth protractile and toothless; barbells present or absent; single dorsal fin with no spines; adipose

fin absent; ventral fins abdominal; body with cyloid scales; head scaleless; lateral line present; branchiostegal rays 3.

Family CYPRINIDAE

Body compressed, abdomen rounded or with sharp edge; mouth terminal; no teeth in jaws; lips thin; barbells present or absent; pharyngeal teeth well developed in one to three tows; anal fin short based; head naked.

Genus ***Rasbora*** Bleeker, 1860

Rasbora daniconius (Hamilton, 1822)

Cyprinus danoconius Hamilton, F. 1822. An account of the fishes found in the river Ganges and its branches: 327, 391, Pl. 15 (fig. 89).

Rasbora daniconius Liao, T. Y., S. O. Kullander, and F. Fang 2010. Phylogenetic analysis of the genus Rasbora (Teleostei: Cyprinidae). Zoologica Scripta v. 39 (no. 2): 166.

Diagnostic features: D. 9; A. 7; P. 14; V. 9; Ll. 32-34; Ltr. 4½ + 1 + 2½. Body oblong and compressed; mouth small; lips simple; lateral line almost complete. Body olive, sides and belly silvery; a distinct black stripe from eye to base of caudal fin, edged above and below by a thin golden line; a dark narrow stripe above anal fin.

Habitat: Found in pools and streams.

Distribution: Pakistan, India, Andaman Island, Sri Lanka, Bangladesh, Burma and Mekong.

Order SILURIFORMS

Body elongate and compressed, naked or covered with bony plates; eyes small, majority of the fishes have barbells extending from each side of the upper and lower jaws; spines often present at front of the dorsal and pectoral fins; no ventral fin spine; adipose dorsal fin usually present; pectoral fin low in position.

Family CLARIIDAE

Body cylindrical and elongate; head broad and flattened; eye small; anterior nostrils tubular behind upper lip; posterior nostrils rounded slits behind nasal barbells; four pairs of barbells; labrynthic organ well developed or vestigial; dorsal fin base very long, not preceded by spine; no adipose fin; pectoral with strong spine; skin naked.

Genus ***Clarias*** Scopoli, 1777

Clarias magur (Hamilton 1822)

Macropteronotus magur, Hamilton, F. 1822. An account of the fishes found in the river Ganges and its branches: 146, 374, Pl. 26 (fig. 45).

Clarias magur, Ng, H. H. and M. Kottelat 2008. The identity of *Clarias batrachus* (Linnaeus, 1758), with the designation of a neotype (Teleostei: Clariidae). *Zoological Journal of the Linnean Society* v. 153: 370.

Diagnostic features: D. 70-76; A. 45-58; P, I, 8-11; V. 6. Body elongate, head compressed; occipital process narrow, mouth terminal with villiform teeth on jaws; vomerine teeth villiform in a cressentic band or two pyriform patches; barbells four pairs, the maxillary pair extending beyond base of pectoral fin and nasal pair extend to gill openings; dorsal fin inserted anterior to tip of pectoral fins; pectoral spine strong an serrated on both edges. Body greenish-blue, flanks and belly pinkish with numerous pale to white spots on flanks; dorsal fin yellowish with red margin.

Habitat : Found in pools, ponds and rivers.

Distribution : Pakistan, India, Andaman Is., Sri Lanka, Burma to Philippines.

Family HETEROPNEUSTIDAE

Body elongate and compressed, head flat; dorso-lateral side covered with osseous plates; mouth small; four pairs of barbells; air-sac elongated; dorsal fin without spine; adipose fin absent; anal fin extremely long; pectoral fin with strong spine; body naked.

Genus ***Heteropneustes*** Muller, 1840

Heteropneustes fossilis (Bloch, 1794)

Silurus fossilis Bloch, 1794. *Nat. Ausland. Fische.*, **8** : 46, pl. 370, fig. 2.

Heteropneustes fossilis : 1991. Talwar & Jhingran, Inland Fishes of *India and adjacent countries*, **2** : 689, fig. 219.

Diagnostic features: D. 6-7; A. 65-68; P. I, 7; V. 6. Occipital process not extending to base of dorsal fin; four pairs of barbells; pectoral spine strong

and serrated; anal fin separated by a distinct notch from caudal fin. Body dark purplish-brown above, lighter below with two lateral yellowish bands.

Habitat: Found in ponds, swamps and rivers.

Distribution: Pakistan, India, Andaman Is., Sri Lanka, Bangladesh to Thailand.

Order CYPRINODONTIFORMES

Body fusiform, compressed, elongate or moderately elongate; opercular bones without spines; single dorsal fin; both dorsal and anal fins inserted on rear half of body; no spines in fins; upper or both jaws extremely elongate; branchiostegal rays 4-15.

Family APLOCHEILIDAE

Body fusiform and compressed, upper jaw protrusible; villiform teeth on jaws and vomer; single dorsal fin, inserted on posterior third of body; no spines in the fin; ventral fin bases set close together, fin rays 6; large cycloid scles on body; lateral on head, not on body.

Genus ***Aplocheilus*** Mc Clelland, 1839

Aplocheilus panchax (Hamilton, 1822)

Esox panchax Hamilton. 1822. *Fishes of Gages*, p. 211, 380, pl. 3, fig. 69.

Aplocheilus panchax : Talwar & Jhingran, 1991. *Inland Fishes of India and adjacent countries*, 2: 752, fig. 241.

Diagnostic features: D. 8; A. 15; P. 14; V. 6. Ls. 33. Body elongate and compressed; eyes large, 3.3-3.4 in head; mouth terminal; anal fin square shaped; ventral fins small; caudal fin rounded. Upper part of body greenish, dull white ventrally; fins light yellow; a black at base of dorsal fin; margin of anal fin reddish.

Habitat: Found in streams and ponds.

Distribution: Pakistan, India, Andaman Is., Bangladesh, Burma and Malayan Archipelago.

Order : Perciformes

Family: ***Kuhlidae*** (Flagtails)

Body elongate-oval and fairly compressed, with weakly ctenoid scales. Preopercle serrate; opercle with two exposed flat spines. Mouth with fine teeth in bands on jaws, also on vomer and palatines; tongue toothless. Fin spines strong; a notch before soft dorsal fin; anal fin with 3 spines. Dorsal and anal fins each with a well developed scaly sheath; no scaly pelvic axillary process. Branchiostegal rays 6.

Genus ***Kuhila*** Gill, 1861

Kuhila mugil (Forster, 1801)

Sciaena mugil Forster, 1801, *Systema Ichthyol.*: 541 (type locality: Tahiti).

Kuhila rupestris : Talwar & Jhingran, 1991. Inland Fishes of *India and adjacent countries*, 2 : 814.

Diagnostic features: D. X 10-11; A. III, 10-13; P. I 13; V. I 5. Ll. 48-56. Body rather oval, its depth 2.7 to 3.1 times in standard length. Gillrackers 23-25 on lower arm of first arch. Caudal fin covered with small scales, larger basally. Colour in life bluish above, silvery on flanks and belly; fins yellowish; caudal fin with two prominent black oblique bands across each lobe and a narrower black band along middle rays of fin.

Habitat: Inhabits freshwater and estuaries, rarely in seas.

Distribution: Indo-West Pacific.

Kuhila rupestris Lacepede, 1802

Centropomus rupestris Lacepede, 1802, *Hist. nat. Poiss.*, 4: 252 (type-locality: Reunion Is.)

Kuhila rupestris: Talwar & Jhingran, 1991. *Inland Fishes of India and adjacent countries*, 2: 814.

Diagnostic features: D. X 10-12; A. III, 9-10; P. I 12-13; V. I 5. Ll. 38- 44. Body rather oval, its depth 2.6 to 3 times in standard length. Gillrackers 17-19 on lower arm of first arch. Colour in life silvery, in fresh most scales with a large dusky spot; juveniles often with oblique blackish blotch on each caudal lobe merging with growth to give broad vertical bar in adults.

Habitat: Inhabits freshwater and estuaries, rarely in seas.

Distribution: Indo-West Pacific.

Family CICHLIDAE (Cichlids)

Body moderately deep and compressed. Single nostril on each side of snout. Teeth on jaws; palatines and vomer edentulous. Dorsal fin with

12 to 22 spines and 8 to 23 soft rays; anal fin with 3 to 16 spines and 6 to 24 soft rays. Lateral line interrupted or abruptly ceasing, usually with 30 to 40 scales. Pseudobranchiae absent. Branchiostegal rays 6. Air bladder large and simple.

Genus ***Orechromis*** Gunther, 1889

Orechromis mossambicus (Peters, 1852)

Chromis (Tilapia) mossambicus, Peters, 1852, *Montab. Akad. Wiss., Berlin:* 681 (type locality: Mozambique).

Orechromis mossambica, Jayaram, K. C. 2010. *The freshwater fishes of the Indian region:* 463.

Diagnostic features: D XV-XVI 10-12; A III 10-11; P 14-15; V I 5. Body elongate, deep and compressed; Upper profile of body more convex than lower. Mouth large; teeth in 3 to 5 series on jaws. Caudal fin truncate; 30 to 32 scales in lateral line. Colour of females and non breeding males watery grey to yellowish, with 3 to 4 dark blotches; body of breeding males deep black. Dorsal fin black with a red margin; pectoral fins translucent red; caudal fin with a broad red margin.

Habitat: Found in primarily brackish waters and also freshwaters.

Distribution: East Africa; an introduced species in India and other countries.

Remark: This species was introduced in India in August 1952 and is cultured in freshwater ponds. These fish are suitable for farming because they can breed easily and are hardy and also high yielding. In Andaman Islands it was introduced in 1970 in ponds, due to tsunami of 2004 this fish penetrates in creeks and some of the freshwater streams. The introduction of alien species can have a profound and devastating impact upon an ecosystem. Since the introduction of the Tilapia, some of the species are either extinct or only occur in very small populations. Tilapia now comprises 40% of the fish biomass. Their introduction has probably led to the extinction of native climbing perch (*Anabas* sp) in some of the freshwater streams.

Family ELEOTRIDAE

Small to moderate fishes; teeth in jaws small conical in several rows; no lateral line; canals and pores present on head; branchiostegal rays 6; ventral fins widely separated; second dorsal short based, much less than caudal peduncle length; anal fin origin behind dorsal origin; scales ctenoid or cycloid; body and most part of head region scaled.

Genus ***Belobranchus*** Bleeker, 1857

Diagnostic features: D. VII, 8; A. 8; P. 19-23; V. I, 5; Ll. 70; Ltr. 20; predorsal scales 30. Body elongate, cylindrical anteriorly, compressed posteriorly; head depressed; snout convex; lower jaw prominent; anterior nostril in a rim; teeth in front in a few rows, outer row a little enlarged; no distinct pore on head; supraopercular groove distinct; a mucous canal round each eye; continued in the supraopercular groove; first branchiostegal ray form a spine; first dorsal fin obtuse, 3rd to 6th rays longest; caudal fin rounded. Colour dark to obvious above, dark to yellowish below; 4-5 longitudinal dark reddish- brown stripes radiating from eye to preopercle; 8-9 longitudinal dark blotches on body; fins yellowish to orange; dorsal fins with longitudinal stripes; pectoral fin base with dark blotch; a dark spot at caudal peduncle. Habitat: freshwater pools and streams. Distribution: Andaman Islands. Remark: New to India

Genus ***Butis*** Bleeker, 1856

Butis butis (Hamilton, 1822)

Cheilodipterus butis Hamilton, 1822. *Fishes of Gange,*. p. 57, 367.

Butis butis: Hoese, in Smith & Heemstra, 1986. *Smith's Sea Fishes*, p. 808, fig. 241.1.

Diagnostic features: D. VI + I, 8; A. I, 8; P. 18-20; V. I, 5; Ls. 28-30. Depth 5.4-5.9 in standard length; head depressed; maxilla reaches below front edge of eye; predorsal scales 22-24. Body dark with several longitudinal lines; caudal fin dark, upper margin light; base of pectoral with black spot.

Habitat: Found in back water and creeks.

Relationship of the genus *Belobrachus* with other genera of Eleotridae (Larson and Murdy 2001)

Eleotris	*Butis*	*Belobranchus*	*Ophiocara*
Rear of preopercle with a ventrally directed spine (covered by skin); predorsal scales 35-53.	Bony irregular ridge or row of spiny serrations above eye and on top of snout (spines may be indistinct) Lower jaw distinctly anteriormost, chin protruding; head without fleshy knobs or barbels on chin; distinct black spot on pectoral base or on bases of pectoral fin rays.	No bony irregular to spiny ridge above eye or top of snout, Head without elongate papillae or branched barbels. Head scaleless; first (or first and second) branchiostegal rays with anteriorly-directed spine; sensory papillae on head in longitudinal pattern.	Sensory papillae on head arranged in transverse pattern ;Usually 33-42 scales in a lateral series; body brown with 2-3 wedge-shaped whitish to yellowish bars across back, when live, body with pale golden speckles.

Distribution: Indo-West Pacific, from east coast of Africa to Sri Lanka, Andaman Is. to Australia.

Genus ***Eleitris*** Schneider, 1801

Eleotris andamensis Herre, 1939

Herre, A. W. C. T. 1939. on a collection of littoral and freshwater fishes from the Andaman Islands. *Records of the Indian Museum* (Calcutta) v. 41 (pt 4): 344.

Diagnostic features: D VI,9; A 9. Scales in longitudinal series 58-60; transverse series between origin of second dorsal and anal 19-20; predorsal scales 38-40. Body thick, robust; eyes are small; mouth strongly oblique, projecting chin; maxillary extends beneath front of eye. Brown, scales darker; a black spot at upper angle of gill opening; three black stripes extend back from the eye; dorsal, anal, pectoral and caudal fins with rows of brown spots.

Habitat: Inhabits freshwater. Andaman Islands.

Eleotris fusca (Schneider, 1801)

Poecilia fusca Scheneider, in Bloch & Schneider, 1801. *Syst. Ichth.*, p. 453.

Eleotris fusca: Hoese, in Smith & Heemstra, 1986. *Smith's Sea Fishes*, p. 809, fig. 241.4.

Diagnostic features: D. VI + I, 8; A. I, 8; P. 18; V. I, 5; Ls. 62-64. Depth 4.2-4.6 head 4.1-4.2 in standard length. Maxilla reaches to middle of eye; cheek scaled below eye; 8-11 transverse papillae rows along lower margin of preopercle; caudal fin rounded. Head, body and fins dark brown; numerous dark horizontal lines on body.

Habitat: Found in freshwater and back waters.

Distribution Habitat: Indo-West Pacific, from east coast of Africa to Ryukyu Islands.

Genus ***Giuris*** Sauvage, 1880

Giuris margaritacea (Valenciennes 1837)

Eleotris aporos, Bleeker. 1854. *Natuurkundig Tijdschrift voor Nederlandsch Indie*, v: 59.

Ophieleotris aporos, Talwar, P. K. and A. G. Jhingran. 1991 *Inland fishes of India and adjacent countries*, 2: 979.

Giuris margaritacea Allen, G. R., H. Midgley, and M. Allen. 2002. *Field guide to the freshwater fishes of Australia*. I-xiv: 289.

Diagnostic features: D. VII, 8-9; A. I, 9; P. 14-15; V. I, 5; Ll 30; Ltr. 10-11; predorsal scales 13-18. Body large, elongate, anteriorly cylindrical, posteriorly compressed; head dorsally flattened; profile concave; snout pointed; anterior nostrils near margin of snout in short tubes; lower jaw a little prominent; maxillary extends to below anterior part of eye; teeth in many rows, outer row a little enlarged; two longitudinal mucous canal on cheek.

Colour generally greenish brown with 8-10 dark bars across sides and large black blotch at base of pectoral fins; lower half of head tan or yellowish with 3-4 dark brown to reddish stripes radiating from lower part of eye; dorsal fin, ventral and anal fins bordered with red. Habitat: Found in freshwater bodies. Distribution: Indonesia, Palau, Papua New Guinea, Philippines, Australia, Fiji, Vanuatu, Madagascar, Taiwan, India, Malaysia, Germany, France.

Family GOBIIDAE

Small fishes; body scaled or naked; head generally with mucus canals and open pores; barbells on head present or absent; usually tow dorsal fins, some with single dorsal fin; 1st dorsal spines flexible; ventrals separate, partly connected or united to form a disc; membrane connecting two ventral spines or absent; small and conical teeth in one to several rows in jaws; brachiostegal rays free.

Genus *Awaous* Valenciennes, 1837

Awaous grammepomus (Bleeker, 1849)

Gobius grammepomus Bleeker, 1849. *Verhandelingen van het Bataviaasch Genootschap van Kunsten en Wetenschappen.* v. **22** (6): 34.

Awaous grammepomus Koumans, 1953. Fishes of Indo-Australian Archipelago, **10**: 151.

Diagnostic features: D. VI + I, 10; A. I, 10; P. 15-17; V. I, 5; Ls. 50-52; L.tr. 13-15; Predorsal scales 13-15. Head and snout obtusely convex; small falps on shoulder girdles; lips thick; tongue bilobed; caudal fin obtuse. Body olive green, lighter below; head violet to olive green, two longitudinal black streaks from eye to maxillary; back and sides with irregular blackish streaks; dorsal fins with dark streaks; caudal fin with 7-9 transverse blackish streaks; outer part of pectoral base and middle base of caudal fin with black spots.

Habitat: Found in freshwater rivers.

Distribution: From India, Andaman Islands to Philippines.

Exyrias puntang (Bleeker, 1851)

Gobius puntang Bleeker, 1851. *Nat. Tijd. Ned., Indie.*, **2** : 486. (Type locality: Rio, Indonesia).

Exyrias puntang, Murdy, 1985. *Indo-Pacific Fishes*, No. 10, p. 10, fig. 1 & 2, p. 2B.

D. VI + I, 10; A. I, 9-10; P. 17-18; V. I, 5; Ls. 30-32. Mouth inferior; small teeth in 4-5 rows in each jaw; predorsal scales 10-12. Body dark brown, lighter ventrally; small red spots on anterior part of dorsal body contour and small silvery white spots on posterior part of body; dorsal fin with alternating purple and yellow stripes; anal fin yellow, blackish medially with two red stripes; dusky spot on pectoral fin; ventral fin blackish. Found in creeks. Indo-West Pacific, from Andaman Island to Ryukyu Is. and New Guinea to New Caledonia. (Photo Rajan)

Genus *Bathygobius* Bleeker, 1878

Bathygobius fuscus (Ruppell, 1830)

Gobius fuscus Ruppell, 1830. *Atl. Reise. Afrik. Fishce.* p. 137.

Bathygobius fuscus, 1986: Hoese, in *Smith & Heemstra*, Smith's Sea Fishes., p. 781, pl. 122.

Diagnostic features: D. VI + I, 9; P. I, 8; P. 17-18; V. I, 5; Ls. 30-33. Depth 4.5-5.0, head 3.2-3.3 in standard length; head rounded; lips thick; teeth in several rows in jaws; upper three pectoral rays free from membrane; pre-pelvic area scaled; 14-16 predorsal scales. Body dusky with scattered spots; sides of body with faint blotches, extends ventrally; fins dark with dusky markings.

Habitat: Found in freshwater and backwaters.

Distribution: Indo-Pacific, from east coast of Africa to Japan and Australia

Genus *Glossogobius* Gill, 1862

Glossogobius giuris (Hamilton 1822)

Gobius giuris Hamilton, 1822. An account of the fishes found in the river Ganges, p. 51, 366, pl. 33 (fig. 15).

Glossogobius giuris: Hoese, in Smith & Heemstra, 1986. Smith's Sea Fishes, p. 790, fig. 240. 44.

Diagnostic features: D. VII + 8-9; A. I, 8-9; P. 19-20; V. I, 5; Ls. 30-32. Head flattened; snout elongate, lips thick; dorsal fins close together; predorsal scales 22-26. Cheek with multiserial rows of papillae. Body is brownish-yellowish with 5-6 dark rounded spots on its sides; dorsal fins with small black spot forming longitudinal stripes; rays of dorsal, pectoral and caudal fins with black spots.

Habitat: Found in freshwaters.

Distribution: Indo-West Pacific, from east coast of Africa, coasts of India, Andaman Island to Japan and Australia.

Remarks: Four species of Glossogobius recorded from Andamans, they are Glossogobius bicirrhosus (Weber, 1894), Glossogobius

biocellatus (Valencienns, 1837), Glossogobius celebius (Valenciennes, 1837) and Glossogobius giuris (Hamilton, 1822). The former two species are seldom found in freshwater. In G. celebius cheek with only uniserial rows of papillae and in G. giuris cheek with multiserial rows of papillae.

Genus ***Sicyopterus*** Gill, 1860

Sicyopterus microcephalus (Bleeker, 1854)

Sicydium microcephalus Bleeker, 1854. *Nat. Tijd. Ned. Indie.*, **7**:437.

Sicyopterus garra Hora, 1925. *Rec. Indian Mus.*, XXVII, p. 35, pl. ii, figs. 2-5.

Sicyopterus microcephalus Koumans, 1953. Fishes of Indo-Australian Archipelago, 10 : 223.

Diagnostic features: D. VI + I, 10; A. I, 10; P. 20; V. I, 5; Ls. 65-68. Snout obtuse; papillae along lower margin; 5-8 canines in lower jaw on each side; dorsal fins separate; 20 predorsal scales. Body violet above, silvery-white below; sides of body with yellows spots in rows, the spots form into stripes on caudal peduncle; fins light reddish-violet; caudal fin with violet streaks, above and below bordered with orange. Habitat: Found in freshwater pools and fast streams and feed on adhesive algae, when ascends a torrential stream, it sometimes climbs up on wet rocks along torrent using the mouth and pelvic fins alternately as suckers. Distribution: Andaman Islands to Indonesia.

Genus ***Stenogobius*** Bleeker, 1874

Stenogobius gymnopomus (Bleeker, 1853)

Gobius gymnopomus Bleeker, 1853. *Nat. Tijd. Ned. Indie.*, **4** : 270.

Larson, H. K. and E. O. Murdy 2001. Families Eleotridae, Gobiidae. In: Carpenter & Niem, 2001. v. 6:3602

Stenogobius gymnopomus : Kamla *et al*, 1993. Environment & Ecology, **11**(4): 814, fig. 2.

Diagnostic features: D. VI + I, 10; A. I, 10; P. 15-16; V. I, 5; Ls. 50. Head highly compressed; jaws sub-equal; finger-like flap on shoulder girdle; dorsal fins separate, 18 predorsal scales. Body light brown with 3 transverse bands on sides; a dark band descends from eye; brown blotches on head; all fins violet with several rows of dark spots.

Habitat: Found in backwaters and freshwater streamss.

Distribution: Indian Ocean, from coasts of India, Andaman Island to Indonesia.

Stenogobius gymnopomus

Family ANABANTIDAE

Body oblong and compressed posteriorly; head broad; operculum serrate with two spines; mouth large, upper jaw prostrusile; jaws with small conical teeth; palatine edentate; single dorsal fin; pectoral and caudal fins rounded; scales ctenoid; two lateral lines.

Genus ***Anabas Cuvier*** and Cloquet, 1816

Anabas testudineus (Bloch, 1795)

Anthias testudineus Bloch, 1795. *Nat. Ausland. Fische.*, (6) : 121.

Anabas testudineus: Talwar & Jhingran, 1991. Inland Fishes of India and Adjacent Countries. **2**: 996, fig. 283.

Diagnostic features: D. XVI-XVII, 8-9; A. VIII, 9-10; P. 14; V. I, 5; LI. 24-28. Body elongate and moderately deep; depth 3.25-3.4, snout 14.2-16.5 in standard length; jaws with villiform teeth; scales on the body very large; caudal fin rounded. Body dark grey, fading to pale yellow ventrally; a dark spot at base of caudal fin and at base of pectoral fin; dorsal and caudal fins grey; pectoral and anal fins pale.

Habitat: Found in fresh water canal and ponds.

Distribution: Pakistan, India, Andaman Is, Sri Lanka, Bangladesh, Burma, Indonesia and Philippines. Remarks: Anabas testudineus, has been designated as threatened species in Indian waters.

Family CHANNIDAE

Body elongate and cylindrical, mouth large; jaws and palate dentate; eyes located in anterior half of head; single soft dorsal; scales cycloid and ctenoid; caudal fin rounded, air bladder present.

Genus ***Channa*** Scopoli, 1777

Channa gachua (Hamilton, 1822)

Channa gachua Hamilton, 1822. *Fishes of Ganges*: 68, 367, pl. 21, fig. 21.

Benziger, A., S. Philip, R. Raghavan, P. H. Anvar Ali, M. Sukumaran, J. C. Tharian, N. Dahanukar, F. Baby, R. Peter, K. R. Devi, K. V. Radhakrishnan, M. A. Haniffa, R. Britz, et A. Antunes, 2011. Unraveling a 146 years old taxonomic puzzle: validation of Malabar snakehead, species-status and its relevance for channid systematics and evolution. PLoS ONE v. 6 (no. 6): 1-12.

Diagnostic features: D. 32-38; A. 20-23; P. 14-15; V. 6; Ll. 39-47. Body fairly rounded; eye 5.5-6.0 in head; 4-5 scale rows between preopercular angle and posterior border of orbit; predorsal scales 12. Body greenish-black, ventral side pale; a row of dark oblique bands above and below lateral line; pectoral fins with a series of alternate blue and pale orange vertical bands; outer margin of caudal fin orange and barred. Habitat: Found in streams. Distribution: Afghanistan, Pakistan, India, Andaman Islands, Nepal, Sri Lanka, Burma, Bangladesh.

Channa ***punctatus*** (Bloch, 1793)

Ophiocephalus punctatus Bloch, 1793. Nat. Ausland. Fische., 7 : 139, pl. 358.

Channa punctatus: Talwar & Jhingran, 1991. Inland Fishes of India and Adjacent Countries,2 : 1020, fig. 290.

Diagnostic features: D. 32, A. 22; P. 16; V. 6; Ll. 39. Body elongate; eye 8.1-8.35 in head; scale rows between preopercular angle and posterior border of orbit present; predorsal scales 12. Upper side of body and flanks dark-green, ventral side pale yellow; several dark blotches on sides of body; dorsal, anal and caudal fins dusky. Habitat: Found in freshwater streams. Distribution: Afghanistan, Pakistan, India, Andaman Is., Sri Lanka, Nepal, Bangladesh, Burma and China.

Channa striatus (Bloch, 1793)

Ophiocephalus striatus *Bloch*, 1793, *Natutges. ausland.* Fische, (7):141, pl. 359 (type locality: Malabar)

Channa striatus: Talwar & Jhingran, Inland Fishes of India and Adjacent Countries, 2 : 1022, fig. 291.

Diagnostic features: D. 37-46, A. 23; P. 15; V. 6; Ll. 50-57. Body elongate; eyes moderate, 6-7 in head; Mouth large; lower jaw with 4 to 7 canines behind a single row of villiform teeth which deepens to six rows at symphysis; villiform teeth on vomer and palatines; caudal fin rounded; predorsal scales 18 to 20. Upper side of body and flanks dark-green, ventral side pale yellow; several dark blotches on sides of body which form angular bands; dorsal, anal and caudal fins dusky.

Habitat: Fund in freshwater streams.

Distribution: Pakistan, India, Sri Lanka, Nepal, Bangladesh, Nepal, Burma, Malay Archipelago, Thailand and south China.

DISCUSSION

Fauna on the Mount Harriet National Parks have high levels of endemism (Kailash and Rajan, 2004) and this is true in the case of freshwater fishes of Andaman Islands (Vijay and Priya, 2009). Of the 24 species recorded 12 were native freshwater fishes, including 2 endemic fishes and a new species of the genus Belobranchus sp. as new to India. Though the numbers of primary freshwater species are few there are 6 species endemic to Andaman waters viz. the syngnathid Microphis insularis (Hora), eleotrid Eleotris andamanensis Hora, syngnathid Microphis insularis (Hora), two new species of the genera Sicyopterus sp. (Gill) and Schismatogobius sp. (de Beaufort) and a gobiid fish Acentrogobius caninus (Valenciennes) as a new record (Vijay and Priya 2009) and Belobranchus sp. Bleeker (Rajan and Sreeraj). The hill stream gobioid fish Sicyopterus garra Hora, described from Andaman Islands is relegated to the synonym of .Sicyopterus microcephalus (Bleeker) (Koumans, 1940).

Five species of freshwater fish have been introduced deliberately or accidentally in the freshwater streams of Mount Harriet National Park. Streams of Wimberley Gunj have been altered by water diversion, channel modification, introduced species, and water quality degradation compared to streams of Mannarghat, Kalatang and Shoal Bay, South Andaman. The Andaman Islands, with freshwater streams ranging from the relatively pristine to the highly degraded, offer an opportunity to examine the impacts of human disturbance on native stream

Table 1. Native, Exotic and Endemic Freshwater species and their status

Species	Native	Exotic	Endemic	Status
Rasbora daniconius	√			Very common
Clarias magur		√		common
Heteropneustes fossilis		√		common
Aplocheilus panchax	√			Very common
Orechromis mossambica		√		common
Awaous grammepomus	√			Rare
Glossogobius giuris	√			Common
Sicyopterus microcephalus	√			Very Common
Stenogobius gymnopomus	√			Very Rare
Belobranchus sp.	√		√	Very Rare
Eleotris andamensis	√		√	Rare
Eleotris fusca	√			Common
Exyrias puntang (Bleeker, 1851)	√			Rare
Giuris margaritacea	√			Common
Anabas testudineus		√		Very Rare
Channa gauchua	√			Common
Channa punctatus	√			Common
Channa striatus		√		Rare

communities. For example, urbanization is often accompanied by stream-channel modification and reduced canopy cover, resulting in higher water temperatures and greater fluctuations in daily temperature. Even in relatively pristine streams, diversions can result in decreased flow velocity and water depth, reducing habitat availability. Many nonnative aquatic species are better adapted than native species to degraded habitats; once established in these habitats, they can cause further reduction in native populations through competition, predation, and the introduction of parasites or diseases. Poisoning, dumping of solid waste and diverting water flows to encroach land are the major threats. Creating awareness, controlling poisoning fishing and protecting the breeding grounds of fishes are some of the measures recommended to counter these threats. The most urgent initiative appears to be a national reserve system 'gap analysis' which would identify those ecosystems most at risk. A comprehensive national assessment of the conservation status of freshwater ecosystems should be undertaken immediately. Such a study would provide a platform for the systematic expansion of the nation's freshwater protected areas, as well as a catalyst for innovative 'bottom-up' conservation approaches driven by local stakeholders. The new findings have indicated that more new species can be found in undisturbed regions. However, many of the native species are threatened due to habitat loss and invasive species.

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MOUNT HARRIET NATIONAL PARK

	Longitude	Latitude
Site 1	92.70855556	11.76183333
Site 2	92.70941667	11.75852778
Site 3	92.711	11.75869722
Site 4	92.71477778	11.75586111
Site 5	92.71472222	11.7925
Site 6	92.72083333	11.80922222
Site 7	92.72097222	11.81052778
Site 8	92.72002778	11.81727778
Site 9	92.72305556	11.81486111
Site 10	92.71561111	11.74283333
Site 11	92.717525	11.74508333
Site 12	92.7213	11.81043333
Site 13	92.7271	11.82575

Sampling sites in Mount Harriet National Park with GPS coordinates

Freshwater pool and cast netting in the waterfall, Shoal bay, South Andaman

Fish collection with Hook and line

Study tour for forest officials, waterfall, Mannarghat

Insecticide used for catch fish by settlers

Human habitation, altered and polluted streams at Wimberly Gunj

Dumping of inorganic waste materials into the stream, Wimberly Gunj, South Andaman

Megalops cyprinoides

Anguilla bengalensis bengalensis

Anguilla bicolor bicolor

Rasbora daniconius

Clarias magur

Heteropneustes fossilis

Aplocheilus panchax

Kuhila mugil

Kuhila rupestris

Orechromis mossambicus (see page 7)

Orechromis mossambicus (see page 7)

Belobranchus sp. (to be named by Rajan and Sreeraj) (see page 8)

Butis butis (see page 8)

Eleotris fusca (See page 8)

Giuris margaritacea (See page 8)

Giuris margaritacea (See page 8)

Awaous grammepomus

Exyrias puntang (Bleeker, 1851)

Glossogobius giuris

Sicyopterus microcephalus using the mouth and pelvic fins alternately as suckers to climb

Stenogobius gymnopomus

Anabas testudineus

Channa gachua

Channa punctatus

Channa striatus

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FRESHWATER SPONGES OF ARUNACHAL PRADESH, INDIA

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The sponges are aquatic, sedentary, filter feeding Metazoa with a cellular grade of construction, without organs, mouth or nervous tissue, with a body permeated with pores, canals and chambers and involving a unidirectional water current through the body propelled by random beating of flagella occurring on a single layer of flagellated cells called choanocytes and feed on suspended organic particles. Skeleton - made up mainly of spicules of silica or calcite and spongin fibres laid down around the spicules or parts thereof so that the skeleton held together in a reticulum, a set of plumose fibres, or as dense tracts of spongin and spicules. Fine collagen fibrils occur in the mesohyle of all sponges. Due to having very poorly organised body structure as well as little or no locomotory activities, they have a tendency to high morphological plasticity which leads to their susceptibility to pronounced polymorphism. Sponges can be used as fine indicator for specific population alteration and the analysis of their cytopathology can be employed for the kind as well as degree of pollution.

Colonies of Fresh water sponges are found as adhering to the surface of any substratum inside the water bodies' i.e. aquatic weeds, logs, stones, bricks or any other artificial substratum in the ponds, lakes, water reservoirs, streams, and rivers. Globally about 257 sponge species are found in freshwater (Van Soest RWM, Boury-Esnault N, Vacelet J, Dohrmann M, Erpenbeck D, et al. 2012). After the pioneering works of Dr. N. Annandale practically there is no work for more than half a century. Khera and Chaturvedi (1976) gave a check list on freshwater sponges of India. Soota and Pattanayak (1982) described 9 species based on the unnamed collection of the Zoological Survey of India and included more up-to-date data. Soota *et al.* (1983) added the ecological studies of freshwater sponges and described 4 species including one new species. Soota (1991) reviewed the hitherto known 31 Indian species of freshwater sponges based on the study of all the available material coupled with the perusal of the relevant literature to date. Pattanayak (1998) described 16 species from West Bengal, Pattanayak (1999) recorded one species from Meghalaya and Pattanayak (2003) reported two species from Tripura state.

At present only 31 species of freshwater sponge recorded from India as per Soota, (1991). But the species *Metania vesparioides* (Annandale, 1908) is included in Soota (1991) restricted to Myanmar only (p.94). Therefore, the total number of species of freshwater sponges of India is now thirty. In India studies on sponges were entirely based on very inadequate surveys and confined only to a few areas.

There are few records of freshwater sponges from Himalayan ranges. According to Soota (1991) *Spongilla lacustris* (Linnaeus, 1758) from Simla (Himachal Pradesh) and Udhampur (Jammu); *Stratospongilla bombayensis* (Carter, 1882) and *Radiospongilla cinerea* (Carter, 1849) from Naukuchia Tal, alt. 4000 ft. Kumaon (Uttarakhand); *Radiospongilla cerebellata* (Bowerbank, 1863) from Mangal-dai near Bhutan frontier (Assam); *Ephydatia ramsayi* (Haswell, 1882) from western Himalayas namely Kumaon, Naukuchia Tal, Bhim Tal, Sat Tal and Nainital and

Ephydatia meyeni (Carter, 1849) from Bhim Tal, Kumaon, alt. 4500 ft. (U.P.). Pattanayk (1999) reported *Eunapius calcuttanus* (Annandale, 1911) from Meghalaya.

There was no record of freshwater sponge from Arunachal Pradesh. During a recent survey (2010 and 2011) to Arunachal Pradesh present authors collected 5 colonies of freshwater sponges which belong to *Radiospongilla cerebellata* (Bowerbank, 1863), *Trochospongilla paulula* (Bowerbank, 1863) and *Ephydatia meyeni* (Carter, 1849).

SYSTEMATIC ACCOUNT

Phylum PORIFERA Grant, 1863
Class DEMOSPONGIAE Sollas, 1885
Subclass CERACTINOMORPHA Levi, 1953
Order HAPLOSCLERIDA Topsent, 1928
Suborder HAPLOSCLERINA Topsent, 1928
Family SPONGILLIDAE Gray, 1867
Genus ***Radiospongilla*** Penney and Racek, 1968

1. ***Radiospongilla cerebellata*** (Bowerbank, 1863) (Fig. 1a-c)

1863. *Spongilla cerebellata* Bowerbank, . *Zool. Soc. Lond.*, 1863, p. 465.

1907. *Spongilla proliferens* Annandale, *J. Proc. Asiat. Soc. Beng.*, **3**, pp. 15 & 26.

1968. *Radiospongilla cerebellata* Penney and Racek, *Bull. U. S. natn. Mus.* No. 272, p. 73.

1991. *Radiospongilla cerebellata*, Soota, *Rec. zool. Surv. India, Occ. Paper No.* **138**, p. 58.

Material examined: 2 ex. Fishery tank at Tafargram, Near Teju town, Lohit District, Arunachal Pradesh; India. 13. 01. 2011; Regn. No. P3625/1; Coll. J. G. Pattanayak and S. Mitra. .

Description: Sponge forming small and shallow cushions form; surface uneven with brain-like corrugations; oscula conspicuous; dermal membrane well developed; colour- dark green when alive; consistency of live sponge soft.

Skeleton - irregular; spongin more in quantity.

Megascleres - Smooth, stout, fusiform and slightly curved to straight amphioxea, sharply pointed at tips; length 0.230-(0.275) - 0.320mm, width 0.010-(0.011)-0.012 mm.

Microscleres - Absent.

Gemmoscleres - curved, slender, cylindrical, amphistrongyla with small spines erect and less in number on the central portion of shaft but recurved and more in number terminally; length 0.080-(0.085)-0.100 mm, width 0.002-(0.0025)-0.003 mm.

Gemmules - Spherical, numerous, scattered throughout the body; pneumatic layer thick, consisting of small spherical air spaces, gemmoscleres embedded in this layer and forming two separate tiers; foramen tubular, porus tube slender and straight, extending to the level of pneumatic layer; diameter range 0.400-(0.455)-0.500 mm.

Distribution: India: Andhra Pradesh, Arunachal Pradesh, Assam, Bihar, Karnataka, Kerala, Maharashtra, Odisha, Tamil Nadu, U.P. and West Bengal.

Outside India: Tropical and subtropical South and South East Asia, China to Russia extending to South-eastern Europe.

Remarks: *Radiospongilla cerebellata* (Bowerbank, 1863) is recorded for the first time from Arunachal Pradesh.

Genus ***Trochospongilla*** Vejdovsky, 1883

2. ***Trochospongilla paulula*** (Bowerbank, 1863) (Fig. 2a-c)

1863. *Spongilla paulula* Bowerbank, *Zool. Soc. Lond.*, 1863, p. 453.

1907. *Trochospongilla latouchiana* Annandale, *Rec. Indian Mus.*, **1**, 389.

1968. *Trochospongilla latouchiana*, Penney and Racek, *Bull. U. S. natn. Mus.* No. 272, p. 140.

1991. *Trochospongilla paulula* Soota, *Rec. zool. Surv. India, Occ. Paper No.* **138**, p. 84.

Material examined: 2 ex. Khonsa, Tirap District, Arunachal Pradesh; India. 06.01.2011; Regn. No. P 3626/1; Coll. J. G. Pattanayak and S. Mitra.

Description: Sponge forming encrustations with variable size; surface uneven; oscula relatively few but prominent; dermal membrane well developed; colour- dark brown when alive; consistency of live sponge very rigid but often brittle.

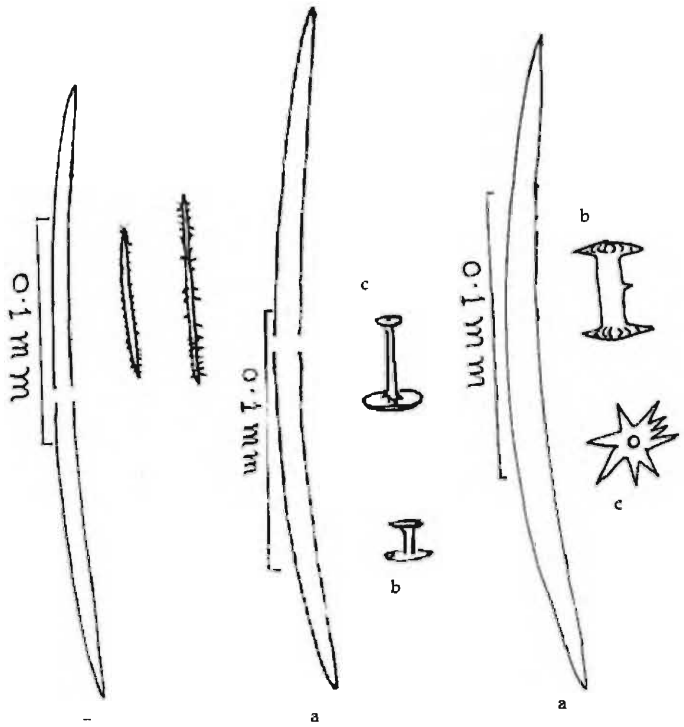

Fig. 1 *Radiospongilla cerebellata*
a=Megasclere
b=Immature gemmosclere
c=Mature gemmosclere

Fig. 2 *Trochospongilla paulula*
a=Megasclere
b& c=Gemmosclere

Fig. 3. *Ephydatia meyeni*
a=Megasclere
b=Gemmosclere
c=Roule

Skeleton - formed of distinct vertical spicule fibers joined together by spongin and irregularly arranged transverse fibers.

Megascleres - Smooth, stout, cylindrical and slightly curved to straight amphioxea; length 0.230-(0.275) - 0.320 mm, width 0.010-(0.013)-0.015 mm.

Microscleres - Absent.

Gemmoscleres - birotulates with a slender smooth shaft, rotules circular differing in diameter and flat, upper rotules considerably recurved, forming a bowl-like structure; length of shaft 0.012-(0.020)-0.025mm, 0.003-(0.004)-0.005mm thick, Upper rotules 0.009-(0.012)-0.015mm, lower rotules 0.015-(0.020)-0.025mm in diameter.

Gemmules - Spherical, numerous, scattered throughout the body and loosely held in position by skeletal network; pneumatic layer thin and granular, gemmoscleres embedded in one layer; foramen conical and short porus tube; diameter range 0.165-(0.225)-0.220 mm.

Distribution: India: Arunachal Pradesh, West Bengal.

Outside India: Southern and South-East Asia north to China and south to eastern Australia, Myanmar.

Remarks: Trochospongilla laulula chiana (Bowerbank, 1863) is recorded for the first time from Arunachal Pradesh.

Genus ***Ephydatia*** Lamouroux, 1816

3. *Ephydatia meyeni* (Carter, 1849)

(Fig. 3a-c)

1849. *Spongilla meyeni* Carter, *Ann. Mag. Nat. Hist.*, 4, p. 84.

1867. *Ephydatia meyeni* Gray, *Proc. Zool. Soc. Lond.*, 1867, p. 550

1907. *Ephydatia mulleri* var. *meyeni* Annandale, *J. Proc. Asiat. Soc. Beng.*, **3**, p.26.

1991. *Ephydatia meyeni* Soota, *Rec. zool. Surv. India*, Occ. Paper No. **138**, p. 75.

Material examined: 1ex. Durga Temple pond, Bomdila, West Kameng district, 2700 m above

msl, West Kamneng district; 27.12.2011, Regd. No. P3627/1, J.G. Pattanayak and S. Mitra.

Description: Colonies are irregular in shape; surface uneven and corruagated; oscula not prominent; dermal membrane well developed; colour- light brownin live; consistency of live sponge firm and moderately hard.

Skeleton - formed of polyspicular radiating fibers joined together by a small quantity of spongin and secondary transverse fibers.

Megascleres - Smooth, stout, cylindrical and slightly curved amphioxea, sharply pointed at tips; length 0.250-(0.275) - 0.300 mm, width 0.010-(0.011)-0.013 mm.

Microscleres - Absent.

Gemmoscleres - birotulates with moderately stout smooth shafts, sometimes small erect sharp spines on the shaft, rotules equal in diameter and flat, rotules irregularly and very much incised; length of shaft 0.025-(0.029)-0.030 mm, rotules 0.025-(0.028)-0.030 mm.

Gemmules - Spherical, small, numerous, scattered throughout the body; pneumatic layer well developed, thick and irregular, consisting of minute spherical air spaces, gemmoscleres embedded in one or two layers, inner layer radially and outer layer irregularly arranged; distal rotules of outer layer protruding from outer gemmular membrane; foramen raised but simple and not tubular; diameter range 0.475-(0.555)-0.600 mm.

Distribution: India: Arunachal Pradesh, Haryana, Kerala, Maharashtra, Rajasthan, Tamil Nadu, Uttar Pradesh and West Bengal.

Outside India: China.

Remarks: Annandale (1907) recorded this species as *Ephydatia mulleri* var. *meyeni* as new variety from Indian Museum tank. This species is recorded for the first time from Arunachal Pradesh.

SUMMARY

The paper dealt with 3 species of freshwater sponges recorded for the first time from Arunachal Pradesh, India.

ACKNOWLEDGEMENTS

The authors wish to express their deep felt gratitude and thanks to Dr. K. Venkataraman, Director, Zoological Survey of India, Kolkata, for providing facilities to complete this work.

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NEW RECORD OF FRESHWATER BRYOZOA FROM ARUNACHAL PRADESH, INDIA

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The Bryozoa or ectoprocta are small benthic, sessile, aquatic invertebrates growing as colonies of connected zooids on submerged substrates, feed on suspended organic particles which they captured by the whorls of ciliated tentacles (lophophore). Globally about 94 bryozoan species are found in freshwater, consisting of 24 genera and 10 families (Massard & Geimer, 2008). Most of these species belongs to exclusively freshwater inhabiting class Phylactolaemata. Colonies of Fresh water bryozoa are found as adhering to the surface of any substratum inside the water bodies' i.e. aquatic weeds, logs, stones, bricks or any other artificial substratum in the ponds, lakes, water reservoirs, streams, and rivers. Annandale (1911) dealt with this group in Indian sub continent. Where as Rao (1962, 1972 and 1976) worked out of fresh water bryozoa in western and middle part of India. At present only 17 species of freshwater bryozoa recorded from India and there is no any record of freshwater bryozoa from Arunachal Pradesh (Samanta, 1998). During a recent survey to Arunachal Pradesh present authors collected 5 colonies of freshwater bryozoa on 06.01.2011.; from a small fishery pond (Fig. 1) at Khonsa (Lat.

Fig. 1. Habitat of ***Plumatella javanicus***

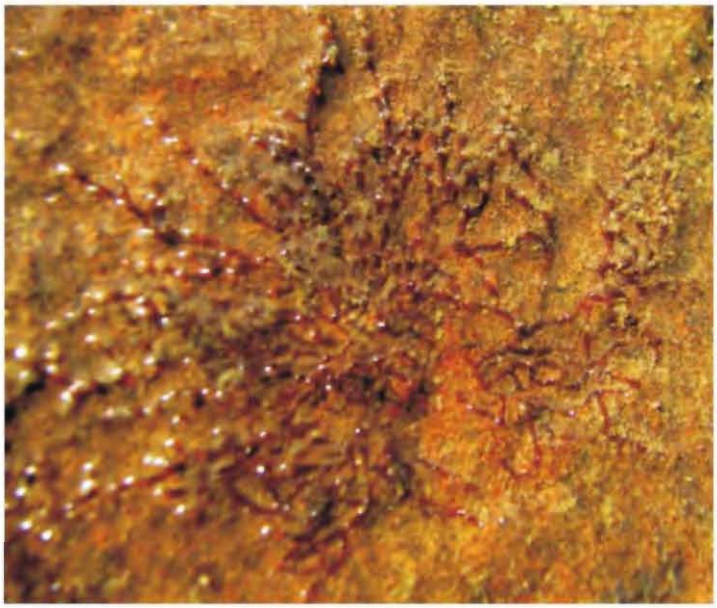

Fig. 2. Colony of *Plumatella javanicus*

26 58 and Long. 85 31), of Tirap district. The colonies are and encrusted on many small pieces of rocks in a depth of 1-1.5 feet in the pond. These colonies are light brown or reddish brown, almost entirely recumbent, with pronounced keel, ends of brunches often rising from substratum, tentacle number about 42, Floatoblast elliptical, large, surface entirely covered with minute hexagonal tubercles, these characters leads to the identification of those colonies as *Plumatella javanica* Karepelin, 1906 (Fig. 2). The specimen has been deposited in NZC (Regd. No. Mp 188/1)

Though this species has a wide distributional range in tropical regions, including Southeast Asia and Japan, Central Africa and The Amazon River in South America, where as in India, it was recorded from West Bengal, Kerala, Madhya Pradesh and Tamilnadu. It is the first record of this species from North-east India and simultaneously this is the first record of any freshwater bryozoan species from the state of Arunachal Pradesh.

ACKNOWLEDGEMENTS

The authors wish to express their deep felt gratitude and thanks to Dr. K. Venkataraman, Director, Zoological Survey of India, Kolkata, for providing facilities to complete this work.

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ISSN 0375-1511

Rec. zool. Surv. India : **113**(Part-4): 65-67, 2013

ON THE FIRST RECORD OF *COMATELLA STELLIGERA* (P. H. CARPENTER) (ECHINODERMATA : CRINOIDEA) FROM WEST COAST OF INDIA

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INTRODUCTION

The Karnataka state on west coast of India abutting the Arabian Sea has a long and narrow coast with small crescent shaped pocket beaches. It is interspersed with rocky head lands, spectacular spits, estuaries, shallow lagoons, mudflats and a few patches of mangroves. The northern coast is rocky while the southern coast has long sandy beaches.

The studies on echinoderms of Karnataka coast were not comprehensive. Among 649 species of echinoderms in Indian region, only 27 species were recorded from Karnataka (Sastry, 2007). Five species of sea lilies (Crinoidea) were reported from Karnataka out of the 65 species from Indian region (Sastry, 2007). Clark (1912) reported 4 species viz., *Heterometra compta, Oligometra serripinna, Comastrocrinus ornatus and Comastrocrinus springeri* from the off shore waters of Karnataka where as Patil (1953) reported *Lampometra* sp. from Karwar coast of Karnataka.

During the recent faunistic survey (2009-2010) of Karnataka coast, authors observed one crinoid specimen in trash collection from the mechanized boat of Murudeswar beach, which is an off shore collection of this area. Subsequently some more specimens were observed in the water column of the rock pools of the Murudeswar sea beach (Fig.1). A study of the specimens revealed the identity as *Comatella stelligera* (P.H.Carpenter), This species was recorded earlier from Tamilnadu (James, 1988) and Andaman island (Sastry, 2005) of Indian coast. But so far there was no record of this species from the west coast of India. This species is recorded for the first time from Karnataka coast as well as from west coast of India. The diagnosis and distribution of this species are given here in brief.

SYSTEMATIC ACCOUNTS

Phylum ECHINODERMATA
Class CRINOIDEA
Order COMATULIDA
Family COMASTERIDAE

Comatella stelligera (P.H. Carpenter, 1880).
Figs -1, 2

1880. *Actinometra stelligera* P.H. Carpenter, *J.Linn. soc., (Zool)*, **15**: 198.

1931. *Comatella stelligera* : Clark, A.H. *Bull., U.S. Natn. Mus.* No., **82**, vol-1(Part 3): 98.

1971. *Comatella stelligera*: Clark, A.H. and Rowe, F.W.E. *Monograph of shallow water indo-west pacific echinoderms*, 6-7 (distribution) and 15 (key).

2005. *Comatella stelligera*: Sastry, D.R.K. *Rec. zool. Surv. India, Occ. Paper* No., **233**: 7

Materials : One example; India, Karnataka, Uttar Kanada dist, Murudeswar off shore; 17.iii. 2009, coll: M. K. Dev Roy and party; Reg. No. E2022/1; One example; India, Karnataka, Uttar Kanada dist, rock pool at Murudeswar sea beach; 20.iii.2010, coll: J. G. Pattanayak and S. Mitra; Reg. No. E2023/1.

Diagnosis : Cirri well developed the distal segments with dorsal tubercles or spines. Arms 30 in number, 22 sirrus segments. III Brachial series

usually present only on the external side of each II Brachial series. All the division series present are of only two ossicles and without a syzygy. II Br series with two III Br series, or III Br only on the outer side. First brachial syzygy at 3+4.

Distribution : India: Murudeswar (Karnataka); Gulf of Mannar (Tamilnadu); North and South Andaman.

Elsewhere : East Indies, Australia, China, S. Japan, South pacific Is., Philipine Is. (Clark & Rowe, 1971)

Remarks : This species was collected from the Murudeswar temple beach in the trash from a mechanized boat and after the discussions with local fishermen, confirmed that this specimen was collected from the off shore area (2-4 km. from the shore) and from a rocky substratum as well as this species established its occurrence in the rock pools of intertidal sandy beach.

SUMMARY

The present communication deals with a crinoid species *Comatella stelligera* (P.H. Carpenter) from the coast of Karnataka. This is the first recorded of the species from Karnataka as well as from the West Coast of India extending the distribution westward into the Arabian Sea.

ACKNOWLEDGEMENTS

The authors wish to express their deep sense of gratitude to Dr. K. Venkataraman, Director, Zoological Survey of India, Kolkata, for providing facilities to complete this work. Sincere thanks to Dr. D.R.K. Sastry, Retired Scientist, ZSI, for his keen interest in identification of the echinoderm specimens from the Karnataka coastal survey and advice. All staff of General Non- Chordata section and Publication division of Zoological Survey of India also acknowledged for their sincere help.

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Fig. 1 : *Comatella stelligera* on Murudeswar seabeach

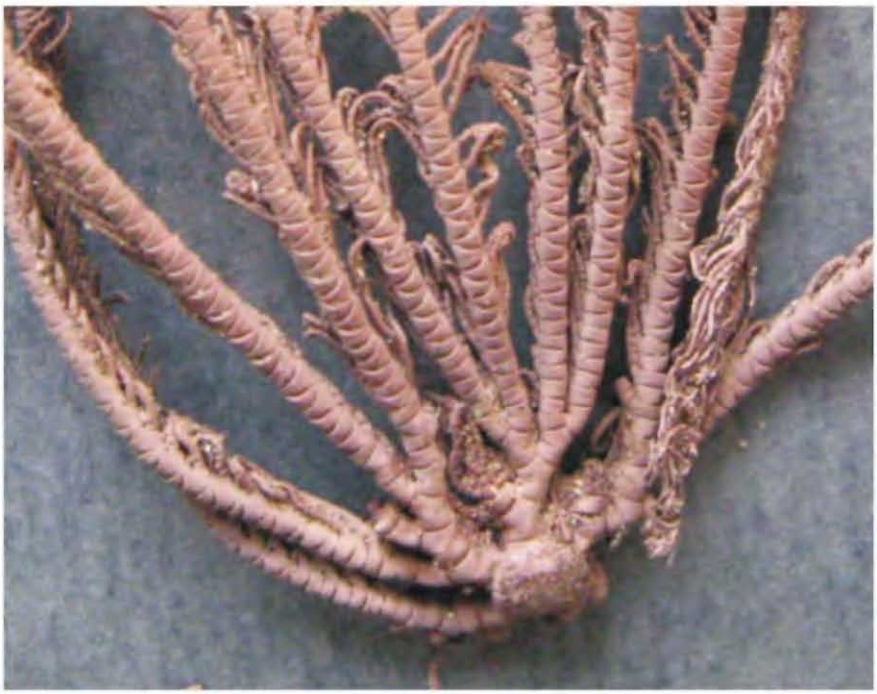

Fig. 2 : *Comatella stelligera* as presurved condition

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Rec. zool. Surv. India : **113**(Part-4): 69-70, 2013

ON THE FIRST RECORD OF TWO SPECIES OF FRESH WATER LEECH (HIRUDINEA) FROM ARUNACHAL PRADESH

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INTRODUCTION

Leeches are hermaphrodite animals with totally reduced both parapodia and setae, with unpaired male and female genital openings in the clitellum, sucker on both anterior and posterior end of the body, each somite divided with three to five annuli.

Leeches are mostly inhabitant of freshwater, some are terrestrial and a very few are live in saline water. Many leeches are blood-sucking on vertebrates and invertebrates; while others are mainly predators and rarely scavengers.

Some species of this group has important medicinal use from ancient time, its bio-active anticoagulant and anti-inflammatory substances are attracting medicinal and pharmaceutical attention. Beside this, these animals are now considered as a very promising model organism for ecological studies, particularly as bio-indicators in freshwater habitats. Taxonomical studies of leeches of India were carried out by several authors (Harding and Moore, 1927; Bhatia, 1955, Chandra, 1983; Ghosh, 1998; and Mandal, 2002, 2004) which reveals a total 63 species in respect of global diversity (680 species) it is remarkable (9.26%).

Arunachal Pradesh are considered as one of the important biodiversity Hot -Spot in India as well as in global context, so far a total seven species of leeches were recorded from this state (Mandal, 2006) and interestingly all those species are belongs to family Haemadipsidae and found in terrestrial habitat only.

During a recent faunistic survey tour to Arunachal Pradesh (2010-2011), the present authors collected some leeches from different freshwater habitats of this state, after investigation that reveals two species of freshwater leeches namely *Hemiclepsis marginata asiatica* Moore, 1924 and *Nematobdella indica Kaburaki, 1921* belong to 2 families and 2 order. These species were not recorded earlier from this state, so this is the first record of this species from the state of Arunachal Pradesh.

The present communication deals with a brief description of those two species with a note on their habitat and distribution which are recorded here for the first time from this state.

MATERIAL AND METHODS

After the collection, leeches were sorted out. Then the cleaned leeches were placed in a tray with a small quantity of water and were slowly killed by anaesthetizing with alcohol. Leeches usually die in an extended condition by the process. Just after death, the leeches were kept in 70% alcohol for permanent preservation. As fixing fluid 4% formalin were used.

SYSTEMATIC ACCOUNT

Phylum ANNELIDA
Class CLITELLATA
Order HIRUDINEA
Suborder RHYNCHOBDELLIDA
I. Family Glossiphonidae
Genus ***Hemiclepsis*** Vejdovsky, 1883

1. ***Hemiclepsis marginata asiatica*** Moore, 1924

1924. *Hemiclepsis marginata asiatica* Moore, *Proc. Acad. Nat. Sci.*, Philad., **76**: 343-388.

2010. *Hemiclepsis marginata asiatica*: Mandal, *Fauna of Uttarakhand, State Fauna Sereis*, **18**(3): 193-197.

Material examined : 2 ex. Noa-Dihing River near Miao, Changlang District, Arunachal Pradesh, India; 12. I. 2011; Regn. No. An 3727/1; Coll. J. G. Pattanayak and party.

Diagnostic characters : Length about 14 mm., width about 4 mm., colour pinkish white with yellowish green pigmented cells on the dorsal side; body smooth ventrally but rough dorsally; middle ring of each somite bears three pairs of larger dorsal papillae; eyes three pairs arranged in two sub-parallel columns; the first, second and third pairs of eyes lie on ring 3, 4 and 7 respectively; male and female pores open between 29/30 and 31/32 respectively rings 73, mouth sub terminal; crop with nine pairs of lateral diverticula.

Distribution: India: Arunachal Pradesh; Assam; Himachal Pradesh; Haryana; Bihar; Jharkhand ; West Bengal; Rajasthan, Maharashtra; Andhra Pradesh and Karnataka.

Remarks: This species was found to attach with in the roots as well as in the lower side of the petiole of the leaf and also on the stalk of the *Eichhornia crassipes* plant, covered some portion of the surface area of Noa-Dihing river at Miao.

Suborder Arhynchobdellida
II. Family Nematobdellidae
Genus ***Nematobdella*** Kaburaki 1921

2. ***Nematobdella indica Kaburaki***, *1921*

1921. *Nematobdella indica* Kaburaki, *Rec. Indian Mus.*, **22**: 689-719.

1983. *Nematobdella indica*: *Chandra, Rec. zool. Surv. India*, **80**: 281.

Material examined: 4 ex. Fishery pond at Tafargram, Near Teju town, Lohit District, Arunachal Pradesh; India. 13. I. 2011; Regn. No. An 3728/1; Coll. J. G. Pattanayak and party.

Diagnostic characters : Larger forms attain a length of about 20 mm and width about 3 mm; form very slender, attenuated anteriorly; colour bright buff when alive but fades away in preserved state; eyes six pairs, the first pair larger and dorsal on somite III, remaining five pairs smaller, sub-marginal on somites V to XI; gonopores separated by five annuli.

Distribution : Arunachal Pradesh; Pradesh; Madhya Pradesh; Maharashtra; Rajasthan; Uttar Pradesh; Himachal Pradesh; Punjab; Karnataka and West Bengal.

Remarks: This species was found to attached with the dense root systems of *Pistia straiotes*, a floating plants on the surface area of the pond at the collection site.

ACKNOWLEDGEMENT

The authors are grateful to Dr. K. Venkataraman, Director, Zoological Survey of India, Kolkata, for his kind permission to conveying the tour to Arunachal Pradesh. We are thankful to Dr. T. K. Pal, former officer-in-charge, Field survey division, for his valuable suggestion during our study.

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Rec. zool. Surv. India : 113(Part-4): 71-73, 2013

FIRST REPORT OF BRASSY CHUB, *KYPHOSUS VAIGIENSIS* (QUOY AND GAIMARD, 1825) FROM NORTHERN EAST COAST OF INDIA

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INTRODUCTION

Sea chubs belonging to the family Kyphosidae generally inhabit rocky zones and coral reefs of tropical and temperate marine waters worldwide (Sakai and Nakabo, 1995). There are six sub-families, sixteen genera and about 45 species belonging to the family Kyphosidae (Nelson, 2006). During local survey around Digha coast authors collected 3 examples of fishes identified as brassy chubs, *Kyphosus vaigiensis* (Quoy and Gaimard, 1825). This species belongs to sub-family Kyphosinae (Rudderfishes) and widely distributed in Indo-Pacific Region (Clements, 1997). Brassy chubs are as taken commercially important only occasionally in India (Talwar & Kacker, 1884). Various studies have been carried out to study the fish faunal diversity of Northern east coast (West Bengal, Odisha & Andhra Pradesh) of India (Manna and Goswami, 1985; Goswami, 1992; Talwar *et al.*, 1992; Barman *et al.*, 2004; Chatterjee *et al.* 2000; Das *et al.*, 2007; Mohapatra *et al.*, 2007; Barman *et al*, 2007). There was no report on the occurrence of *Kyphosus vaigiensis* from the northern east Coast of India. There is no fish from the family Kyphosidae was reported from the West Bengal coast and only *Kyphosus cinerascens* (Forsskål, 1775) from the family Kyphosidae was reported from Odisha (Barman *et al.*, 2007) and Andhra Pradesh coast (Barman *et al.*, 2004).

MATERIALS AND METHOD

Three specimens (1ex, MARC/ZSI/F2471, Col.10.06.12 & 2ex, MARC/ZSI/F2477, Col. 12.06.12) of *Kyphosus vaigiensis* were collected (SL: 153-167 mm) from Digha Mohona (21°37.843'N, 87°32.827'E) by using trawl nets. Photographs were taken on the field and morphometric measurements were made from specimens preserved in 10% formalin. Morphometric characters were measured based on Hubbs and Lagler (1964). Measurements were taken with digital calipers to 0.1 mm. Abbreviations used for meristic character include: D, dorsal fin; P, pectoral fin; V, ventral fin, C, caudal fin; SL, standard length. The specimens are deposited in the laboratory of Marine Aquarium and Regional Centre, Zoological Survey of India, Digha.

RESULT AND DISCUSSION

***Kyphosus vaigiensis* (Quoy and Gaimard, 1825)**

1825. *Pimelepterus vaigiensis* Quoy & Gaimard,: 386, pi. 62, fig. 4 (type locality Waigeo

Island, Indonesia).

1984. *Kyphosus vaigiensis*: Talwar & Kacker Commercial sea fishes of India, 695.

Diagnosis : D: XI, 14; A: III, 13; P: 19; V: I, 5.Body compressed and elliptical, dorsal and ventral profiles equally convex. Head small with small blunt snout, shorter than eyes; interorbital space convex. Two pairs of nostrils before eyes; anterior rounded and posterior elongated.

Fig. 1. ***Kyphosus vaigiensis*** (Quoy and Gaimard, 1825)

Opercle with two weak spines; maxilla reaching anterior margin of eyes. Mouth terminal with horizontal root of teeth in jaws; single outer row of incisor like teeth on both jaws and very narrow inner bands of small, canine like teeth on both jaws; bands of fine villiform teeth on vomer, palatines, pterigoids and tongue. Scales ctenoid and non deciduous, present on body, head, maxilla, soft rayspart of dorsal and anal fins and proximal part of caudal fin; snout, premaxilla and lower jaw without scales. Dorsal fin with convex spinous portions and straight soft rays portions; dorsal origin above pelvic fin origin; 5th to 7th dorsal spines are strongest and long. Anal fin origin slightly posterior to mid body; 3rd anal spine longest. Pectoral fin bluntly pointed posteriorly; pelvic fin slightly shorter than pectoral fin and originating slightly little behind pectoral fin. Gill rakers in upper limb 9 and in lower limb 22-23; total gill rakers 31-32. Pored scales on lateral line 53; scales above lateral line 12; scales below lateral line 20; longitudinal scales series 59-60; cheek scales 16. Body bluish brown, darker dorsally and become pale ventrally. Flank with several yellowish brown longitudinal lines. Head with two yellow oblique stripes; one below eye and other behind eye. Dorsal and anal fins dark brown with black leading edge. Pectoral fin silvery near base and distally slightly darker; a black spot present near pectoral fin base. Details of morphometric data and meristic counts are given in Table 1.

Table 1 : Morphometric data of *Kyphosus vaigiensis* (Quoy and Gaimard, 1825).

Morphometry	% of Standard Length
Head length	28.74-29.41
Body depth	48.36-48.73
Eye diameter	7.05-7.21
Interorbital space	10.63-10.89
Pectoral fin length	19.28-20.25
Ventral fin length	18.95-20.05
Caudal peduncle length	17.64-20.95
Caudal peduncle depth	12.41-12.87
Pre dorsal length	41.83-45.56
Pre anal length	62.02-62.41
Snout length	8.4-8.9
Caudal fin length	28.48-29.41

Distribution : This species is broadly distributed in the Indo-Pacific region, include the Red Sea and South Africa waters, absent in eastern Pacific (Sakai and Nakabo, 1995); New Zealand (Clement, 1997); Samoa, Tahiti (Weber & Beaufort, 1936) east to the Hawaiian, Tuamoto, and Rapa islands (Froese & Pauly, 2012). In Indian coastal water this species was reported from Andaman and Nicobar Islands (Rao *et al.*, 2000); Laccadive Islands (Jones & Kumaran, 1980; Tamil Nadu coast (Barman *et al.*, 2011).

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NEW RECORD OF CONVICT SURGEONFISH *ACANTHURUS TRIOSTEGUS* (LINNAEUS, 1758) FROM CHILIKA LAKE

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INTRODUCTION

Chilika lagoon, the largest coastal wetland, situated between 19° 28'-19° 54' N latitude and 85° 05'-85° 38' E longitude and an internationally famous Ramsar Site, is regarded as the store house of rich living aquatic resources. With unique ecological characteristics resulting from two antagonistic hydrological processes (Fresh water inflow and sea water influx), Chilika has no parallel in the tropical world. Fisheries is most important natural resource of Chilika which provides direct or indirect livelihood for nearly 0.2 million fisherfolk. Various works have been reported from Chilika on the fish fauna of Chilika lagoon (Chaudhuri, 1916a-1916c; Hora, 1923; Koumans, 1941; Jones and Sujansinghani, 1954; Menon, 1961; Misra, 1969, 1976a, 1976b; Jhingran and Natrajan, 1966, 1969; Rajan *et al.*, 1968; Mohanty, 1973; Talwar and Jhingran, 1991; Rama Rao, 1995; Bhatta *et al.*, 2001; Mohanty *et al.*, 2006, Mohapatra *et al.*, 2007; Wetlands International-South Asia,2011). All these reports together have reported 314 numbers of fish species from the lagoon. During the recent survey on "Ornamental fauna of East coast of India" the authors collected a specimen from the central sector of Chilika Lake identified as *Acanthurus triostegus* (Linnaeus, 1758) which was collected for the first time from Chilika Lake and also from Odisha coast.

Acanthurus triostegus (Linnaeus, 1758)

1758. *Chetodon triostegus* Linnaeus, *Syst. Nat. ed.* 10, P. 274

1986. *Acanthurus triostegus*, Randall, in Smith & Heemastra, Smith's Sea Fishes, p. 816, PI.127.

Description: D: IX, 25; A: III, 21; P:16; V: I, 5; LL: 151. Body ovate, compressed and deep; depth 2.32 in length with caudal and 1.87 in standard length; head 3.72 in length with caudal and 3 in standard length. Profile of head convex before eyes and concave on snout; eye 2.5 in snout and 1.21 in concave interorbital space. Teeth with denticulation on sides and tops of both jaws; two closely associate nostrils present just before eyes. Scales minute; 22 gill rakers on first arch. Single continuous dorsal fin origin above gill opening. First dorsal spines small, about 1/3rd of second dorsal spines; following spine gradually increasing in length; posterior part of soft dorsal rounded. First anal spine very small and the third one is the longest; soft part of anal rounded behind. Pectoral fins triangular, as long as snout and eye; ventral fins as long as snout. Caudal fin emerginate; there are small, Sharp, forward-pointing, erectile spine on each side of caudal peduncle.

Colour: Body light greenish grey above and white ventrally with five vertical darker bands first one from the nape through eye to chin; second from origin of dorsal to lower down to pectorals; third band runs from between 6th to 7th dorsal spines to middle of ventral fins; fourth from the soft dorsal to soft anal and fifth from the middle of soft dorsal to soft anal. A sixth band on caudal peduncle but it interrupted and contained as black blotch on caudal peduncle. Dorsal and anal fin with narrow dark subterminal band and a narrow white terminal band; anal fin dark in

Fig. ***Acanthurus triostigus*** collected from Chilika Lake

distal end; caudal fin grayish brown; pectoral fins white and ventral fins terminally dusky.

Distribution: From Indian coastal waters this species was reported from Andaman and Nicobar Island (Rao, 2004); Lakshadweep (Murty, 2002); Gulf of Manner (Varghese *et. al.*, 2011); Tamil Nadu (Krishnan *et. al.*, 2007); West Bengal (Das *et. al.*, 2007); Andhra Pradesh(Barman *et. al.*, 2004). The present report forms the first record of its occurrence from the Chilika Lake as well as Odisha coast.

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IDENTIFICATION OF UNNAMED COLLECTION OF ACRIDIDAE (INSECTA: ORTHOPTERA) FROM KARNATAKA PRESENT IN WRC, PUNE

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INTRODUCTION

Karnataka is one of India's larger states in the southern region. The studies on Acrididae are of significance as they are one of the largest group of plant feeding insects and are also a prey base for many of the vertebrates e.g amphibian, reptilian and birds because of their exoskeleton having rich protein content. Along with this, some of the acrididae are also pests of economic significance.

Acridids have short antennae, tympanum on their first abdominal segment and three segmented tarsi. Stal (1873) started the studies on Indian Acrididae followed by Kirby (1914) (Fauna of British India). Ander in 1939 (a,b) splitted the order Orthoptera into two suborders called - Caelifera and Ensifera. The former are short-horned grasshoppers. The family Acrididae has been further classified into 23 sub-families of which 14 sub-families, 138 genera and 310 species have been reported from India (Tandon *et. al.*, 1991) . Some of the later authors also used the term "subfamily Pyrgomorphinae" of the family Acrididae or Acridiidae (Rehn, 1904). Bolivar (1902) and Fletcher (1914) worked on Indian Pyrgomorphids. Few years ago, Hazra *et. al.*, (1984) studied population ecology of grasslands and cultivated fields, and Schmidt (2004) recorded new species from South India. Bhowmik *et. al.*, (1990) have contributed on the taxonomy as well as on the ecology of Acrididae. Shishodia *et. al.*, (2010) have published an annotated checklist of Orthoptera (insecta) from India which includes 362 species of Acrididae. Usman and Pattarudraiah (1955) collected the material from erstwhile Mysore state, Maaya *et. al.*, (2005) collected the material from Dakshina Kannada district, Nishitha and Rai (1999) collected material from Mangalore University Campus and Kumar, Prasad (1986) surveyed Bangalore district for these insects.

The present study was an attempt to identify the accumulated unidentified collections of Acrididae of Karnataka State, present at Western Regional Centre of Zoological Survey of India, Pune. Out of 30 districts of Karnataka , the available unidentified collections cover only six districts of Karnataka (Uttar Kannada, South Kannada, Mysore, Karwar, Kolar, and Mangalore) besides two National Parks, Bandipur and Nagarhole.

SYSTEMATIC ACCOUNT

Class INSECTA
Order ORTHOPTERA
Family ACRIDIDAE
Sub-family ACRIDINAE
Genus ***Acrida*** Linnaeus, 1758

1. ***Acrida exaltata*** (Walker, 1859)

1914. *Acrida exaltata*, Kirby, *Fauna Brit. India*, Orth.: 99.

Diagnostics: Head conically ascending, basal part narrow, fastigium of vertex broad, laminate and truncate at extremity; transverse sulcus of pronotum placed close to the middle of disc, hind femora without any peg-like structure on internal surface, tegmina without pointed apex, a little

produced beyond the hind knees, wings shorter than the tegmina, male subgenital plate long.

Material Examined: 1♂, Avulakuppam, Dist. Kolar, Coll. M.B. Rao & Pty, 14/03/1978 (Ent-5/1185); 1♀, Manchanpani Tank, Chikkaballapur, Dist. Kolar , Coll. M. B. Rao & Pty, 18/03/1978 (Ent-5/1186); 1♂, Gopal Tank, Chikkaballapur, Dist. Kolar, 19/03/1978 (Ent-5/1187); 1♀ 1♂, Farm near Gauri Bidanur, Dist. Kolar, Coll. M.B. Rao & Pty, 20/03/1978 (Ent-5/1188); 1♀, Mashid Basalguntha pond, Mulbagal, Dist. Kolar, Coll. M.B. Rao & Pty, 08/03/1978 (Ent-5/1189); 1♀, Basanotta village, Dist. Kolar, Coll. M.B. Rao & Pty, 10/03/1978 (Ent-5/1191); 1♂, Bada Talab, Mulbagal, Dist. Kolar, Coll. M.B. Rao & Pty, 09/03/1978 (Ent-5/1192); 1♀, Fatli , Dist. Kolar , Coll. M.B. Rao & Pty, 04/03/1978 (Ent-5/1273); 1♀, Kukkata, Dist. Kolar, Coll. M.B. Rao & Pty, 03/03/1978 (Ent-5/1275); 2♀, Hanuman Temple, Malur, Dist. Kolar, Coll. M.B. Rao & Pty, 05/03/1978 (Ent-5/1276).

Distribution : India (Andaman& Nicobar Islands, Andhra Pradesh, Assam, Arunachal Pradesh, Himachal Pradesh, Karnataka, Maharashtra, Meghalaya, Orissa, Sikkim, Tamil Nadu, Tripura, Uttar Pradesh and West Bengal).

Elsewhere : China, Australia, Celees, Aru Island, Buru Island, Japan, Malacca, New Moluccas, Guinea, Philippines, Sunda Islands, Taiwan and Tonkin.

Genus ***Phlaeoba*** Stal, 1860

2. ***Phaleoba infumata*** Brunner von Wattenwyl, 1893

1893. *Phlaeoba infumata,* Brunner von Wattenwyl, *Ann. Mus. Genova,* **33** (2) : 124.

Diagnostics : Uniformly brown and testaceous; antennae nicolorous; fastigium of vertex rather short and obtuse, concave above, with a continuous median carina extending along the head and pronotum; antennae ensiform; pronotum rugose with a rudimentary carina on either side between the median and lateral carinae; tegmina and wings longer than the abdomen; wings fusco-hyaline; hind femora dotted with black on outer carinae; wings more or less fuscous at the apex.

Material Examined : 1♂, Anuru Chintamani, Dist. Kolar, Coll. MB. Rao & Pty, 15/03/1978 (Ent-5/1205); 1♂, Abdul Ali Garden Bangarpet, Dist. Kolar, Coll. M.B. Rao & Pty, 06/03/1978 (Ent-5/1206).

Distribution : India : Andhra Pradesh, Arunachal Pradesh, Assam, Bihar, Chhattisgarh, Delhi, Goa, Haryana, Himachal Pradesh, Madhya Praesh, Manipur, Meghalaya, Nagaland, Orissa, Punjab, Rajasthan, Sikkim, Tamil Nadu, Tripura, Uttar Pradesh and West Bengal.

Elsewhere : Bangladesh, East Nepal, Hainan Islands, Myanmar, South & North Malacca, South China, Tennasserim and Yunnan.

Sub-family CALLIPTAMINAE
Genus Acorypha Krauss, 1877

3. ***Acorypha glaucopsis*** (Walker, 1870)

1870. *Caloptenus glaucopsis,* Walker, *Cat. Derm. Salt. Brit. Mus.,* **4**: 702.

2009. *Acorypha glaucopsis,* Hemp, *Jour. Orth. Res.,* **18**(2): 197.

Diagnostics : Eyes brown with black markings. Fastigium of vertex elongated longer than its width; dorsum of pronotum crossed by three sulci, anterior and posterior sulci crossing median carina metazona longer than prozona and its posterior end obtusely angular; prosternal process thick, spatulate having rounded apex; mesosternal space wider than its length and metasternal interspace open; hind femur with white or light coloured markings and lobes having margines with black serration on outside and three black bands on upper carina; hind tibia yellowish having spines with black tips; hind femur with expanded marginal area, and dorsal margins having serrations.

Material Examined : 2♀, Near Kulai Tank, Chintamani, Dist. Kolar, Coll. M.B. Rao and Pty, 13/03/1978 (Ent-5/1224); 1♀, Hanuman Temple, Maker , Dist . Coll. M.B. Rao and Pty, 13/03/1978 (Ent-5/1226); 1♂, Hanuman temple, Malur, Dist. Kolar, Coll. M.B. Rao & Pty, 05/03/1978 (Ent-

5/1208); 7♀, Kukkata, Dist. Kolar, Coll. M.B. Rao & Pty, 03/03/1978 (Ent-5/1214).

Distribution : India: Andhra Pradesh, Bihar, Himachal Pradesh, Jammu & Kashmir, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Rajasthan, Tamai Nadu and Uttarakhand.

Elsewhere : Iran and Saudi Arabia.

Sub-family TRUXALINAE

Genus ***Truxalis*** Fabricius, 1775

4. ***Truxalis indica*** (Bolivar, 1902)

1914. *Acridella nasuta*, Kirby, *Fauna Brit. India*, Orth., : 100.

2000. *Truxalis indica*, Sishodia, *Rec. zool. Surv. India*, **98** (Part-1): 44.

Diagnostics : Head as long as or longer than pronotum; fastigium of vertex broad, apex truncate; antennae broadly flattened, tapering at the extremity; hind femora with articulated pegs on internal surface, basal part of wings intensely bright pink; tegmina narrow, pointed, longer than the wings.

Material Examined : 1♂, Gudebande Tank, Dist. Kolar, Coll. M.B. Rao & Pty, 22/03/1978 (Ent-5/1196); 1♂, Gopal Tank, Chikkaballapur, Dist. Kolar. Coll. M.B. Rao & Pty, 19/03/1978 (Ent-5/1198).

Distribution : Arunachal Pradesh, Assam, Gujarat, Himachal Pradesh, Jammu & Kashmir, Maharashtra and Pondicherry.

Elsewhere : Afghanistan, Arabia, South East Iran, South East Tibet, West Aden and Yemen.

Sub-family OEDIPODINAE

Genus ***Gastrimargus*** Saussure, 1884

5. ***Gastrimargus africanus africanus*** (Saussure, 1888)

2000. *Gastrimargus africanus africanus*, Shishodia, *Rec. zool. Surv. India*, **98** (1): 51.

Diagnostics: Fastigium of vertex narrowing forwards, with truncated apex; pronotum tectiform with high sharp median carina, prozona shorter than metazona, posterior margin of metazona acute with X- marking usually effaced and without striae; tegmina and wings well developed, tegmina surpassing hind knee by one quarter to one-half of hind femur length, basal pale, transverse band sometimes reduced or absent; wings with complete fascia, basal area, usually bright yellow, apex variable infumate; cerci conical, inner position slightly blunt.

Material Examined: 1♀, Dist Uttar Kannada, Coll. M.B. Rao & Pty and P.D. Rane & Pty, 25/04/1992 (Ent-5/1114); 1♀, Tygli, Dist. Uttar Karnataka, Coll. P. D. Rane & Pty, 24/04/1992 (Ent-5/1119); 1♂, Kali river 4 km from Ganeshgudi Supa dam, Dist. South Kanara, Coll. R.M. Sharma & Pty, 15/09/1991 (Ent-5/1260); 1♂, Bandipur National Park, Coll. A. S. Mahabal & Pty, 14/1/1978 (Ent-5/1282); 1♀, Banwasi, Dist.Uttar Kannada, Coll. P.D. Rane & Pty, 23/04/1992 (Ent-5/1178).

Distribution : India : Andhra Pradesh, Arunachal Pradesh, Assam, Bihar, Chattisgarh, Delhi, Goa, Himachal radesh, Jammu & Kashmir, Madhaya Pradesh, Maharashtra, Meghalaya, Nagaland, Orissa, Rajasthan Sikkim, Tamil Nadu, Uttarakhand, Uttar Pradesh and West Bengal.

Elsewhere :Africa, Myanmar, Nepal, Pakistan, Saudi Arabia, Sri Lanka, Thailand, Tibet and Yemen.

Genus : ***Trilophidia*** Stal, 1873

6. ***Trilophidia annulata*** (Thunberg, 1815)

1914. *Trilophidia annulata*, Kirby, *Fauna Brit. India*, Orth., : 149.

Diagnostics: Body size small; vertex behind eyes with a pair of tubercles; fastigium of vertex elongate-trapezoid;antennae longer than head and pronotum together; pronotum rugose with a high median carina, forming two teeth in front and with lateral carinae; hind tibiae narrow with a faint narrow pale band beyond the middle.

Material Examined: 6♀, Jog Falls & around, Dist. North Kanara, Coll. R.M. Sharma & Pty, 19/09/1991 (Ent-5/509); 2♂2♀, Jalsar Village, Tal: Sullia Karnataka, Coll. P.P. Kulkarni & Pty, 10/02/1992 (Ent-5/1110); 5♀, Stream 10 kms from Honnavar on Jag Fall Road, Dist. North

Kanara Coll. R.M. Sharma & Pty, 24/09/1991 (Ent-5/1179); 2♀, Kukkata , Dist Kolar, Coll. M.B. Rao & Pty, 03/03/1978 (Ent-5/1231); 1♂ 1♀ , Manchanpalli, Dist. Coll. M.B. Rao & Pty, 20/03/1978 (Ent-5/1240); 1♂ , Anuru Chintamani, Dist. Kolar, Coll. M.B. Rao & Pty, 15/03/1978 (Ent-5/1241); 1♀, Abdul Ali Garden, Bangarpet, Dist. Kolar, Coll. M.B. Rao & Pty, 06/03/1978 (Ent-5/1242);1♀ , Mashid Basalguntha pond, Mulbagal, Dist. Kolar, Coll. M.B. Rao & Pty, 08/03/1978 (Ent-5/1243); 6♂2♀, Fatli Kolar, Coll. M.B. Rao & Pty, 04/03/1978 (Ent-5/1244); 1♂, Basanotta village, Dist. Kolar, Coll. M.B. Rao & Pty, 15/03/1978 (Ent-5/1245); 1♂, Gudebande Tank, Dist. Kolar, Coll. M.B. Rao & Pty, 22/03/1978 (Ent-5/1246); 1♀, Gopal Tank, Chikkaballapur, Dist. Kolar, Coll. M.B. Rao & Pty, 19/03/1978 (Ent-5/1247); 1♀, Kondanajan Nalli, Dist. Kolar, Coll. M.B. Rao & Pty, 11/03/1978 (Ent-5/1250); 1♂ , Tyagli, Dist. Uttar Kannada, Coll. P.D. Rane & Pty, 24/04/1992 (Ent-5/1174); 1♀, Sunkeri, Dist. Karwar, Coll. G.M. Yazdani & Pty, 25/12/1975 (Ent-5/1308); 1♀ , Cashew Research Center, Dist. Mangalore, Coll. G.M. Yazdani & Pty, 03/01/1976 (Ent-5/1309); 1♀ , Magod Falls, Dist. Mysore, Coll. B.S. Lamba & Pty, 25/02/1971(Ent-5/1310).

Distribution : India : Andhra Pradesh, Arunachal Pradesh, Assam, Bihar, Chhatisgarh, Delhi, Goa, Himachal Pradesh, Jammu & Kashmir, Karnataka, Kerala, Madhya Padesh, Maharashtra, Manipur, Meghalaya, Nagaland, Orissa, Rajasthan, Sikkim, Tamil Nadu, Tripura, Uttarakhand, Uttar Pradesh and West Bengal.

Elsewhere :Afghanistan, Bangladesh, Borneo, China, Hong Kong, Japan, Java, Korea, Malaysia, Mongolia, Myanmar, Nepal, Pakistan, Philippines, Sarawak, Singapore, Sri Lanka, Sumatra, Taiwan, Thailand and Vietnam.

Genus ***Dittopternis*** Saussure, 1884

7. ***Dittopternis venusta*** (Walker, 1870)

1914. *Dittopternis venusta, Kirby, Fauna Brit. India,* Orth., :156.

Diagnostics: Body small size; vertex with diverging rows of pale granules running backwards between the eyes; pronotum rugose, granulated and strongly carinated, cut by the principal sulcus, before the middle, obtusely angulated behind; hind tibiae black at base, followed by a light yellow band; tegmina with the basal half brown and with a large yellow blotch; wings yellow at base, with a broad suffused blackish band.

Material Examined: 1♂ , Uttar Kannada, Coll.P.D.Rane & Pty, 25/04/1992 (Ent-5/1115); 1♀, Banwasi, Dist.Uttar Kannada, Coll. P.D. Rane & Pty, 23/04/1992 (Ent-5/1171); 2♂, Bellari Forest Range, Tal : Puttur, Dist. South Kanara, Coll. P.P. Kulkarni & Pty, 09/02/1992 (Ent-5/1176); 1♀ , Avulakuppam, Dist. Kolar,Coll.M.B.Rao & Pty, 19/03/1978 (Ent-5/1248).

Distribution: India: Andhra Pradesh, Chhattisgarh, Karnataka, Madhya Pradesh, Manipur, Meghalaya, Orissa, Tamil Nadu, Tripura and West Bengal.

*Elsewhere :*Sri Lanka

Genus ***Aiolopus*** Fieber, 1853

8. ***Aiolopus thalassinus*** (Fabricius, 1798)

1914. *Aeolopus tamulus, Kirby, Fauna Brit. India,* Orth., : 122.

1990. *Aiolopus thalassinus tamulus,* Bhowmik, *Rec. zool. Surv. India,* **86** (2): 219

Diagnostics: Body medium size; antennae longer than head and pronotum together; fastigium of vertex pentagonal; frontal ridge flat, gradually narrowing towards fastigial end; pronotum slightly constricted between prozona and metazoan; two brown stripes present on middle part of the eyes and running up to the metazoan; posterior tibiae usually with red colored in apical fourth and broadly separated from black band by a wide blue grayish band; cerci rounded and conical.

Material Examined: 1♀ , Mavinakatte, Dist. Uttar Kannada, Coll. P.D. Rane & Pty, 18/04/1992 (Ent-5/1172); 1♂ , Mashid Basalguntha pond, Mulbagal, Dist. Kolar, Coll. M.B. Rao & Pty,

08/03/1978 (Ent-5/1197); 1♀ , Bada Talab, Mulbagal, Dist. Kolar, Coll. M.B. Rao & Pty, 09/03/1978 (Ent-5/1199); 1♀ , Fatli Kolar, Dist. Kolar, Coll. M.B. Rao & Pty, 04/03/1978 (Ent-5/1307); 1♀ , Bandipur National Park, Coll. A.S. Mahabal & Pty, 14/01/1978 (Ent-5/1311).

Distribution: India: Andaman & Nicobar Islands, Andhra Pradesh, Arunachal Prdesh, Bihar, Chhatisgarh, Delhi, Haryana, Himachal Pradesh, Karnaytaka, Kerala, Madhya Pradesh, Maharashtra, Manipur, Meghalaya, Orissa, Punjab, Rajasthan, Tamil Nadu, Tripura, Uttarakhand, Uttar Pradesh and West Bengal.

Elsewhere: Australia, Bangladesh, Borneo, Brunei, Celebes, China, Hainan, Hong Kong, Indonesia, Japan, Java, Lombok, Malaysia, Malaysia, Myanmar, New Guinea, Pakistan, Papua, Philippines, Singapore, Sri Lanka, Sumatra, Taiwan, Thailand and Timor.

Genus ***Morphacris***, Walker, 1870

9. ***Morphacris citrina*** Kirby, 1910

1910. *Morphacris citrina*, Kirby, *Syn. Cat. Orth.*, : **219**

Diagnostics : Pronotum brown with a black band on the lateral sides; abdomen whitish; hind femur with three bands on inner side; hind tibia yellow with a dark band near base, apical half blue; wings yellow at base having a border of a broad blackish band, clouded towards extremity .

Material Examined : 1♀ , Mavinakatte, Dist., Uttar Kannada, Coll. P.D. Rane & Pty, 18/04/1992 (Ent-5/1168);1♀ , Chintamani Road, Dist Kolar, Karnataka , Coll. M.B. Rao & Pty, 24/03/1978 (Ent-5/1209).

Distribution: India : Andhra Pradesh, Goa.

Elsewhere: Sri Lanka.

Sub-family TERATODINAE
Genus ***Teratodes*** Brulle, 1835

10. ***Teratodes monticollis*** (Gray, 1832)

1914. *Teratodes monticollis*, Kirby, *Fauna Brit. India*, Orth., :235.

Diagnostics: Head broad, rounded, face vertical; antenna shorter than head and pronotum; pronotum raised, the front arched above the head in a point, the middle forming a high crest, denticulated, pronotum cover the half of the length of abdomen; legs short; tegmina opaque.

Material Examined: 1♂ , Farm near Gauribidanur, Dist. Kolar, Coll. M.B. Rao & Pty, 20/03/1978 (Ent-5/1105); 1♀, Bandipur National Park, Karnataka, Coll. A.S. Mahabal & Pty, 14/01/1978 (Ent-5/1111); 1♀, Bandipur National Park, Karnataka, Coll. A.S. Mahabal & Pty, 19/01/1978 (Ent-5/1286).

Distribution: India : Andhra Pradesh, Bihar, Chhatisgarh, Jharkhand, Madhya Pradesh and Maharashtra.

Elsewhere: Sri Lanka.

Sub-family HEMIACRIDINAE

Genus ***Hieroglyphus*** Krauss, 1877

11. ***Hieroglyphus banian*** (Fabricius , 1798)

1914. *Hieroglyphus banian*, Kirby, *Fauna Brit. India*, Orth., :204.

Diagnostics: Fastigium of vertex broad; pronotum black with four black coloured sulci, narrowly lined, first sulci present only laterally, second present on medially and the last two continuous; hind tibiae blue, with black tipped spines; tegmina and wings are shorter or longer than abdomen; supra anal plate longer than wide in apical area with two ridge like elevation

Material Examined: 4♂ , Field near Edrebelle Village, Banwasi, Dist. North Kanara, Coll. R.M. Sharma & Pty, 19/09/1991 (Ent-5/508).

Distribution: India : Andhra Pradesh, Arunachal Pradesh, Assam, Bihar, Himachal Pradesh, Jharkhand, Karnataka, Madhya Pradesh, Maharashtra, Manipur, Orissa, Punjab, Rajasthan, Sikkim, Tamil Nadu, Uttarakhand, Uttar Pradesh and West Bengal.

Elsewhere : Afghanistan, Bangladesh, Bhutan, China, Myanmar, Nepal, Thailand and Vietnam.

Sub-family OXYINAE
Genus ***Oxya***, Serville 1831

12. ***Oxya hyla*** Serville 1831

1831. *Oxya hyla Serville, Ann. Sci. nat.* (Zool.) Paris, 22 : 287.

Diagnostics: Body medium size, finely rugose in male; supra anal plate trapezoidal, with triangular apical projection; small tubercle present in both side of supra anal plate; cercus conical or compressed rounded with acute or sub acute apex; inner pair of lophi well developed; in subgenital plate with two longitudinal ridges extending forwards from posterior margin.

Material examined: 2 ♀, Bachanki village and around, Tal : Mundgod, Dist. North Kanara, Coll. R.M. Sharma & Pty, 21/09/1991 (Ent-5/1117); 1♀, Abdul Ali Garden, Bangarpet, Dist. Kolar, Coll. M.B. Rao & Pty, 06/03/1978 (Ent-5/1200); 2♀, Abdul Ali Garden, Bangarpet, Dist. Kolar, Coll. M.B. Rao & Pty, 06/03/1978 (Ent-5/1203); 1♀, Jalasar Village, Tal: Sullia, Dist. South Kanara, Coll. P.P. Kulkarni & Pty, 10/02/1992 (Ent-5/1257); 1♀, Abdul Ali Garden, Bangarpet, Dist. Kolar, Coll. M.B. Rao & Pty, 06/03/1978 (Ent-5/1264); 7♂, Field Near Guruyankare village, Tal: Belthangady, Dist. South Kanara, Coll. P.P. Kulkarni & Pty, 11/02/1992 (Ent-5/1269).

Distribution: India : Andaman & Nicobar Islands, Andhra Pradesh, Arunachal Pradesh, Assam, Bihar, Chhattisgarh, Delhi, Goa, Gugarat, Haryana, Himachal Pradesh, Jammu & Kashmir, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Manipur, Meghalaya, Nagaland, Orissa, Punjab, Rajasthan, Sikkim, Tamil Nadu, Tripura, Uttarakhand, Uttar Pradesh and West Bengal.

Elsewhere: Afghanistan, Africa, Angola, Bangladesh, Benin, Cameroun, Chad, Central African Republic, Cote d'Ivoire, Iran, Fernandopo, Gabon, Gambia, Ghana, Guinea, Iran, Kenya, Liberia, Madagascar, Maldive Island, Mali, Lalawi, Nepal, Niger, Nigeria, Pakistan, Sao Thome, Senegal, Sierra Leopne, Sudan, Sri Lanka, Tanzania, Uganda, Zaire and Zambia.

13. *Oxya velox* (Fabricius, 1787)

1787. *Gryllus velox* Fabricius, Mantisa Insectorum stens eorum species nuper detectas adjectis characteribus genericis, differentiis specificis, emendationibus, observationibus, **2** (1) : 239

2007. *Oxya velox*. Chandra *et al.*, zoos' Print Journal, **22** (5) : 2686

Diagnostics : Antenna as long as head and pronotum together; interocular distance as wide as or slightly wider than frontal ridge near median ocellus; prozona is longer as compared to metazoan, latter with posterior margin widely obtuse-angular; posterior tibia modified for swimming with 8 external and 9 inernal yellowish black tipped spines; females are larger and more robustly built than males.

Material Examined: 2♂3♀, Village Balval 10 km from Karkala on Mordibidri Road, Tal: Karkala, Dist. South Kanara, Coll. P.P. Kulkarni & Pty, 16/02/1992 (Ent-5/1163); 1♂, Manchanhalli, Dist Kolar, Coll. M.B. Rao & Pty, 20/03/1978 (Ent-5/1202).

Distribution: India : Andhra Pradesh, Arunachal Pradesh, Bihar, Assam, Himachal Pradesh, Jammu & Kashmir, Jharkhand, Madhya Pradesh, Manipur, Maharashtra, Meghalaya, Nagaland, Orissa, Rajasthan, Sikkim, Tamil Nadu, Tripura, Uttarakhand, Uttar Pradesh and West Bengal.

Elsewhere : Bangladesh, China, Myanmar, Pakistan, Singapore, Sri Lanka and Thailand.

Genus : ***Gesonula*** Uvarov, 1940

14. *Gesonula punctifrons* (Stal,1861)

1861. *Acridium (Oxya) punctifrons* Stal, *Kongl. Svensk. Fregat Eugen. Res. Omkring*, Jorden, **3** : 336

1870. *Heteracris tenuis* Walker, *Cat. Derm. Satt. Brit. Mus.*, **4** : 647, 668

1910. *Racilia okinawaensis* Shiraki, Acrididen Japans, : 58.

2007. *Gesonula punctions*, Mandal *et. al.*, Pictorial handbook on Indian short-horned grasshopper pests (Acridoidea : Orthoptera) (Zool. Surv. India), : 22.

Diagnostics : A broad dark band running from behind the eyes on head to tympanum; fastigium of vertex from above parabolic, slightly longer than the width at base; dorsum of pronotum shallowly sulcate crossed by three transverse sulci; prosternal process conical and its apex is rounded; mesosternal interspace squarish and metasternal interspace closed; tegmina extending beyond tip of abdomen and hind knee; arolium large, equal in length to claws.

Material Examined : 1♂, Near Srinivasapur Tank, Dist. Kolar, Coll. M.B. Rao & Pty, 14/03/1978 (Ent-5/1249); 1♂, Near Srinivasapur Tank, Dist. Kolar, Coll. M.B. Rao & Pty, 14/03/1978 (Ent-5/1252); 1♂, Kahiga, Kanwar Tehsil, Dist. North Kannada, Coll. P.D. Rane & pty, 14/04/1992 (Ent-5/1256); 1♂, Kali river 4 km from Ganeshgudi Supa dam, Dist. South Kanara, Coll. R.M. Sharma & Pty, 15/09/1991 (Ent-5/1263); 6♂ 1♀, Field Near Guruyankare village, Tal : Belthangady, Dist. South Kanara, Coll. P.P. Kulkarni & Pty, 11/02/1992 (Ent-5/1270); 2♀ 3♂, Bandipur National Park, 19/01/1978 (Ent-5/1284); 1♀, Bandipur National Park, 14/01/1978 (Ent-5/1285); 1♂ 1♀, Ranipura, Dist. Mangalore, Coll. G.M. Yazdani & Pty, 02/01/1976 (Ent-5/1294); 1♂ 1♀, Kadekar, Dist. Mangalore, Coll. G.M. Yazdani & Pty, 30/12/1975 (Ent-5/1295); 1♂1♀, Cashew Research Center, Dist. Mangalore, Coll. G.M. Yazdani & Pty, 03/01/1976 (Ent-5/1296); 1♂, Sunkeri, Dist. Karwar, Coll. G.M. Yazdani & Pty, 25/12/1975 (Ent-5/1297); 1♂, Chruch Road, Dist. Karwar, Coll. G.M. Yazdani & Pty, 23/12/1975 (Ent-5/1303).

Distribution: India : Andaman & Niocobar Islands, Andhra Pradesh, Arunachal Pradesh, Assam, Bihar, Chhattisgarh, Delhi, Goa, Kerala, Madhya Pradesh, Maharashtra, Manipur, Meghalaya, Nagaland, Orissa, Punjab, Tamil Nadu, Uttar Pradesh and West Bengal.

Elsewhere : Bangladesh, Borneo, China, Hainan, Japan, Java, Kalimantan, Malacca, Myanmar, North Vietnam, Philippines, sri Lanka, Taiwan and Thailand.

Sub-family CYRTACANTHACRIDINAE
Genus ***Cyrtacanthacris*** Walker, 1870

15. ***Cyrtacanthacris tatarica*** (Linnaeus, 1758)

1758. *Gryllus (Locusta) tataricus* Linnaeus, Systema Naturae per Regna Tria naturae, (10th ed.) : 432.

2008. *Cyrtacanthacris tatarica*, Gupta *et. al.*, Natl. J. Life Sci., **5** (1) : 124.

Diagnostics: Body large size; pronotum on both sides above with a broad velvety blackish brown band; hind tibiae bluish or brown with black tipped yellow or brown spines present; tegmina with dense and thick reticulation or irregular spots.

Material Examined: 1♂, Anuru chintamani, Dist. Kolar, Coll. M.B. Rao & Pty, 15/03/1978 (Ent-5/1104); 1♂, Basantola village, Dist. Kolar, Coll. M.B. Rao & Pty, 10/03/1978 (Ent-5/1104); 1♂, Basantola village, Dist. Kolar, Coll. M.B. Rao & Pty, 10/03/1978 (Ent-5/1165); 2♀, Kane Palli Tank, Chintamani, Dist. Kolar, Coll. M.B. Rao & Pty, 13/03/1978 (Ent-5/1190); 1♂, Gudebande Tank, Dist. Kolar, Coll. M.B. Rao & Pty, 22/03/1978 (Ent-5/1204).

Distribution: India : Andhra Pradesh, ArunachaL Pradesh, Assam, Bihar, Chhattisgarh, Delhi, Haryana, Himachal Pradesh, Jammu & Kashmir, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Manipur, Meghalaya, orissa, Rajasthan, Tamil Nadu, Tripura, Uttarakhand, Uttar Pradesh and West Bengal.

Elsewhere :Africa, Bangladesh, Central America, Hainan, Indonesia, Madagascar, Mediterranean Region, Myanmar, Nepal, Pakistan, Philippines, Red-Sea, Sahara, Saudi Arabia, Seychelles, Sri Lanka, South West Asia, Sumatra and Thailand.

Sub-family CATANTOPINAE
Genus **Diaboloc *tantops*** , Jago,1984

16. ***Diabolocatantops pinguis*** (Stal, 1860)

1860. *Acridium (Catantops) pingue* Stal, *Kongl. Svensk. Fregat Eugen. Res., Omkring,* Jorden, **3** : 330.

1870. *Acridium delineolatum* Walker, *Cat. Derm. Salt. Brit. Mus.*, **4**: 631.

1914. *Catantops pinguis,* Kirby, *Fauna Brit, India,* Orth., : 252.

1984. *Diabolocatantops pinguis* Jago, Trans. Amer. Ent. Soc., **110** (3) : 370.

2004. *Catantops pinguis* Shishodia & Tandon, *Fauna of Manipur, State Fauna Series,* **10**: Zool. Surv. India : 130.

Diagnostics: Body size medium; antennae shorter than head and pronotum together; lateral lobe of pronotum without colour pattern, hind femur broad and thick without black median spot,

external disc of the hind femur with a small black median spot, below upper carinula on external disc, small four black spots on internal disc, hind tibiae red; basal disc of wings colourless to weakly greenish,.

Material Examined: 1♀, Kahiga, Kanwar Tehsil, Dist. North Kannada, Coll. P.D. Rane & pty, 14/04/1992 (Ent-5/1255); 2♀, Kali river 4 km from Ganeshgudi Supa dam, Dist. South Kanara, Coll. R.M. Sharma & Pty, 15/09/1991 (Ent-5/1261); 1♀, Bhatkal, Dist. Uttar Kannada; Coll. P.D. Rane & Pty, 14/04/1992 (Ent-5/1265); 1♂, Rest House and around, Dist. Manglore, Coll. S.S. Kamble & Pty, 29/08/1991 (Ent-5/1268); 1♀, Ullal, Dist. Mangalore, Coll. G.M. Yazdani & Pty, 29/12/1975 (Ent-5/1304).

Distribution : India : Kerala, Manipur, Sikkim adn Tamil Nadu.

Elsewhere : Cambodia, China, Hainan, Japan, Myanmar, Sri Lanka and Taiwan

Genus ***Xenocatantops*** Dirsh & Uvarov, 1953

17. ***Xenocatantops humilis humilis*** (Serville, 1839)

1914. *Catantops humilis*, Kirby, *Fauna Brit. India*, Orth., : 250.

1985. *Xenocatantops humilis humilis*, Shishodia, *Rec. zool. Surv. India*, **82** (1-4): 21.

Diagnostics: Body medium size; antennae longer than the head and pronotum together; pronotum constricted in the middle, pronotal and thoracic markings much lighter with proportionately broader light oblique band on episternum III; hind femora with two blackish bands above; hind tibiae and tarsi red, tibiae with black tipped spines; male circus with rounded apex.

Material Examined: 2♂, Banwasi, Dist. Uttar Kannada, Coll. P.D. Rane & Pty, 23/04/1992 (Ent-5/1169); 5♀, Laar Siddhapur, Dist. Uttar Kannada, Dr. P.D. Rane & Pty, 20/04/1992 (Ent-5/1181).

Distribution : India : Andaman & Nicobar Islands, Arunachal Pradesh, Assam, Bihar, Chhattisgarh, Himachal Pradesh, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, Tamil Nadu, Tripura, Uttarakhand, Uttar Pradesh adn West Bengal.

Elsewhere :Bangladesh, Borneo, Indo-China, Java, Lombok, Malaysia, Myanmar, Nepal, New Guinea, Philippines, Sumatra, Sri Lanka, Thailand, Tibet, Vietnam and Yunan.

Sub-family SPATHOSTERNINAE

Genus ***Spathosternum*** (Walker, 1871)

18. ***Spathosternum prasiniferum prasiniferum*** (Walker, 1871)

1914. *Spathostrnum prasiniferum*, Kirby, *Fauina Brit. India*, Orth., : 208.

1985. *Spathostrnum prasiniferum prasiniferum*, Shishodia, *Rec. zool. Surv. India*, **82** (1-4): 20.

Diagnostics: Body size small; broad blackish or dark green stripe runs behind the lower part of the eyes and below the lateral carinae of the pronotum; spathulated prosternum tubercle; central area of tegmen with a longitudinal black streak which is well marked in females and alomst obsolete in males; tegmina and wings well developed.

Material Examined: 1♀, Mavinakatte, Dist. Uttar Kannada, Coll. P.D. Rane & Pty, 18/04/1992 (Ent-5/1173); 3♀, Bellari forest Range, Tal : Puttur, Dist. South Kanara, Coll. P.P. Kulkarni & Pty, 09/02/1992 (Ent-5/1175); 1♂, Jalasar Village, Tal : Sullia, Dist. South Kanara, Coll. P.P. Kulkarni & Pty, 10/02/1992 (Ent-5/1258); 4♂, Field Near Guruyankare village, Tal : Belthangady, Dist. South Kanara, Coll. P.P. Kulkarni & Pty, 11/02/1992 (Ent-5/1272); 1♂ 1♀, Ullal, Dist. Mangalore, Coll. G.M. Yazdani & Pty, 29/12/1975 (Ent-5/1302).

Distribution : India : Andaman & Nicobar Islands, Andhra Pradesh, Arunachal Pradesh, Assam, Bihar, Chhattisgarh, Delhi , Goa, Himachal Pradesh, Jammu & Kashmir, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Manipur, Meghalaya, Mizoram, Nagaland, Orissa, Punjab, Punjab, Rajasthan, Sikkim, Tamil Nadu, Tripura, Uttrakhand, Uttar Pradesh and West Bengal.

Elsewhere : Bangladesh, Hainan, Myanmar, Nepal, Pakistan, South & East China, Sri Lanka, Thailand, Vietnam and West Malaysia.

Sub-family GOMPHOCERINAE
Genus ***Aulacobothrus*** Bolivar, 1902

19. ***Aulacobothrus luteipes luteipes*** (Walker, 1871)

1871. *Stenobothrus luteipes* Walker, *Cat. Derm. Salt. Brit. Mus.*, **5**:82

1983. *Dnopherula (Aulacobothrus) lutepes* Bhowmik & Halder, *Rec. zool. Surv. India*, **81**(1-2) ;171.

1993. *Aulacobothrus luteipes luteipes* Ingrisch, *Ent. Scand.*, **24** (3) : 321.

Diagnostics: Fastigium of vertex nearly trapezoidal with truncate apex; fastigial foveolae not visible from above; pronotum with nearly lateral carinae which are weakly concave in the middle; disc of pronotum with principal sulcus distinctly behind the middle.

Material Examined: 1♀, Field near Edvebelle village, Banswasi, North Kanara,Coll. R.M. Sharma & Pty, 27/09/2011 (Ent-5/460); 1♀, Stream 10 kms from Honnavar on Jag Fall Road, Dist. North Kanara, Coll. R.M. Sharma & Pty, 24/09/1991 (Ent-5/1180); 1♀, Field Near Guruyankare village, Tal : Belthangady, Dist. South Kanara, Coll. P.P. Kulkarni & Pty, 11/02/1992 (Ent-5/1271); 4♂, Cashew Research Center Mangalore, Dist. Mangalore, Coll. G.M. Yazdani & Pty, 03/01/1976 (Ent-5/1277); 1♂, Sadashivgarh,Dist. Karwar, Coll. G.M. Yazdani & Pty, 24/12/1975 (Ent-5/1278); 4♂, Ullal, Dist. Mangalore, Coll. G.M. Yazdani & Pty, 29/12/1975 (Ent-5/1279); 1♂, Chruch Road, Dist. Karwar, Coll. G.M. Yazdani & Pty, 23/12/1975 (Ent-5/1280); 3♂, Bandipur National Park, Coll. A.S. Mahabal & Pty, 14/1/1978 (Ent-5/1281); 2♂, Ranipura, Dist. Mangalore, Coll. G.M. Yazdani & Pty, 02/01/1976 (Ent-5/1293).

Distribution : India : Andaman & Nicobar Islands, Andhra Pradesh, Assam, Bihar, Chhattisgarh, Delhi, Himachal Pradesh, Jammu & Kashmir, Karnataka, Madhya Pradesh, Maharashtra, Orissa, Rajasthan, Sikkim, Tamil Nadu, Uttarakhand and West Bengal.

Elsewhere : Bangladesh, China, Europe, Japan, Myanmar, Nepal, North America, Pakistan, Sri Lanka, Taiwan and Thailand.

Genus ***Gelastorhinus***, Brunner von Wattenwyl, 1893

20. ***Gelastorhinus semipictus*** (Walker, 1870)

1870. *Opomala semipictus* Walker, *Cat. Derm. Salt. Brit. Mus.*, **4**: 512

1910. *Gelastorhinus semipictus*, Kirby, *Syn. Cat. Orth.*, **3**(2): 409

Diagnostics : Antenna ensiform; head elongated, conical; fastigium of vertex long, with widely obtuse angular apex; fastigial fovoelae absent; pronotum elongate with well developed median and lateral carinae; metazona shorter than prozona and its posterior margin is rounded, prosternal process short, acutely conical with broad basal part, metasternal interspace closed behind; intercalary vein of medial area of tegmina present; hind tibia bluish with brown tipped spines.

Material examined: 8♂ 14♀, Field near Edvebelle village Banswasi, Dist. North Karnataka, Coll. R.M. Sharma & Pty, 27/09/2011 (Ent-5/461); 4♂, Bachanki village and around, Tal : Mundgod, Dist. North Kanara, Coll. R.M. Sharma & Pty, 21/09/1991 (Ent-5/1118); 1♀, Anuru Chintamani, Dist. Kolar, Coll. M.B. Rao & Pty, 15/03/1978 (Ent-5/1251).

Distribution : South India.

Sub-family EYPREPOCNEMIDINAE
Genus ***Eyprepocnemis*** Fieber, 1853

21. ***Eyprepocnemis alacris alacris*** (Serville, 1839)

1914. *Euprepocnemis alacris*, Kirby, *Fauna Brit. India*, Orth., : 267.

1990 *Eyprepocnemis alacris alacris*, Bhowmik, *Rec. zool. Surv. India*, **86** (2): 222.

Diagnostics: Body size medium; concavity of fastigium of vertex distinct, a broad velvety black subparallel – sided stripe runs over the vertex and pronotum; tegmina subhyaline; hind tibiae bluish grey with two whitish rings at base, reddish tarsus.

Material Examined: 1♀, Basanotta village, Dist. Kolar, Coll. M.B. Rao & Pty, 10/03/1978 (Ent-5/1184).

Distribution : India : Andhra Pradesh, Arunachal Pradesh, Assam, Bihar, Chhattisgarh, Delhi, Goa, Haryana, Himachal Pradesh, Karnataka, Kerala, Madhya Pradesh, Manipur, Maharashtra, Meghalaya, Orissa, Punjab, Rajasthan, Sikkim, Tamil Nadu, Tripura, Uttarakhand, Uttar Pradesh and West Bengal.

Elsewhere : Afghanistan, Bangladesh, Iran, Iraq, Pakistan and Sri Lanka.

Sub-family TROPIDOPOLINAE

Genus ***Tristria*** Stal, 1873

22. ***Tristria pulvinata*** (Uvarov, 1921)

1921. *Tapiophyma pulvinata* Uvarov, *Ann. Mag. Nat. Hist. London.*, 7(9) :497.

1929. *Tristral pulvinata* Uvarov, *Rev. Suisse Zool.*, **36** : 559.

Diagnostics: Medium in size; fastigium of vertex parabolic; prosternal tubercle curved backwards, strongly widened and concave apically, circus at apical third incurved, downcurved, and laterally flattened, in male subgenital plate almost linear, compressed, knife like, in female it is on the posterior margin on either side of mid line.

Material Examined: 6♂, Bellari Forest Range, Tal : Puttur, Dist. South Kanara, Coll. P.P. Kulkarni & Pty, 09/02/1992 (Ent-5/1177); 2♂, Fields near village Ujire, Tal : Belthangady, Dist. South Kanara, Coll. P.P. Kulkarni & Pty, 12/02/1992 (Ent-5/1182); 1♂ , Gopal Tank, Chikkaballapur, Dist. Kolar, Coll. M.B. Rao & Pty, 19/03/1978 (Ent-5/1193); 1♀ , Farm near Gauri Bidanur, Dist. Kolar, Coll. M.B. Rao & Pty, 20/03/1978 (Ent-5/1194); 1♂, Abdul Ali Garden, Bangarpet, Dist. Kolar, Coll. M.B. Rao & Pty, 06/03/1978 (Ent-5/1195); 1♂, Abdul Ali Garden, Bangarpet, Karnataka Dist. Kolar, Coll. M.B. Rao & Pty, 06/03/1978 (Ent-5/1201); 2♀ , Kali river 4 km from Ganeshgudi Supa dam, Dist. South Kanara, Coll. R.M. Sharma & Pty, 15/09/1991 (Ent-5/1262); 5♀ , Field Near Guruyankare village, Tal : Belthangady, Dist. South Kanara, Coll. P.P. Kulkarni & Pty, 11/02/1992 (Ent-5/1274); 1♀ , Ullal, Dist. Mangalore, Coll. G.M. Yazdani & Pty, 29/12/1975 (Ent-5/1298); 1♀ , Sadashivgarh, Dist. Karwar, Coll. G.M. Yazdani & Pty, 24/12/1975 (Ent-5/1299); 2♀ , Cashew Research Center, Mangalore, Dist. Mangalore, Coll. G.M. Yazdani & Pty ,03/01/1976 (Ent-5/1300); 2♀ , Church Road, Dist. Karwar, Coll. G.M. Yazdani & Pty, 23/12/1975 (Ent-5/1301).

Distribution : India : Andhra Pradesh, Assam, Bihar, Delhi, Haryana, Karnataka, Kerala, Maharashtra, Meghalaya, Orissa, Punjab, Tamil Nadu, Uttarakhand, Uttar Pradesh adn West Bengal.

Elsewhere : Sri Lanka.

Family PYRGOMORPHIDAE

Sub-family PYRGOMORPHINAE

Genus ***Atractomorpha*** Saussure, 1862

23. ***Atractomorpha crenulata*** (Fabricius, 1793)

1914. *Atractomorpha crenulata,* Kirby, *Fauna Brit. India,* Orth.,: 181.

1960. *Atractomorpha crenulata,* Banerjee & Kevan, *Trenbia,* **25**: 184.

Diagnostics: Body medium, narrow and slender; antennae short and stout, sub- filiform; head conical; fastigium of vertex short; eye oval; pronotum submarginate in front and ungulated behind; tegminal pointed, extended for one-forth of their length beyond the hind femora; hind wings normally tyrian pink to light mallow purple at base.

Material Examined: 1♂ , Chintamani Road, Dist. Kolar, Coll. M.B. Rao & Pty, 24/03/1978 (Ent-5/1109); 1♂ , Village Balval, 10 km from Karkala on Mordibidri Road, Tal : Karkala, Dist. South Kanara, Coll. P.P. Kulkarni & Pty, 16/02/1992 (Ent-5/1164), 2♀, Near Srinivasapur Tank, Dist. Kolar, Coll. M.B. Rao & Pty, 14/03/1978 (Ent-5/1227); 1♀ , Farm near Gauri Bidanur, Dist. Kolar, Coll. M.B. Rao & Pty, 20/03/1978 (Ent-5/1228); 1♀ , Mashid Basalguntha pond, Mulbagal, Dist. Kolar, Coll. M.B. Rao & Pty, 08/03/1978 (Ent-5/1229); 1♀ , Gopal Tank, Chikkaballapur , Dist. Kolar, Coll. M.B. Rano & Pty,19/03/1978 (Ent-5/1230); 1♀ ,

Kali river 4 km from Ganeshgudi Supa dam, Dist. South Kanara, Coll. R.M. Sharma & Pty, 15/09/1991 (Ent-5/1259); 1♂, Bazarka Amanai Bagepali, Dist. Kolar, Coll. M.B. Rao & Pty, 16/3/1978 (Ent-5/1289); 1♂, Basanotta village, Dist. Kolar, Coll. M.B. Rao & Pty, 10/03/1978 (Ent-5/1290); 1♂, Anuru Chintamani, Dist. Kolar, Coll. M.B. Rao & Pty, 15/03/1978 (Ent-5/1291), 1♀, Cashew Research Center, Dist. Mangalore, Coll. G.M. Yazdani & Pty, 03/01/1976 (Ent-5/1306).

Distribution : India : Andaman & Nicobar Islands, Andhra Pradesh, Arunachal Pradesh, Assam, Bihar, Chhattisgarh, Delhi, Goa, Gujarat, Haryana, Himachal Pradesh, Jammu & Kashmir, Jharkhand, Karnataka, Kerala, Lakshadweep Island, Madhya Pradesh, Maharashtra, Manipur, Meghalaya, Nagaland, Orissa, Punjab, Rajasthan, Sikkim, Tamil Nadu, Tripura, Uttarakhand, Uttar Pradesh, West Bengal.

Elsewhere : Bangladesh, Cambodia, Laos, Maldiv Island, Malaya, Myanmar, Nepal, Pakistan, Sri Lanka, Sumatra, South Vietnam and Thailand.

Genus ***Chrotogonus*** Serville, 1838

24. ***Chrotogonus (Chrotogonus) trachypterus*** (Blanchard, 1836)

1836. *Ommexecha trachypterum*, Blanchard, *Ann. Soc. Ent. France*, **5**: 618

1914. *Chrotogonus incertus*, Kirby, *Brit. India, Orth.*, :163.

2007. *Chrotogonus (Chrotogonus) trachypterus trachypterus*, Mandal *et al.*, Pictorial Handbook on Indian Short horned grasshopper pests (Acridoidea: Orthoptera). *Rec. zool. Surv. India* : 10

Diagnostics: Body medium size, dorsoventrally flattened; hind wings hyaline or occasionally with faintly tinged yellowish brown but never infumated or infuscated apparently always at least two third as long as tegmina.

Material examined: 1♀ 2♂, Gopaltank, Chikka Belapur, Dist. Kolar, Coll. M.B. Rao & Pty, 19/03/1978 (Ent-5/1107); 1♂, Near Kuppam Tank, Bangarpet, Dist. Kolar, Coll.M.B. Rao & Pty, 0603/1978 (Ent-5/1108); 1♀, Fatli, Dist. Kolar, Coll. M.B. Rao & Pty, 04/03/1978 (Ent-5/1113); 2♀, Tyagli, Dist.Uttar Kannada, Coll. PD. Rane & Pty, 24/04/1992 (Ent-5/1116); 8 ♂, Dist. Uttar Kannada, Coll. P.D. Rane & Pty,19/04/1992 (Ent-5/1166); 1♀, Bhatkal, Dist. Uttar Kannada, Coll. Coll. P.D. Rane & Pty, 18/04/1992 (Ent-5/1167); 2♂ 2♀, Mavinakatte, Dist. Uttar Kannada, Coll. P.D. Rane & Pty, 18/04/1992 (Ent-5/1170); 1♂, Kahiga, Kanwar Tehsil, Dist. North Kannada, Coll. P.D. Rane & pty, 14/04/1992 (Ent-5/1254); 2♀, Bhatkal, Dist. Uttar Kannada, Coll. P.D. Rane & Pty, 14/04/1992 (Ent-5/1266); 1♂ 1♀, Anuru chintamani, Dist. Kolar, Coll. M.B. Rao & Pty, 15/03/1978 (Ent-5/1287); 1♀, Manchanpani tank, Chikkaballapur, Dist. Kolar, Coll. M.B. Rao & Pty, 18/03/1978 (Ent-5/1292); 2♂ 4♀, Kukkata, Dist. Kolar, Coll. M.B. Rao & Pty, 03/03/1978 (Ent-5/1223); 1♀, Hanuman Temple, Malur, Dist Kolar, Coll. M.B. Rao & Pty, 05/03/1978 (Ent-5/1225).

Distribution: India : Andhra Pradesh, Assam, Chhattisgarh, Delhi, Gujarat, Haryana, Himachal Pradesh, Jammu & Kashmir, Madhya Pradesh, Maharashtra, Meghalaya, Orissa, Punjab, Rajasthan, Sikkim, Tamil Nadu, Uttarakhand, Uttar Pradesh and West Bengal.

Elsewhere : Afghanistan, Bangladesh, Iran, Nepal and Pakistan.

25. ***Chrotogonus (Chrotogonus) oxypterus*** (Blanchard, 1863)

1798. *Gryllus scaber* [nec. Gmelin] Fabricius, Entomologia systematica Suppl., : 196

2008. *Chrotogonus oxypterus*, Shishodia, Faunal Diversity of Jabalpur district, M.P. (Zool. Surv. India), : 101

Diagnostics : Wings pisceous, not extending beyond fifth abdominal segment. Tegmina reaching fourth segment.

Material examined : 2♀, Fatli, Dist. Kolar Coll. M.B. Rao & Pty, 4/03/1978 (Ent-5/1112); 2♀, Bazarka Amanai, Bagepali, Dist. Kolar, Coll. M.B. Rao & Pty, 16/03/1978 (Ent-5/1236); 1♀, Vijayapura Tank, Dist. Kolar, Coll. M.B. Rao &

Pty, 19/03/1978 (Ent-5/1237); 1♀ , Anuru Chintamani, Dist. Kolar, Coll. M.B. Rao & Pty, 15/03/1978 (Ent-5/1238); 1♀, Bhatkal, Dist. Uttar Kannada, Coll. P.D. Rane & Pty, 14/04/1992 (Ent-5/1267); 4♂ 3♀, Kukkata, Dist. Kolar, Coll. M.B. Rao & Pty, 03/03/1978 (Ent-5/1221); 8♂4♀, Fatli, Dist. Kolar, Coll. M.B. Rao & Pty, 04/03/1978 (Ent-5/1222).

Distribution : India : Andhra Pradesh, Bihar, Chhattisgarh, Goa, Karnataka, Kerala, Maharashtra, Madhya Pradesh, Orissa, Tamil Nadu, Uttar Pradesh and West Bengal.

Elsewhere : Bangladesh and Sri Lanka.

Genus : Pyrgomorpha Serville, 1838

26. ***Pyrgomorpha bispinosa*** Walker, 1870

1870. *Opomala cingulata* Walker, *Cat. Derm. Salt. Brit. Mus.*, **3** : 517

2007. *Prygmorpha bispinosa bispinosa*, Mandal & Yadav, *Fauna of Andhra Pradesh, State Fauna Series*, 5 : (Part - 3), Zool. Surv. India, : 191.

Diagnostics: Integument rugose; head and pronotum with tubercles; fastigium of vertex convex with rounded apex, frons strongly oblique and incurved; dorsum of pronotum crossed by two sulci; hind wings rosy at base; prosternal process very short almost collar like with broad base mesosternal lobe longer than broad.

Material Examined : 1♂, Konda rajan Nalli, Dist. Kolar, Coll. M.B. Rao & Pty, 11/03/1978 (Ent-5/1232); 1♂ , Mashid Basalguntha pond, Mulbagal, Dist. Kolar, Coll. M.B. Rao & Pty, 08/03/1978 (Ent-5/1233); 1♂ , Gopal Tank, Chikkaballapur, Dist. Kolar, Coll. M.B. Rao & Pty, 19/03/1978 (Ent-5/1234);1♂ , Kanepalli Tank, Chintamani, Dist. Kolar, Coll. M.B. Rao & Pty, 13/03/1978 (Ent-5/1235); 1♀, Fatli, Kolar, Dist. Kolar, Coll. M.B. Rao & Pty, 04/03/1978 (Ent-5/1215); 1♀ , Kadekar, Dist. Mangalore, West coast survey 1975-76, Coll. G.M. Yazdani & Pty, 30/12/1976 (Ent-5/1305).

Distribution : India : Andhra Pradesh : Andhra Pradesh, Chhattisgarh, Madhya Pradesh, Orissa and Tamil Nadu.

Sub-family ORTHACRIDINAE Bolivar, 1905

Genus ***Neorthacris*** Kevan & Singh, 1964

27. ***Neorthacris acuticeps acuticeps*** (Bolivar, 1902)

1902. *Orthacris acuticeps* Bolivar, I., *Ann. Soc. Ent. Fr. Paris*, **70** : 608

2007. *Neorthacris acuticeps acuticeps*, Mandal & Yadav, *Fauna of Andhra Pradesh, State Fauna Series*, **5** : (Part - 3), Zool. Surv. India, : 192.

Diagnostics: A black band runs from eyes to the middle of the abdominal segments on the lateral side ; fastigium of vertex long , apex rounded with a median carina pronotum with red lateral stripe and scattered white tubercles; dorsum of pronotum and median carina crossed by two sulci, metazona shorter than prozona with rounded posterior margin; prosternal process short, conical with broad base; last abdominal segment emarginated in middle forming triangular lobes.

Material Examined : 1♀ , Basanotta village, Dist. Kolar, Coll. M.B. Rao & Pty, 10/03/1978 (Ent-5/1207); 1♀ , Basanotta village, Dist. Kolar, Coll. M.B. Rao & Pty, 10/03/1978 (Ent-5/1208); 1♀, Kanepalli Tank, Chintamani, Dist. Kolar, Coll. M.B. Rao & Pty, 13/03/1978 (Ent-5/1210); 1♂ , Kulai tank, Chintamani, Dist. Kolar, Coll. M.B. Rao & Pty, 13/03/1978 (Ent-5/1211); 1♀ , Manchanpani Tank, Chikkaballapur, Dist. Kolar, Coll. M.B. Rao & Pty, 18/03/1978 (Ent-5/1212); 5♂, Basanotta village, Dist. Kolar, Coll. M.B. Rao & Pty, 10/03/1978 (Ent-5/1213); 3♂ , Kanepalli Tank, Chintamani, Dist. Kolar, Coll. M.B. Rao & Pty, 13/03/1978 (Ent-5/1216); 2♂ , Bazar ka Amarai, Basepalli, Dist. Kolar, Coll. M.B. Rao & Pty, 16/03/1978 (Ent-5/1218); 1♂ , Near Kulla Tank, Chintamani, Dist. Kolar, Coll. M.B. Rao & Pty, 13/03/1978 (Ent-5/1219); 10♂1♀, Nagarhole National Park, Karnataka Murkul Forest, Coll. S.G. Patil & Pty, 24/09/1990 (Ent-5/1253); 1♂/♀?, Nagarhole National Park, Karnataka Murkul Forest, Coll. S.G. Patil & Pty, 24/09/1990 (Ent-5/1253); 2♂ , Bandipur National Park, Coll. A.S. Mahabal & Pty, 14/1/1978 (Ent-5/1283); 4♂ , Kukkata ,Dist. Kolar, Coll. M.B. Rao & Pty, 03/03/1978 (Ent-5/1220).

Distribution : India : Andhra Pradesh and Tamil Nadu.

SUMMARY

The systematic account of 27 species belonging to 25 genera under family Acrididae and Pyrgomorphidae covering over 340 examples from Karnataka State is provided here. The study material is based on the collection present in Western Regional Centre, Pune, Maharashtra.

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SOME OBSERVATION ON THE STATUS AND CONSERVATION OF SWAMP DEER *CERVUS D. DUVAUCELI* (CUVIER, 1823) IN DUDHWA NATIONAL PARK, INDIA

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INTRODUCTION

Barasingha is one of the large size deer belonging to the family *Cervidae* with characteristic highly branched antler and residing in a marshy habitat, so called swamp deer (Jerdon, 1874; Blanford, 1888-91; Lydekker, 1898, Bhadian, 1934; Pocock, 1943; Schaller, 1967; Krishnan, 1972; Prater, 1971). Brander (1923) mentioned two races of barasingha north-eastern and central Indian races according to their living in two different type of habitat. Ellerman & Morrison-Scott (1951) subsequently distinguished two subspecies: *Cervus duvauceli duvauceli* Cuvier 1823 and *Cervus duvauceli branderi* Pocock 1943. Groves (1982) later described another new subspecies *Cervus duvauceli ranjitsinghai* and thus three different races of barasingha are present today due to geographical variation mentioned as sub-species (Singh, 1985). They prefer hard and soft ground grassy areas near to moisy or swampy soil and sand (Gee, 1964; Martin, 1977; Panwar, 1978). Various worker like Blanford (1888-91), Sterndale (1929), Schaller (1967), Prater (1973), Brander (1923), Martin (1977), Panwar (1978), Schaff (1978), Dinerstein (1979), Singh (1979), Sinha (1986) and Pandey (1986) studied on the various aspects of barasingha like the taxonomy, biology, distribution, ecology and behaviour.

The status of barasingha includes population, group composition and age-sex ratio was assessed by some workers from time to time noatably; Schaller (1967), Martin (1977), Schaff (1978), Khajuria (1982), Singh (1995) and Qureshi (1991). Apart from the above study no any detailed study was found on the present status of barasingha in the park and its adjoining areas.

In the developing world the major habitat of the precious wildlife animal are encroached and degraded by human beings through the industrialization and urbanization. In addition the rapid changes in the various environmental factors and climatic changes possess threats to the various species of animal evolves through the complex phenomenon of evolution. The phenomenal changes in the natural areas of wildlife basically the mammalian fauna are severely affected in comparison to the other animal. Due to these changes, the natural habitat of barasingha is diminishing day to day and as result barasingha is now under unfnerable category (Duekworth *et. al.*, 2013) now this animal the successful conservation and management of in their natural habitat require a detailed study on their surviving population in the various localities.

STUDY AREA

The study was conducted in Dudhwa National Park, U.P. (Fig. 1) and adjoining Kishanpur Wildlife Sanctuary to ertimate the current population status and pattern of

Key words: Barasingha, Age-sex ratio, population, Conservation, Dudhwa National Park.

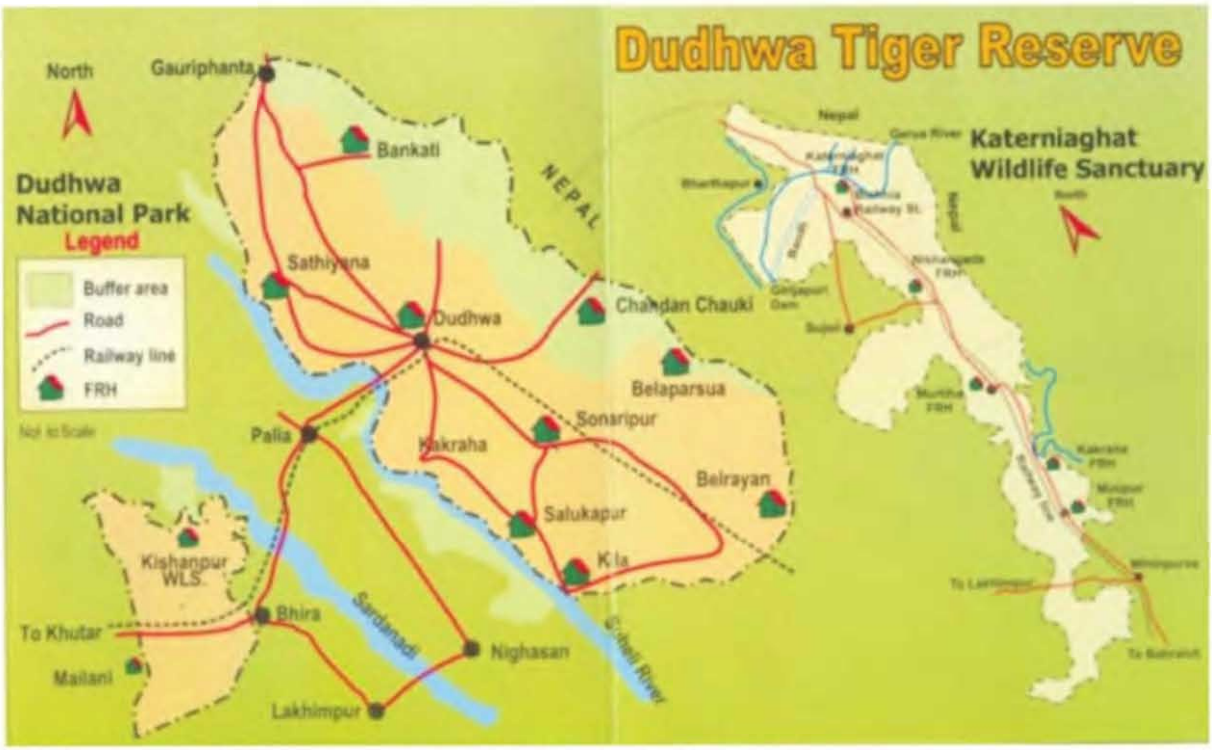

Fig. 1: Map of Dudhwa National Park

distribution of the barasingha (*Rueervus duvauceli*). Dudhwa National Park comes under core area of Dudhwa Tiger Reserve along with Kishanpur Wildlife Sanctuary. The Park is located on the Indo-Nepal border in the Nighasen Tehsil of district Lakhimpur-Kheri and lies between 28° 18'N and 28° 42'N latitudes and 80° 28'E and 80° 57'E longitudes. The altitude above mean sea level ranges from 182 m in the extreme north to 150 m in the farthest southeast. The Kishanpur Wildlife Sanctuary (KWS) lies in the Lakhimpur-Kheri and Shahajahanpur districts in Uttar Pradesh. It covers an area of about 20341 ha (De, 2000) and lies in southern part of Dudhwa National Park and also on the southern bank of river Sarada. The KSW is about 15 km from DNP and separated by agricultural landscape and divided into Kishanpur and Mailani forest ranges. In general the area of both DNP and KWS is a vast alluvial plain scoured with the channels of numerous large and small watercourses. The surface being formed by the riverbeds and their high banks results the formation of a series of fairly elevated plateaus separated by streams flowing from northwest to southeast bordered by low alluvial belts of varying width. The general slope of the area is from northwest to southeast.

As per the bio-geographic classification of Rodgers and Panwar (1988), the area of the Reserve falls within the Tarai-bhabar bio-geographic subdivision of the Upper Gangetic plain. About 66 % of the Reserve is woodland which provide food and shelter to a vast variety of animals. The main tree species of this National park is Shorea rolurta. The grasslands are a prominent feature of both the National Park and the Sanctuary. They constitute about 19 % of the National Park and 21 % of the Sanctuary. The buffer areas have 31.50% under grasslands. About 22.30% of the park is covered by grasslands. Water logging occurs for some time during monsoon. The area under the National park is characterized by extremes of wet and dry conditions. The soil is permanently saturated and wet; aeration is poor with some water standing round the year. Apart from the swamp deer the other species of deer in this park includes cheetal, sambar, hog deer and other mammalian species like porcupines, wild boar, rats and mice etc.

Fig. 2 : Grass lands at Kakraha, Dudhwa National Park

Fig. 3 : Swamp Deer at Jhandi Taal

MATERIALS AND METHODS

General surveys were conducted to the whole Dudhwa National Park (DNP), UP in the year 2008 for observation of various parameters to assess the habitat and population of the barasingha. The population data was recorded by two teams separately to cover the whole areas of the park for 10 days. The research team recorded population of barasingha based on age-sex categories in the six ranges within the DNP by road side count techniques (Davis, 1982) and Block count techniques (Lancia *et. al.*, 1994).

During surveys, the team moves by vehicles in an average speed of 20 km/h to record the population data on various age-sex individuals of barasingha whenever any group or herd and individual encountered. A total of 560 km were covered during whole survey period for population and in ecological study. The individual of barasingha present on both sides of the road upto 100 meter distance by one observer on each side of the road was noted with the aid of Binocular (8x50 power), Digital Camera (300 mm telescopic lens) and data preferred sheet designed to record all information of the individuals. Age-sex categories of individuals was identified and observed with the help of coat colour, horn length and morphology with standard literatures (Prater, 1971; Singh). Most of the data gathered during morning and afternoon time when visibility was good.

The age and sex of the individuals of the animal were identified according to Schaller (1967), Prater (1971) and Martin (1977). The populations of barasingha present in a distance more than 100 m to the road side and in a specific location like plain grassland, water holes, riverside, bushes and open grassy patches were recorded by making blocks in the whole DNP. During the study period all major type of habitat (Fig. 2 and Fig.3) covered by the survey team have all the grassland surrounded by rivers and open grassy patches inside the sal forests.

Data recorded by the surveys was analyzed, tested and calculated the average size of the herd, age-sex individuals and availability index of barasingha in the various blocks and ranges of Dudhwa National Park, U.P.

RESULTS AND OBSERVATIONS

I. Population structure: In the present study, the population of the various age-sex groups of individuals of barasingha in the various ranges and blocks of Dudhwa National Park were recorded. A total of 831 individuals of barasingha recorded in the DNP out of that 172 male (20.69%), 469 female (56.43%) and 190 (22.86%) were yearling. After analysis of the recorded data it is estimated that the population of barasingha in DNP is about 920. The above record of total population is very similar to the population recorded by Singh (1978). Out of the six ranges of Dudhwa National park the maximum number of barasingha has recorded in Belrayan (290) and minimum in Gauriphanta (42). The mean and Standard error are (8.40±0.90), (22.33±2.34) and (9.04±1.10) in male, female and yearlings respectively (Fig.4).

The total number of individual recorded in various ranges of DNP is given in table 1 and mean number of individual of each age-

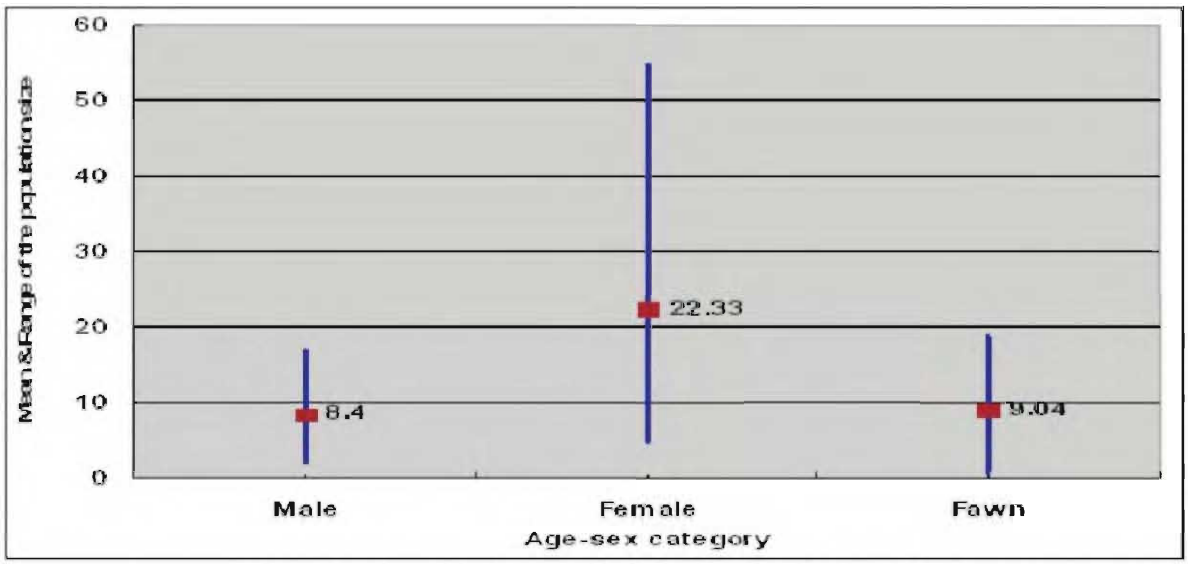

Fig.4: Mean group size of barasingha in Dudhwa National Park, U.P.

sex category in a herd in different forest ranges of DNP is given in table 2. The highest of the mean population of male was recorded in the herd of south Sonaripur (9) and Belrayan and lowest in north Sonaripur (4). Similarly, the highest average number of female and yearling were recorded in the herd of south Sonaripur (23.5 female and 10.75 yearlings) and lowest in North Sonaripur (12 female and 3.33 yearlings).

The population recorded in the present study showed a stable population of barasingha in Dudhwa National Park, U.P. as recorded by earlier workers (Holloway, 1972; Schaaf & Singh, 1977; Singh, 1985; Qureshi, 1991; Shankaran, 1989) time to time in the same locality but the population was estimate more compare to the population recorded by Qureshi (1991) and Shankaran (1989)

II. Herd composition: On analyris of data collected during the study revealed that the mean size of the herd of banasingle was 19.34±3.4 while the rise of the herd between different habitat of Dudhwa National Park was 8.9. This heval size recorded was very much similar to the herd size (18.41) recorded by Shankaran (1989). The above herd size is also comparable to the herd size recorded by Singh (1978) in Dudhwa National Park, India as recorded in summer, monsoon, and winter were 32, 13 and 7 respectively.

In the current survey the age-sex ratio (males: females: fawns) of barasingha recorded in Dudhwa National Park is 1:2.74:1.01 which is significantly different from the ratio recorded in earlier surveys in the various localities by forests department of various states in the 1960's. Among the different ranges of Dudhwa National Park the highest age-sex ratio recorded in Dudhwa range

Table 1 : Age-sex composition of barasingha in Dudhwa National Park, U.P.

Sl. No	Range	Male	Female	Young
1	Dudhua Range	4.28	15.14	5.28
2	Bankati Range	5	13.75	5
3	Gauriphanta	6	14.34	5.6
4	South Sonaripur	9	23.5	10.75
5	North Sonaripur	4	12	3.33
6	Belrayan	9	22.14	10.28

Table 2 : Observed population of various age-sex categories of barasingha in DNP.

Sl. No	Range	Male	Female	Young
1	Dudhua Range	30	106	37
2	Bankati Range	20	55	20
3	Gauriphanta	11	23	8
4	South Sonaripur	36	94	43
5	North Sonaripur	12	36	10
6	Belrayan	63	155	72

Table 3 : Age-sex ratio of barasingha in various the ranges of DNP, U.P.

Sl. No	Range	Male	Female	Young
1	Dudhua Range	1	3.53	1.23
2	Bankati Range	1	2.75	1
3	Gauriphanta	1	2.09	0.72
4	South Sonaripur	1	2.61	1.19
5	North Sonaripur	1	3	0.83
6	Belrayan	1	2.46	1.14

(1:3.53:1.23) and lowest in Gauriphanta (1:2.09:0.72) is shown in table 3. In the present study the maximum number of barasingha was recorded in Belrayan range and minimum in Gauriphanta range (fig. 5). The sex ratio observed was greater in comparison to the sex ratio (1:2) observed by Schaller (1967) and very close to the sex ratio (1:2.5) of Singh (1978). The ratio observed between hind and fawn was 100:40.65 which was greater than the ratio observed between hind and fawn (100:37.14) by Shankaran (1989).

III. **Animal abundance & Availability Index:** A total of 10 day survey to the six ranges of Dudhwa National Parkn was conducted to observe the availability of barasingha for conservation and management.

The population recorded in the various ranges of the park helps the abundance and availability index of the barasingha assess in Dudhwa National Park (Table 3 and Fig. 5). The abundance in term of availability index of barasingha in the DNP was 1.11 animal per sq. km and the availability index of various age-sex categories was 0.23 males per sq. km., 0.63 females per sq. km. and 0.25 yearlings per sq. km. The availability index shows that the maximum abundance of barasingha was recorded in Belrayan (1.18 animal/sq. km.) and minimum in north Sonaripur (0.64 animal/sq. km.). In the various ranges of Dudhwa National Park, the availability index (Table 4) of male was highest in Belrayan (0.4) and lowest in north Sonaripur (0.13). Similarly, the highest availability index of female and yearling found in Belrayan and lowest in North Sonaripur. Schaller (1967) recorded 0.2 individual of barasingha in Kanha National Park, India was less than the present record in Dudhwa

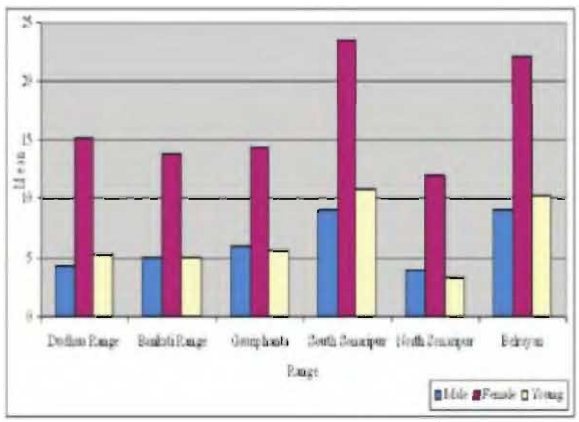

Fig. 5 : Mean size of the population of the different age-sex group of barasingha in Dudhwa National Park, U.P.

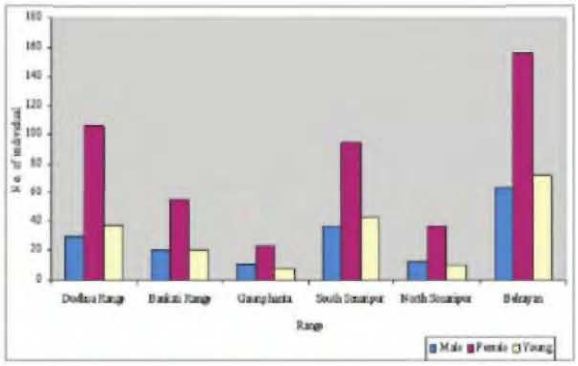

Fig. 6 : Population structure of barasingha in different ranges of Dudhwa National Park, U.P.

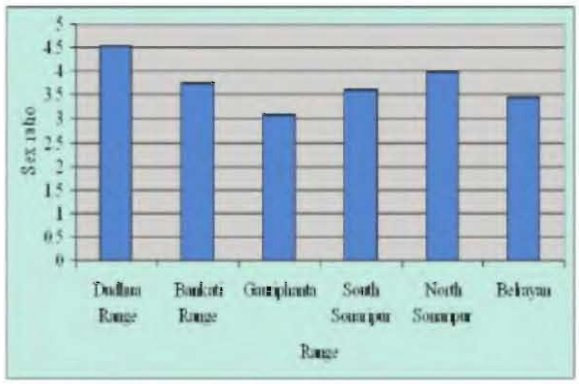

Fig.7: Sex-ratio (Total number of adult individuals/Total number of adult males) of barasingha in different forest ranges of Dudhwa National Park, U.P.

Table: 4 Availability index of each age-sex category individual and total number of animal in Dudhwa National Park, UP

Sl. No	Range	Availability index			
		Male	Female	Yearling	Barasingha
1	Dudhua Range	0.18	0.64	0.22	**1.04**
2	Bankati Range	0.19	0.53	0.19	**0.92**
3	Gauriphanta	0.3	0.62	0.22	**1.14**
4	South Sonaripur	0.19	0.5	0.22	**0.92**
5	North Sonaripur	0.13	0.4	0.11	**0.64**
6	Belrayan	0.4	0.97	0.45	**1.82**

National Park which might be due to the nature of residing in ecologically different type of habitat.

DISCUSSION

The barasingha was formerly located in suitable localities throughout the basins of the Indus, Ganges and Brahmaputra Rivers as well as central India as far south as the Godavari River, generally in areas covered by moist deciduous forests. At one point of time, Barasingha used to inhabit most of the areas of northern as well as central India. However, today their habitat has been restricted to the protected forests of Uttar Pradesh, Assam and Madhya Pradesh only. The area frequency of different ranges was not related with encounter frequency of the no. of individuals of swamp deer. The area frequency of Dudhwa range was higher than that of Kishanpur range. But the encounter frequency was higher in kishanpur range. The Mialani range had more area frequency than some of the other ranges but it had the poor encounter frequency than those areas.

The Swamp Deer in Dudhwa National Park can be said to be occupying two distinct portions – Sathiana grass lands in the west and several grass lands and Taal in the east such as Kakraha, Bankey Taal, Bhadi Taal, Chota Kakraha, Churela Taal and Nagra Taal. There is another populatin in the Kishanpur Sanctuary using single key habitat offered by Jhadi Taal. The Sathiana area is famous for Swamp Deer and the other promising areas are Bhadi and Jhadi Taal and associated grass lands. Both have good populations of Swamp Deer.

The distribution of swamp deers generally depend on the availability of their annual food items. The Swamp Deer typically occurs only in wet grasslands. That's why; they generally prefer those swampy area and water-hole in different ranges and some ranges have good abundances of

food resources having those wet grasslands like Kishanpur, South Sonaripur and Belllraien ranges. The habitat of swamp deer in Dudhwa National Park was divided into two major habitats which are Grassland surrounded by rivers and nalahs, and open grassy patches in sal forests. The first type of habitat is found in Sathiana and Belghat block while the second type of habitat distributed in six blocks of DNP (Singh, 1995).

According to Schaller (1967) in 1965 the population was between 1400 and 1800 in India and about 1600 in Nepal. In 1980 the population of swamp deer was 2000 (Dudhwa National Park, Uttar Pradesh) and in 1995 the population was 4168 (both species). De (2000) recorded 698 barasingha in Dudhwa National Park and 370 in Kishanpur Wildlife Sanctuary. The population sex ratio of barasingha in Kanha National Park was recorded by Martin (1977) as 75 male: 100 female, Schaf (1978) recorded 78 male in 100 female at Royel Sukla Phanta, Nepal and Singh (1978) recorded 43 male in 100 female at Dudhwa National Park. Khajuria (1982) recorded the age-sex ratio i.e male: female: fawn was 1:2.65:0.538 in 1965 and 1:1.65:0.730 in 1971. Qureshi (1991) the age-sex ratio was 57 male: 100 female: 44 fawn in Karkaha range and 37 male: 100 male: 40 female in Sathiana.

In the present study, the population composition of barasingha was 37 male: 100 female: 40 fawn at Dudhwa National Park. The age-sex ratio is 1:2.70:1.07 which reflects with the male-female ratio of Khajuria (1982) while the male-fawn ratio of present study was greater then previous studies by Khajuria (1982) and Qureshi (1991). In the present observation it may be said that the population of barasingha is increasing as the ratio of fawn in the recorded population is high. Qureshi (1997) provided the age-sex ratio of barasingha in different blocks of DNP which is about 54.8 male and 44.30 fawns in per 100 female, but in the present study, the age-sex ratio in the different blocks is less number of male in comparison to the females and more or less same number of fawns.

The density of the barasingha population was more in Dudhwa Range, Gauriphanta and Belryen. This may be due to presence of more number of suitable wet grass lands and availability of more number of water hole, and river flow through those areas. The distribution of swamp deer were generally depends on the availability of their annual food items (Martin, 1977). The Swamp Deer typically occurs only in wet grasslands. That is why; they generally prefer those swampy areas and water holes in different ranges and some of these ranges had good abundances of food resources viz., Kishanpur, South Sonaripur and Belrayan ranges.

The complex of tall wet grasslands and swamps contribute immensely towards making the ecosystem one of the most diverse and productive. They account for a sizable portion of the swamp deer populations of the Park and the Sanctuary. In the Park the key areas are the Southern border along the Suheli River where most of the major grasslands occur. Among the grasslands, the most prominent are the Sathiana and Kakraha areas having healthy population of barasingha. The mosaic of grasslands and high forests form unique niches that are occupied by numerous life forms. Barasingha populations showed the highest preference for open and short grassland. Dudhwa National Park is one of the natural habitats for the barasingha from time immemorial. But in this habitat their population is depleting due to excessive exploitation by poaching and fragmentation of their various localities within this National Park. In this current scenario, a regular study on their various aspects of population dynamics, ecology and behavioural pattern is needed to conserve and adopting proper management to this precious natural beckon in future.

SUMMARY

Barasingha is one of the large size deer belong to the family *Cervidae*, also known as swamp deer. A socio-ecological study on barasingha was conducted in Dudhwa National Park, India by road side count techniques and Block count techniques. A total of 831 individuals of

barasingha recorded in the DNP out of that 172 male (20.69%), 469 female (56.43%) and 190 (22.86%) were yearling; with an estimated population is about 920. The mean size of the herd and age-sex ratio (males: females: fawns) of barasingha was recorded 19.34±3.4 and 1:2.74:1.01 respectively. The abundance in term of availability index was analysed at 1.11 animals per sq. km. In conclusion, the population of barasingha is increasing as the ratio of fawn in the recorded population is recorded high. The recorded population and age-sex ratio revealed that barasingha prefer open and wet grasslands and swamps for survival in Dudhwa National Park.

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THE BIOGEOGRAPHICAL DISTRIBUTION OF SPECIES OF THE SUPERFAMILY COREOIDEA: HEMIPTERA IN INDIA

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INTRODUCTION

Coreoidea is a large Superfamily of predominantly herbivorus insects that belong in the Hemipteran Suborder Heteroptera. The Superfamily Coreoidea is divided into 4 families namely Coreiddae, Stenocephalidae, Alydidae, Rhopalidae but the Coreoidea as a whole are part of a close-knit group with the Lygaeoidea and Pyrrhocoroidea and it is likely that these three super families are paraphyletic to a significant extent. They are therefore in need of revision and red limitation. There are more than 3400 species recorded in the world.

The insects of the family Coreidae vary from 7 to 45 mm, making the larger species some of the big heteropterans (Sehuh and Slater, 1950). The body shape of these insects is quite variable, with some species broadly oval while others are slender. Coreids are found throughout the world but most species are found in the tropics and subtropics. They are also called "leaf-footed bugs and squash bugs" due to the leaf like expansions some species have on their hind leg. These bugs feed on the shoots, buds, fruits and unripe seeds of many plants throughout the world. Thoracic scent glands produce strong smelling, defensive chemicals. Some species are considered serious pests. The general morphological features of Coreidae are oval shaped body, antennae composed of 4 segments, numerously veined forewing membrane, a metathoracic stink gland and enlarged hind tibia. Many species are covered with spines and tubercles. Antennae 4 segmented; ocelli 2; beak 4 segmented; front wing with many veins; tarsi 3 segmented; scent glands present on the thorax; head narrower than and often shorter than the pronotum; hind tibia of some species expanded and resembling leaves. The species in the family Coreidae are separated from those in Alydidae by differences in width and length of their heads relative to the pronotum. There are more than 1800 species have been recorded under this family in the world.

The family Stenocephalidae is represented by only one (*Dicranocephalus*) genera. They are commonly called as spurge bugs. These are phytophagus insects. They feed on *Euphorbia* species. They are small to large in size. Length of the body ranges from 8-14 mm long; fliers; relatively stout bodied; not stilt-legged; with conspicuous dark and pale banding on the antennae and legs. Head non-linear. Rostrum clearly separated ventrally from the prosternum by a sclerotized gula; 4 segmented. Antennae longer than the head, readily visible from above; 4 segmented; non-striae. Ocelli present. Scutellum relatively small. Forewings well developed; differentiated into a basally thickened and distally membraneous region with a clavus. Membrane of the hemelytron with numerous veins reaching or almost reaching the margin. Tarsi 3 segmented. The abdomen without ventral silvery pubescence. The second dorsal abdominal scent gland aperture not displaced into the fifth

tergite and distant from the first gland. They are dark-brown bugs with black and yellow banded antennae, front of the head bilobed.

Alydidae commonly called broad headed bugs, have a head that is nearly as wide as and as long as the pronotum. It is similar to Coreidae, but buccula not extending past base of antennae; these are common and notable because of their noxious smell and the nymphs that resemble ants. They feed on plants.

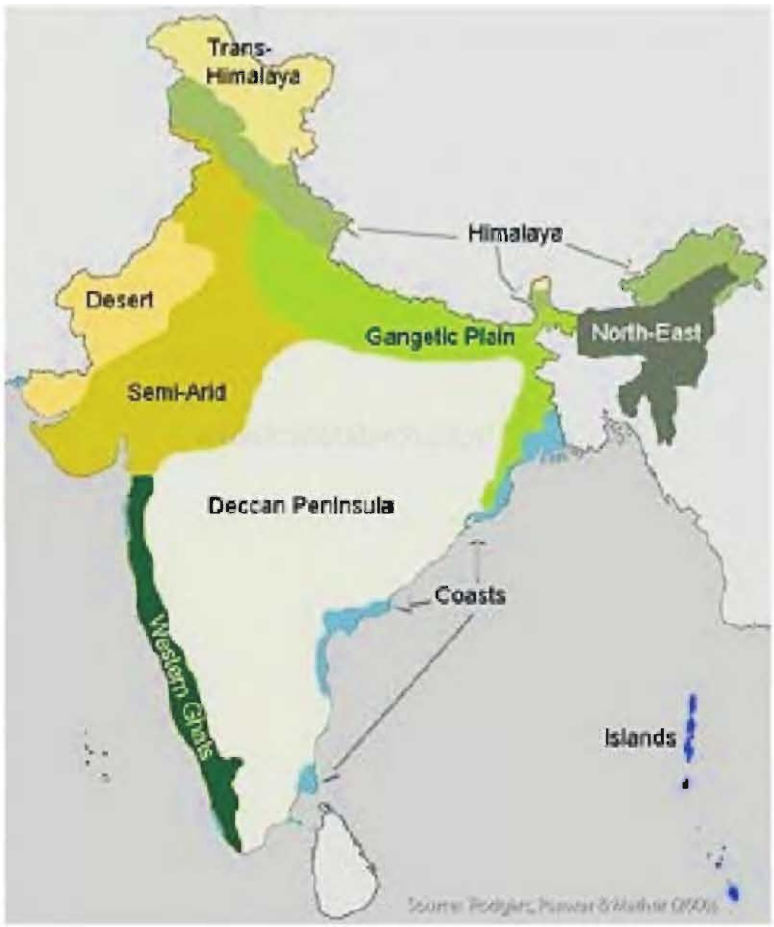
The body length of the members of the family Rhopalidae the Scentless plant bugs range from 4 to 15 mm. They vary greatly in shape and colour. The majority are dull brownish and resemble species of Orsillinae (Lygaeidae), with which one often finds them confused in collections. The remainder is much larger and similar in shape, body form and bright colouration to species of Lygaeinae and many species of Pyrrhocoreidae and Largidae. The clypeus surpassing mandibular plates; ocelli situated on low tubercles ; antennae never dilated, first segment constricted basally; metathoracic scent gland openings usually obsolete or obsolescent ; corium frequently with large hyaline areas ; membrane of forewing always with numerous veins; tricobothira on abdominal sterna 3 and 4 mediolateral, those of 5, 6 and 7 lateral; abdominal spiracles ventral; inner laterotergites present; nymphs with dorsal abdominal scent gland openings between terga 4/5 and 5/6 the later displaced forward, a unique and universally occurring character in the family; pygophore with lateral, median and paralateral lobes; ovipositor plate-like; abdominal sternum 7 of females entire; spermatheca consisting of a round bulb, small pump and long, generally coiled duct. They feed on the seeds of box elder and aggregate on the sunny, south facing sides of the houses in the fall, looking for sites to overwinter.

Some important workers on the taxonomy and distribution of Coreoidea are : Agassiz (1843), Basu & Mitra (1977, 1978, 1996, 2003, 2004), Dallas (1852), Distant (1902, 1904, 1908, 1918), Dohrn (1859), Dolling (2006), Fallen (1814), Gollner-Scheiding (1980), Hahn (1826), Herrich-Schaffer (1853), Horvath (1917), Kerzhner (1962), Kirklady (1903), Latreille (1829), Lethireey & Severin (1894), O'Shea & C. W. Schaefer (1980), Putshkov, V. G. & Kerzhner (1983), Schmidt (1911), Stål (1866, 1871, 1873), Van Duzee (1914), Walker (1871), 1873), White (1839) etc.

The insects are known to be most successful and diverse animals on earth. They have adapted for almost every conceivable type of environment from the equator to the arctic and from sea level to the snowfield of highest mountain, on land, in air and water and almost everywhere. Coreoids are found throughout the world but most species are found in the tropics and subtropics. The Coreoidea fauna on the oriental region comprises of 212 species and the Indian fauna pertains to 160 species belonging to 59 genera which are about 5% of the world fauna.

Biogeography is the study is the study of the distribution of species, organisms and ecosystems in space and through geological time. Organisms and biological communities vary in a highly regular fashion along geographic gradients of latitude, elevation, isolation and habitat area. Knowledge of spatial variation in the numbers and types of organisms is as vital to us today as it was to our early human ancestors, as we adapt to heterogeneous but geographically predictable environments. Biogeography is an interactive field of inquiry that unites concepts and information from ecology, evolutionary biology, geology and physical geography. Modern biogeographic research combines information and ideas from many fields, from the physiological and ecological constraints on organismal dispersal to geological and clomatological phenomena operating at global spatial scales and evolutionary time frames.

An ecoregion (Biogeographic region) sometimes called a bioregion, is an ecologically and geographically defined area that is smaller than an ecozone and larger than an ecosystem. Ecoregions cover relatively large areas of land or water and contain characteristic geographically



Biogeographic Regions of India

distinct assemblages of natural communities and species. The biodiversity of flora, fauna and ecosystems that characterizes an ecoregions tends to be distinct from that of other ecoregions. India has a highly variable natural continuum divided into 8 major separate biogeographic regions (Ecoregions). They are the Himalayan, the Desert, the Arid and Semiarid, the Western Ghats, the Deccan Plateau, the Gangetic plain, the Northeast India and the Islands. The regions discerned primarily according to Rodgers, Panwar and Mathur, 2002. Since, only one hemipteran family is dealt with, further divisions of these regions into sub regions has been avoided so as to yield numerically significant data.

The Trans-Himalayan region

The Trans-Himalayan region of India consists of the cold deserts of Ladakh and Kargil in Jammu and Kashmir, and the Lahaul and Spiti valleys of Himachal Pradesh. Ladakh, located at the edge of the Tibetan plateau, gets an annual rainfall of only 140 mm. The major portion of the precipitation occurs in the form of snow in the winter months and, hence, cannot be used for agriculture. Kargil district is nestled in the Himalayas, giving it a cool, temperate climate. Summers are warm with cool nights, while winters are long and cold with temperatures often dropping to−40°C (−40°F) with recorded temperatures of − 60°C (−76°F) in the tiny town of Dras, situated some 56 km (35 mi) from the Kargil town. The Zanskar plateau is even colder, making it thus a near-uninhabitable place for humans, except for the hardy Khampas. The entire Kargil district is spread over 14,086 km^2 (5,439 sq mi). The Suru River flows through the district. The Lahaul-Spiti bounded by Tibet in the east and Ladakh in the north, the Lahaul-Spiti district of Himachal Pradesh is located at a mean elevation of 3,048-4,572 m. The low monsoon

clouds get blocked by the high mountains and leave the area dry and devoid of vegetation.

The Himalayan region

The Himalayan region consists of Jammu & Kashmir, parts of Himachal Pradesh, Uttarakhand, Sikkim, Darjeeling district of West Bengal and some parts of Arunachal Pradesh. It has a forest cover of almost all types like the tropical wet evergreen, subtropical pine, montane wet temperature, Himalayan moist and dry temperate, as well as sub alpine and alpine forests. Temperature fluctuations in this region are also high, from below 0°C in winter on the snow-clad peaks to around 30°C in the foothills in summer.

The Northeast Indian region

This region is primarily a hilly region covering the "seven sisters" or the states of Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland and Tripura and physiographically spreads over Naga, Patkai, Khasi, Jaintia, Garo, Lusai, Mikir hills and a part of eastern Himalayas. Vegetation in this area is mainly tropical wet evergreen, semi-evergreen and moist deciduous forests, subtropical broad leaved hill and pine forests, and montane wet temperate forests. Average rainfall is around 250 to 300 cm with some regions of Assam and Meghalaya receiving over 500 cm of rainfall. Summer temperature is around 7°C to 20°C and winter temperature is around 2°C to 18°C.

The Gangetic Plains

The gangetic plains is the entire fertile stretch of low lying plains on either side of the river Ganges covering the states of Uttar Pradesh, Bihar, parts of West Bengal. Vegetation in this region is mainly tropical, semi-evergreen, moist deciduous, swampy and dry deciduous forest. Mean annual temperature in summer is over 24°C and 18°C in winter with an annual rainfall of 100-200 cm.

The semi-arid region

The region is typified by low rainfall and sparse vegetation spreading over the majority areas of Gujarat, parts of Rajasthan, Haryana and Punjab. This area experiences extremes of weather conditions. Winter is cold; with temperatures as low as 4°C and summer is extremely hot around 45°C. The area receives an annual rainfall of 300-500 mm. Vegetation is usually dry deciduous tropical forests and dry grasslands.

The Desert region

The Thar desert also known as the Great Indian Desert is a large, arid region in the northwestern part of the Indian subcontinent with an area of more than 2, 00,000 sq. km. It is the 9th largest subtropical desert in the world. It lies mostly in the Indian states of Rajasthan, and extends into the southern portion of Haryana and Punjab states and into northern Gujarat state. There are three principal landforms in the desert region. The predominantly sand covered Thar, the plains with hills including the central dune free country and the semiarid areas surrounding the Aravalli range. The natural vegetation is classed as northern desert thorn forest (Champion, 1936). These occur in small clumps scattered in a more or less open forms.

The Deccan plateau region

The Deccan plateau spreading over the states of Maharashtra, Karnataka, Andhra Pradesh, Madhya Pradesh, Chhattisgarh, Jharkhand, parts of Odisha, Pudhucherry and Tamil Nadu. The plateau part of the Deccan peninsula covers an area of 7, 00,000 sq. km. with an average altitude of 600 m (Alfred *et al.*, 2000). A major part of the Deccan plateau is covered by dry deciduous forests and degraded scrubland. The Eastern Ghats is an assemblage of discontinuous ranges of hills, plateaus and escarpments with an elevation around 1750 m. The Eastern Ghats receives an average rainfall of 120-160 cm. In the summer the maximum temperature is 41°C while winter is as low as 2°C. Forest cover in the Eastern Ghats is broadly evergreen, semi-evergreen, tropical, moist deciduous, southern tropical dry deciduous, northern mixed dry deciduous, dry savannah and dry evergreen scrub.

The Western Ghats

The Western Ghats also known as Shyadri Mountains is mountain range along the western side of India. It runs north to south along the

western edge of the Deccan plateau and separates the plateau from a narrow coastal plain along the Arabian Sea. The range starts near the border of Gujarat and Maharashtra, south of the river Tapti and runs approximately 1600 kms through the states of Maharashtra, Goa, Karnataka, Tamil Nadu and kerala ending at Kannyakumari at the southern tip of India. About 60% of the Western Ghats are located in the state of Karnataka. These hills cover 60,000 sq. km and form the catchment area for a complex of river systems that drain almost 40% of India. The average elevation is around 1200 meters. The area is one of the world's ten hottest biodiversity hotspots.

The climate is humid and tropical in the lower reaches tempered by the proximity to the sea. Average annual temperature here is around 15°C. In some parts frost is common and temperatures touch the freezing point during the winter months. Mean temperature range from 20°C in the south to 24°C in the north. The Western Ghats are home to four tropical and subtropical moist broadleaf forest ecoregions. They are the northwestern Ghats moist deciduous forests, north Western Ghats montane rain forests, south Western Ghats moist deciduous forests and south Western Ghats montane rain forests. The evergreen Wayanad forests of Kerala mark the transition zone between the northern and southern ecoregions of Western Ghats. The southern ecoregions are generally wetter and more species rich.

The Islands

Indian limits include two different island groups viz, the Andaman and Nicobar Islands lying in the Bay of Bengal and the Lakshadweep islands in the Arabian Sea. The Andaman Islands are an arcute chain of more than 500 islands, islets and rocky outcrops running north to south in the Bay of Bengal extending over 800 kms. (Alfred *et al.*, 2001). Lakshadweep archipelago is irregularly scattered in the south Arabian Sea and stretches about 2500 km in the ocean along north south direction (Alfred *et al.*, 2001). The archipelago comprises of 36 islands including 12 atolls, 3 reefs and 5 submerged banks with a total land area of 32 sq. km. vegetation in the Andaman is a varied mosaic of tropical evergreen, semi-evergreen, moist deciduous, littoral forests and mangroves. Climate in this region is tropical with temperature around 23° to 30°C and 300 cm of rainfall.

The Coasts

The Eastern Coastal Plain is a wide stretch of land lying between the Eastern Ghats and the Bay of Bengal. It stretches from Tamil Nadu in the south to West Bengal in the east. The Mahanadi, Godavari, Kaveri, and Krishna rivers drain these plains. The temperature in the coastal regions often exceeds 30 °C (86 °F), and is coupled with high levels of humidity. The region receives both the northeast monsoon and southwest monsoon rains. The southwest monsoon splits into two branches, the Bay of Bengal branch and the Arabian Sea branch. The Bay of Bengal branch moves northwards crossing northeast India in early June. The Arabian Sea branch moves northwards and discharges much of its rain on the windward side of Western Ghats. Annual rainfall in this region averages between 1,000 and 3,000 mm (39 and 120 in). The width of the plains varies between 100 and 130 km (62 and 81 mi). The plains are divided into six regions- the Mahanadi delta, the southern Andhra Pradesh plain, the Krishna-Godavari deltas, the Kanyakumari coast, the Coromandel Coast, and sandy coastal.

The Western Coastal Plain is a narrow strip of land sandwiched between the Western Ghats and the Arabian Sea, ranging from 50 to 100 km (31 to 62 mi) in width. It extends from Gujarat in the north and extends through Maharashtra, Goa, Karnataka, and Kerala. Numerous rivers and backwaters inundate the region. Mostly originating in the Western Ghats, the rivers are fast-flowing, usually perennial, and empty into estuaries. Major rivers flowing into the sea are the Tapi, Narmada, Mandovi and Zuari. Vegetation is mostly deciduous, but the Malabar Coast moist forests constitute a unique ecoregion. The Western Coastal Plain can be divided into two parts, the Konkan and the Malabar Coast.

SYSTEMATIC LIST

Order HEMIPTERA
Suborder HETEROPTERA
Infraorder PENTATOMOMORPHA
Superfamily COREOIDEA
Family COREIDAE
Subfamily COREINAE
Division **Mictaria**
Tribe **Mictini** Amyot & Serville, 1843

Genus ***Molipteryx*** Kiritshenko, 1916

1916. ***Molipteryx*** Kiritshenko, *Fauna Rossii. Nasekomye poluzhestkokrylye* (Insecta Hemiptera) **6**(2):27, 32-42.

1. ***Molipteryx hardwickii hardwickii*** (White, 1839)

1839. *Derepteryx hardwickii* White, *Mag. Nat. Hist.* (n.s.) **3**: 542: Nepal.

Distribution : Assam and Sikkim.

Genus ***Derepteryx*** White, 1839

1839. *Derepteryx* White, *Mag. Nat. Hist.* (n.s.) **3**:542.

2. ***Derepteryx grayii*** White, 1839

1839. *Derepteryx grayii* White, Mag. *Nat. Hist.*, (n.s.) **3**: 542: Nepal.

Distribution: Sikkim and West Bengal.

Genus ***Helcomeria*** Stål, 1873

1873. *Helcomeria* Stål, *K. Svens. Vet.-Akad. Hand.*, **11**(2):37, 40.

3. ***Helcomeria spinosa*** (Signoret, 1851)

1851. *Petascelis spinosus* Signoret, *Annales de la Société Entomologique de France*, **29**: 123-124.

Distribution: Assam, Nagaland, Sikkim and West Bengal (Singla and Darjeeling district).

Genus ***Prionolomia*** Stål, 1873

1873. Stål, *K. Svens. Vet.-Akad. Hand.* **11**(2):37, 40.

4. ***Prionolomia cardoni*** Lethierry, 1891

1891. *Prionolomia cardoni* Lethierry, *Ann. Soc. Entomol. Belg.*, **35**: cxliii – cxliv. Bengal, Kunbir.

Distribution: West Bengal.

5. ***Prionolomia fulvicornis*** (Fabricius, 1787)

1787. *Cimex fulvicornis* Fabricius, Mantissa insectorum sistens species nuper detectas adjectis synonymis, observationibus, descriptionibus, emendationibus, **2**: 288.

Distribution: Assam and Sikkim.

6. ***Prionolomia gigas*** Distant, 1879

1879. *Prionolomia gigas* Distant, *Ann. Mag. Nat. Hist.*, **53**: 127-129: India.

Distribution: Assam and Sikkim.

Genus ***Prionolomiopsis*** O'Shea, 1980

1980. O'Shea, In O'Shea & C. W. Schaefer, A generic revision of the Asian and Australian Mictini (Heteroptera: Coreidae). *Oriental Insects*, **14**(2):222, 246-247.

7. ***Prionolomiopsis amplicollis*** (Stål, 1873)

1873. *Mygdonia amplicollis* Stål, *K. Svens. Vet.-Akad. Hand.*, **11**(2): 43 – 44: Bangladesh.

Distribution: Nagaland.

Genus ***Ochrochira*** Stål, 1873

1873. Stål, *K. Svens. Vet.-Akad. Hand.*, **11**(2): 39, 44.

8. ***Ochrochira aberrans*** (Distant, 1889)

1889. *Prionolomia aberrans* Distant, *Ent. Mon. Mag.*, **25**: 230. NZSI, Kolkata.

Distribution: Assam and Sikkim.

9. ***Ochrochira albiditarsis*** (Westwood, 1842)

1842. *Myctis albiditarsis* Westwood, A Catalogue of Hemiptera in the collection of the Rev. F. W. Hope, **2**: 4, 11: Nepal.

Distribution: Himachal Pradesh and Uttar Pradesh.

10. ***Ochrochira biplagiata*** (Walker, 1871)

1871. *Mictis biplagiata* Walker, Catalogue of the Specimens of Hemiptera Heteroptera in the Collection of the British Museum **IV**: 21-23: Northern India.

Distribution: Assam, Sikkim and West Bengal (Rongirum, Peshok, Siliguri of Darjeeling district).

11. ***Ochrochira pallescens*** Distant, 1889

1889. *Ochrochira pallescens* Distant, Ent. *Mon. Mag.*, **25**: 230.

Distribution: Assam and Sikkim.

12. ***Ochrochira palliditarsis*** Stål, 1873

1873. *Ochrochira palliditarsis* Stål, *K. Svens. Vet.-Akad. Hand.*, **11**(2): 44: India.

Distribution: Northeast India.

Genus ***Mictis*** Leach, 1814

1814. Leach, the Zoological Miscellany, being descriptions of new, or interesting Animals, **1**: 91.

13. ***Mictis gallina*** Dallas, 1852

1852. *Mictis gallina* Dallas, List of the specimens of hemipterous insects in the collection of the British Museum, **II**: 403 - 404: India.

Distribution: Assam.

14. ***Mictis macra*** Stål, 1865

1865. *Mictis macra Stål, Annales de la Société Entomologique de France* **45**: 173–174: Malaya, Malacca and Thailand, Ligor; NHRS Stockholm.

Distribution: Kerala.

15. ***Mictis tenebrosa*** Fabricius, 1787)

1787. *Cimex tenebrosus* Fabricius, Mantissa insectorum sistens species nuper detectas adjectis synonymis, observationibus, descriptionibus, emendationibus, **2**: 288. rec. East India.

Distribution: Assam, Nagaland, Sikkim and West Bengal.

Genus ***Aspilosterna*** Stål, 1873

1873. *Mictis* (*Aspilosterna*) Stål, *K. Svens. Vet.-Akad. Hand.*, **11**(2): 46-47.

16. ***Aspilosterna pictor*** (Fabricius, 1794)

1794. *Lygaeus Pictor* Fabricius, Entomologia systematica emendata et aucta secundum classes, ordines, genera, species adjectis synonymis, locis, observationibus, descriptionibus 4: 138.

Distribution: Assam.

Genus ***Neomictis*** O'Shea & Schaefer, 1980

1980. O'Shea & C. W. Schaefer, *Oriental Insects* **14**(2): 224, 231.

17. ***Neomictis filicornis*** (Walker, 1871)

1871. *Mictis filicornis* Walker, Catalogue of the Specimens of Hemiptera Heteroptera in the Collection of the British Museum, **IV**: 25, 27.

Distribution: Sikkim.

Elsewhere: Borneo.

Genus ***Anoplocnemis*** Stål, 1873

1873. Stål, *K. Svens. Vet.-Akad. Hand.*, **11**(2): 39, 47-50.

18. ***Anoplocnemis binotata*** Distant, 1918

1918. *Anoplocnemis binotata* Distant, *The fauna of British India, including Ceylon and Burma.* Rhynchota. Vol. **7**: 153.

Distribution: Assam.

19. ***Anoplocnemis phasianus*** (Fabricius, 1781)

1781. *Cimex phasianus* Fabricius, Species Insectorum exhibentes eorum differentias specificas, synonyma auctorum, loca natalia, metamorphosin adiectis observationibus, descriptionibus., **2**: 89.

Distribution: Assam, Karnataka, Kerala, Maharashtra, Madhya Pradesh, Nagaland, Sikkim and West Bengal (Darjeeling and Buxaduar, Jalpaiguri district).

20. ***Anoplocnemis protracta***
(Herrich-Schäffer, 1850)

1850. *Mictis protractus Herrich* - Schäffer, *Die wanzenartigen Insecten* **9**: 247.

Distribution: Assam and Uttarakhand (Dehradun).

Genus ***Xyrophoreus*** Breddin, 1909

1909. Breddin, *Ann. Soc. Entomol. Belg.*, **53**: 283.

21. ***Xyrophoreus cristatus***
Brailovsky & Barrera, 2000

2000. *Xyrophoreus cristatus* Brailovsky & Barrera, *J. New York Entom. Soc.*, **108**(1-2):146-150.

Distribution: Karnataka (Mysore).

Division **Petasclaria**
Tribe **Petascelini** Stål, 1873
Genus ***Trematocoris*** Mayr, **1865**

1865. Mayr, *Verh. Zool.-Bot. Ges. Wien*, **15**: 431

22. ***Trematocoris lobipes*** (Westwood, 1842)

1842. *Myctis lobipes Westwood*, A Catalogue of Hemiptera in the collection of the Rev. F. W. Hope., **2**: 11.

Distribution: Karnataka (Belghaum), Maharashtra and West Bengal (Shibpur in Howrah district)

23. ***Trematocoris notatipes*** Walker, 1871

1871. *Trematocoris notatipes* Walker, Catalogue of the Specimens of Hemiptera Heteroptera in the Collection of the British Museum, **IV**: 32, 34.

Distribution: Bihar and West Bengal.

Genus ***Petillopsis*** Hsiao, 1963

1963. Hsiao, Acta *Zoologica Sinica*, **15**: 614-615, 622.

24. ***Petillopsis calcar*** (Dallas, 1852)

1852. *Mictis calcar* Dallas, List of the specimens of hemipterous insects in the collection of the British Museum, **II**: 397-398.

Distribution: Assam, Maharashtra, Manipur, Odisha, Sikkim, Uttarakhand and West Bengal (Sukna and Peshok in Darjeeling district).

25. ***Petillopsis patulicollis*** (Walker, 1871)

1871. *Trematocoris patulicollis* Walker, Catalogue of the Specimens of Hemiptera Heteroptera in the Collection of the British Museum, **IV**: 33, 37.

Distribution: Nagaland, Sikkim and West Bengal (Kurseong in Darjeeling district and buxa Tiger Reserve in Jalpaiguri district).

Division **Daladeria**

Tribe **Daladerini** Stål, 1873

Genus *Dalader* Amyot & Serville, 1843

1843. Amyot & Serville, *Histoire naturelle des insectes.* Hémiptères **xxxi**, 187-188.

26. ***Dalader acuticosta*** Amyot & Serville, 1843

1843. *Dalader acuticosta* Amyot & Serville, *Histoire naturelle des insectes.* Hémiptères, 188.

Distribution: Assam, Sikkim and West Bengal (Mirik, Darjeeling district and Buxa Tiger Reserve, Jalpaiguri district).

Elsewhere: Borneo.

27. ***Dalader planiventris*** (Westwood, 1842)

1842. *Acanonicus planiventris* Westwood, A Catalogue of Hemiptera in the collection of the Rev. F. W. Hope., **2**: 8.

Distribution: Assam, Maharashtra, Meghalaya, Sikkim, Tamil Nadu and West Bengal.

Division **Brachytaria**

Genus ***Brachytes*** Westwood, 1842

1842. Westwood, A Catalogue of Hemiptera in the collection of the Rev. F. W. Hope., **2**: 8.

28. ***Brachytes bicolor*** Westwood, 1842

1842. *Brachytes bicolor* Westwood, A Catalogue of Hemiptera in the collection of the Rev. F. W. Hope, **2**: 8-9.

Distribution: Assam, Karnataka, Maharashtra and Odisha (Chilka Lake).

Division **Homoceraria**

Tribe **Homoeocerini** Amyot & Serville, 1843

Genus : ***Aschistocoris*** Bergroth, 1909

1909. Bergroth, *Ann. Soc. Entomol. Belg.*, **53**: 34, 57, 63.

29. ***Aschistocoris brevicornis*** (Dallas, 1852)

1852. *Ornytus brevicornis Dallas*, List of the specimens of hemipterous insects in the collection of the British Museum, **II**: 448.

Distribution: Madhya Pradesh and Sikkim.

Genus ***Homoeocerus*** Burmeister, 1835

1835. Burmeister, *Handbuch der Entomologie*, 300, 303, 316.

Subgenus ***Anacanthocoris*** Uhler, 1861

30. ***Homoeocerus (Anacanthocoris) albiguttulus*** Stål, 1873

1873. *Homoeocerus albiguttulus Stål, K. Svens. Vet.-Akad. Hand.*, **11**(2): 61.

Distribution: Assam, Odisha, Sikkim and West Bengal (Kolkata and Buxa Tiger Reserve, Jalpaiguri district).

31. ***Homoeocerus (Anacanthocoris) albiventris*** Dallas, 1852

1852. *Homoeocerus albiventris* Dallas, List of the specimens of hemipterous insects in the collection of the British Museum, **II**: 444 – 445.

Distribution: Maharashtra and Tamil Nadu.

32. ***Homoeocerus (Anacanthocoris) angulatus*** Westwood, 1842

1842. *Homoeocerus angulatus* Westwood, A Catalogue of Hemiptera in the collection of the Rev. F. W. Hope., **2**: 5, 22.

Distribution: Kerala, Sikkim and West Bengal (Singla, Darjeeling district).

33. ***Homoeocerus (Anacanthocoris) biguttatus*** Westwood, 1842

1842. *Homoeocerus* biguttatus Westwood, A Catalogue of Hemiptera in the collection of the Rev. F. W. Hope., **2**: 5, 22.

Distribution: Sikkim.

34. ***Homoeocerus (Anacanthocoris) concisus*** Walker, 1871

1871. *Homoeocerus concisus* Walker, Catalogue of the Specimens of Hemiptera Heteroptera in the Collection of the British Museum, **IV**: 92, 97.

Distribution: Assam and Sikkim.

35. ***Homoeocerus (Anacanthocoris) fasciolatus*** Stål, 1873

1873. *Homoeocerus fasciolatus* Stål, *K. Svens. Vet.-Akad. Hand.*, **11**(2): 60 – 61.

Distribution: Sikkim.

36. ***Homoeocerus (Anacanthocoris) graminis*** (Fabricius, 1803)

1803. *Lygaeus graminis* Fabricius, Systema Rhyngotorum secundum ordines, genera, speciesadjectis synonymis, locis, observationibus, descriptionibus, 216.

Distribution: Assam.

37. ***Homoeocerus (Anacanthocoris) javanicus*** Dallas, 1852

1852. *Homoeocerus javanicus* Dallas, List of the specimens of hemipterous insects in the collection of the British Museum, **II**: 369-592.

Distribution: Assam.

38. ***Homoeocerus (Anacanthocoris) lacertosus*** Distant, 1889

1889. *Homoeocerus lacertosus* Distant, *Ent. Mon. Mag.*, **25**: 230-231.

Distribution: Punjab.

39. ***Homoeocerus (Anacanthocoris) macula*** Dallas, 1852

1852. *Homoeocerus macula* Dallas, List of the specimens of hemipterous insects in the collection of the British Museum, **II**: 445.

Distribution: Tamil Nadu.

40. ***Homoeocerus (Anacanthocoris) simiolus*** Distant, 1902

1902. *Homoeocerus simiolus* Distant, *The fauna of British India, including Ceylon and Burma.* Rhynchota 1 (Heteroptera): 363.

Distribution: Assam, Meghalaya, Sikkim and West Bengal (Peshok in Darjeeling district).

41. ***Homoeocerus (Anacanthocoris) striicornis*** Scott, 1874

1874. *Homoeocerus striicornis Scott, Ann. Mag. Nat. Hist.*, **414**: 362.

Distribution: Assam, Maharashtra, Sikkim, Uttarakhand and West Bengal (Darjeeling and Jalpaiguri).

42. ***Homoeocerus (Anacanthocoris) subjectus*** Walker, 1871

1871. *Homoeocerus subjectus* Walker, Catalogue of the Specimens of Hemiptera Heteroptera in the Collection of the British Museum, **IV**: 92, 97.

Distribution: Assam.

43. ***Homoeocerus (Anacanthocoris) tinctus*** Distant, 1883

1883. *Homoeocerus tinctus* Distant, *Trans. Ent. Soc. London*, **1883**: 170.

Distribution: West Bengal (Buxa Tiger Reserve, Jalpaiguri district).

44. ***Homoeocerus (Anacanthocoris) walkeri*** Kirby, 1892

1892. *Homoeocerus walkeri* Kirby, *Journal of the Linnean Society of London* **24**: 91.

Distribution: Assam, Nagaland, Sikkim and West Bengal (Peshok in Darjeeling district and Jayanti Village in Buxa Tiger Reserve of Jalpaiguri district).

Subgenus ***Tliponius*** Stål, 1860

45. ***Homoeocerus (Tliponius) atkinsoni*** Distant, 1901

1901. *Homoeocerus atkinsoni* Distant, *Ann. Mag. Nat. Hist.*, 77(37): 10, 11.

Distribution: Assam and Nagaland.

46. ***Homoeocerus (Tliponius) badgleyi*** Distant, 1908

1908. *Homoeocerus badgleyi* Distant, *The fauna of British India, including Ceylon and Burma.* Rhynchota, **4** (2): 468.

Distribution: Assam.

47. ***Homoeocerus (Tliponius) indus*** Distant, 1918

1918. *Homoeocerus indus* Distant, *The fauna of British India, including Ceylon and Burma.* Rhynchota. Vol. 7: 156.

Distribution: Tamil Nadu (Kodaikkanal) and Uttarakhand (Kumaon Hills).

48. ***Homoeocerus (Tliponius) laevilineus*** Stål, 1873

1873. *Homoeocerus laevilineus* Stål, *K. Svens. Vet.-Akad. Hand.*, **11**(2): 85.

Distribution: Assam and Maharashtra.

49. ***Homoeocerus (Tliponius) montanus*** Distant, 1901

1901. *Homoeocerus montanus* Distant, *Ann. Mag. Nat. Hist.*, 77(37): 11.

Distribution: Tamil Nadu.

50. ***Homoeocerus (Tliponius) nigridorsum*** Horváth, 1889

1889. *Homoeocerus nigridorsum* Horváth, *Természetrajzi Füzetek*, **12**: 34-35.

Distribution: Himalaya and Tamil Nadu.

51. ***Homoeocerus (Tliponius) picturatus*** Distant, 1918

1918. *Homoeocerus picturatus* Distant, *The fauna of British India, including Ceylon and Burma.* Rhynchota. Vol. **7**: 155.

Distribution: Karnataka (Chikkaballpura).

52. ***Homoeocerus (Tliponius) puncticornis*** (Burmeister, 1834)

1834. *Coreus puncticornis* Burmeister, Beiträge zur Zoologie, gesammelt auf einer Reise um die Erde, und W Erichson's und H. Burmeister's Beschreibungen und Abbildungen der von Herrn Meyen auf dieser Reise gesammelten Insekten. Nova Acta Academiae Caesareae Leopoldino-Carolinae Naturae Curiosorum, **16**: 295.

Distribution: India.

53. ***Homoeocerus (Tliponius) punctum*** Dallas, 1852

1852. *Homoeocerus punctum* Dallas, List of the specimens of hemipterous insects in the collection of the British Museum, **II**: 446.

Distribution: Sikkim.

54. ***Homoeocerus (Tliponius) serrifer*** (Westwood, 1842)

1842. *Coreus serrifer* Westwood, A Catalogue of Hemiptera in the collection of the Rev. F. W. Hope., **2**: 6, 24.

Distribution : Assam, Sikkim and West Bengal (Peshok in Darjeeling district).

Genus ***Prismatocerus*** Amyot & Serville, 1843

1843. Amyot & Serville, *Histoire naturelle des insectes.* Hémiptères : 184 – 185.

55. ***Prismatocerus apicicornis*** (Distant, 1918)

1918. *Homoeocerus apicicornis* Distant, *The fauna of British India, including Ceylon and Burma.* Rhynchota. Vol. **7**: 154-155.

Distribution : Karnataka (Chikkaballapura).

56. ***Prismatocerus borealis*** (Distant, 1918)

1918. *Homoeocerus borealis* Distant, *The fauna of British India, including Ceylon and Burma.* Rhynchota. Vol. **7**: 155, 156.

Distribution : Uttarakhand (Dehradun).

57. ***Prismatocerus cordiger*** (Stål, 1860)

1860. *Tliponius cordiger* Stål, *Öfvers.K. VetenskAkad. Förh. Stockh* **16**: 465.

Distribution : Kerala.

58. ***Prismatocerus inornatus*** (Stål, 1873)

1873. *Homoeocerus inornatus* Stål, *K. Svens. Vet.-Akad. Hand.*, **11**(2): 58-59.

Distribution : Goa, Odisha, Pudhucherry, Sikkim and West Bengal (Peshok in Darjeeling district).

59. ***Prismatocerus prominulus*** (Dallas, 1852)

1852. *Ceratopachys prominulus* Dallas, List of the specimens of hemipterous insects in the collection of the British Museum **II**: 501.

Distribution : Maharashtra.

60. ***Prismatocerus sigillatus*** (Stål, 1873)

1873. *Homoeocerus sigillatus* Stål, *K. Svens. Vet.-Akad. Hand.* **11**(2): 59.

Distribution : Sikkim and Uttarakhand.

61. ***Prismatocerus signatus*** (Walker, 1871)

1871. *Homoeocerus signatus* Walker, Catalogue of the Specimens of Hemiptera Heteroptera in the Collection of the British Museum, **IV**: 92, 97.

Distribution : Kerala, Maharashtra, Sikkim and West Bengal (Peshok in Darjeeling and Buxa Tiger Reserve in Jalpaiguri district).

Tribe **Anhomoeini** Hsiao, 1964

Genus ***Anhomoeus*** Hsiao, 1963

1963. Hsiao, *Acta Entomologica Sinica*, **12**: 312, 327, 341.

62. ***Anhomoeus nepalensis*** (Distant, 1908)

1908. *Aschistus nepalensis* Distant, *The fauna of British India, including Ceylon and Burma.* Rhynchota, **4** (2): 468.

Distribution : Uttarakhand and Uttar Pradesh.

Elsewhere : Nepal.

63. ***Anhomoeus sulcatus*** (Distant, 1908)

1908. *Aschistus sulcatus* Distant, *The fauna of British India, including Ceylon and Burma.* Rhynchota **4** (2) : 469-470.

Distribution : Uttarakhand (sabhawala, Dehradun).

Elsewhere : Myanmar.

Genus ***Omanocoris*** Kiritshenko, 1916

1916. Kiritshenko, Fauna Rossii. Nasekomye poluzhestkokrylye (Insecta Hemiptera) **6**(2) : 29, 68, 69, 83 -100.

64. ***Omanocoris versicolor*** (Herrich-Schäffer, 1841)

1841. *Gonocerus versicolor* Herrich-Schäffer, *Die wanzenartigen Insecten* **6** : 58 - 59, plate 199, fig. 619.

Distribution : Kerala, North India, Sikkim and Tamil Nadu.

Division **Cloresmaria**

Tribe **Cloresmini** Stål, 1873

Genus ***Notobitus*** Stål, 1860

1860. Stål, *Öfvers. K. Vetensk Akad. Förh. Stockh,* **16** : 451.

65. ***Notobitus abdominalis*** Distant, 1901

1901. *Notobitus abdominalis* Distant, *Ann. Mag. Nat. Hist.* **77**(37) : 13.

Distribution : Assam and Nagaland.

66. ***Notobitus dorsalis*** (Westwood, 1842)

1842. *Nematopus dorsalis* Westwood, A Catalogue of Hemiptera in the collection of the Rev. F. W. Hope. **2** : 4, 13.

Distribution : Maharashtra and West Bengal.

67. ***Notobitus excellens*** Distant, 1879

1879. *Notobitus excellens* Distant, *Ann. Mag. Nat. Hist.* **53** : 127.

Distribution : Assam, Meghalaya, Nagaland and Sikkim.

68. ***Notobitus marginalis*** (Westwood, 1842)

1842. *Nematopus marginalis* Westwood, A Catalogue of Hemiptera in the collection of the Rev. F. W. Hope., **2** : 4, 14.

Distribution : Meghalaya, Nagaland and West Bengal.

69. ***Notobitus meleagris*** (Fabricius, 1787)

1787. *Cimex meleagris* Fabricius, Mantissa insectorum sistens species nuper detectas adjectis synonymis, observationibus, descriptionibus, emendationibus, **2** : 297.

Distribution : Kerala, Tamil Nadu and West Bengal.

Elsewhere : China.

Distribution : Meghalaya, Nagaland and West Bengal.

70. ***Notobitus serripes*** (Dallas, 1850)

1850. *Nematopus serripes* Dallas, *Trans. Ent. Soc. London New series,* **1** : 4-5.

Distribution : Assam, Nagaland and Sikkim.

Elsewhere : Bhutan.

Genus ***Cloresmus*** Stål, 1860

1860. *Öfvers. K. Vetensk Akad. Förh. Stockh,* **16** : 451.

71. ***Cloresmus antennatus*** Distant, 1908

1908. *Cloresmus antennatus* Distant, *The fauna of British India, including Ceylon and Burma.* Rhynchota, **4** (2) : 471-472.

Distribution : Assam, Sikkim and West Bengal (Nazeok in Darjeeling district).

72. ***Cloresmus khasianus*** Distant, 1901

1901. *Cloresmus khasianus* Distant, *Ann. Mag. Nat. Hist.,* **77**(37) : 15.

Distribution : Assam, Meghalaya, Sikkim and West Bengal.

73. ***Cloresmus modestus*** Distant, 1901

1901. *Cloresmus modestus* Distant, *Ann. Mag. Nat. Hist.,* **77**(37) : 14, 15.

Distribution : Assam, Meghalaya, Sikkim and West Bengal.

74. ***Cloresmus nepalensis*** (Westwood, 1842)

1842. *Nematopus nepalensis* Westwood, A Catalogue of Hemiptera in the collection of the Rev. F. W. Hope., **2** : 4, 14.

Distribution : Assam, Kerala, Sikkim and Tamil Nadu.

Elsewhere : Nepal.

Division COPLPURARIA
Tribe Colpurini Breddin, 1900
Genus ***Hygia*** Uhler, 1861

1861. Uhler, *Proc Acad. Natur. Sci. Phila*, **13**: 287.

Subgenus ***Hygia*** Uhler, 1861

75. ***Hygia (Hygia) erebus*** (Distant, 1901)

1901. *Colpura erebus* Distant, *Ann. Mag. Nat. Hist.*, **77**(37): 18.

Distribution : Assam, Nagaland and West Bengal.

Subgenus ***Hygia (Colpura)*** Bergroth, 1894

1894. *Colpura* Bergroth, *Revue d'Entomologie* **13**: 154.

76. ***Hygia (Colpura) obscura*** (Dallas, 1852)

1852. *Lybas obscures* Dallas, List of the specimens of hemipterous insects in the collection of the British Museum **II**: 463-464.

Distribution: Assam and West Bengal.

77. ***Hygia (Colpura) funebris*** (Distant, 1901)

1901. *Colpura funebris* Distant, *Ann. Mag. Nat. Hist.*, **77**(37): 16.

Distribution : Assam and Sikkim.

78. ***Hygia (Colpura) lativentris*** (Motschulsky, 1866)

1866. *Maccevethus lativentris* Motschulsky, *Bull. Soc. Imp. Natur. Moscou*, **39**(1): 188.

Distribution: Assam, Sikkim and West Bengal.

79. ***Hygia (Colpura) sulcata*** (Paiva, 1919)

1919. *Colpura sulcata* Paiva, *Rec. Ind. Mus. Calcutta*, **16**: 357-358, plate 36 fig. 1.

Distribution : Assam, Meghalaya (Garo Hills, above Tura).

Genus ***Hygia (Microcolpura)*** Breddin, 1900

1900. *Colpura* (*Microcolpura*) Breddin, *Revue d'Entomologie* **19**: 203.

80. ***Hygia (Microcolpura) terebrans*** (Breddin, 1906)

1906. *Colpura* (*Microcolpura*) *terebrans* Breddin, *Ann. Soc. Entomol. Belg.*, **50**: 48, 50-51.

Distribution: Assam.

Subgenus ***Hygia (Pterocolpura)*** Blöte, 1936

1936. *Hygia* (*Pterocolpura*) Blöte, *Zoölogische Mededeelingen* **19**: 42.

81. ***Hygia (Pterocolpura) noctua*** (Distant, 1901)

1901. *Colpura noctua* Distant, *Ann. Mag. Nat. Hist.*, **77**(37): 18-19.

Distribution: Assam.

82. ***Hygia (Pterocolpura) nodulosa*** (Distant, 1889)

1889. *Lybas nodulosus* Distant, *Ent. Mon. Mag.*, **25**: 231.

Distribution : Assam, Meghalaya, Sikkim and West Bengal.

Division ANISOSCELARIA
Tribe **Anisoscelini** Laporte, 1832
Genus ***Leptoglossus*** Guérin-Méneville, 1831

1831. *Leptoglossus* Guérin-Méneville, Crustaces, *Arachnides et Insectes. Zoologie*, **2**(2): pl. 12, fig. 9.

83. ***Leptoglossus gonagra*** (Fabricius, 1775)

1775. *Cimex gonagra* Fabricius, Systema entomologiae: sistens insectorum classes, ordines, genera, species, adiectis synonymis, locis, descriptionibus, observationibus 708.

Distribution : Assam and Andaman & Nicobar islands.

Tribe **Dasynini** Bergroth, 1913
Genus ***Chinadasynus*** Hsiao, 1964

1964. *Chinadasynus* Hsiao, Acta Scientiarum Naturalium Universitatis Nankaiensis **5**(1): 19, 21, 28, 35.

84. ***Chinadasynus orientalis*** (Distant, 1889)

1889. *Pendulinus orientalis* Distant, *Ent. Mon. Mag.*, **25**: 231.

Distribution: Assam and Sikkim.

Genus ***Dasynus*** Burmeister, 1834

1834. *Dasynus* Burmeister, Beiträge zur Zoologie, gesammelt auf einer Reise um die Erde, und W Erichson's und H. Burmeister's Beschreibungen und Abbildungen der von Herrn Meyen auf dieser Reise gesammelten Insekten. Nova Acta Academiae Caesareae Leopoldino-Carolinae Naturae Curiosorum, **16**: 297.

85. ***Dasynus antennatus*** (Kirby, 1891)

1891. *Homoeocerus antennatus* Kirby, *Journal of the Linnean Society, Zoology*, **24**: 149 -150: 90-91, plate 4, fig. 6.

Distribution: Odisha and Tamil Nadu.

86. ***Dasynus fumosus*** (Blöte, 1935)

1935. *Amblypelta fumosa* Blöte, *Zoölogische Mededeelingen* **18**: 214-215.

Distribution : Karnataka (Chikkaballapura).

87. ***Dasynus relatus*** Paiva, 1919

1919. *Dasynus relatus* Paiva, *Rec. Ind. Mus. Calcutta*, **16** : 358.

Distribution : Assam.

Genus ***Odontoparia*** Mayr, 1865

1865. *Odontoparia* Mayr, *Verh. Zool.-Bot. Ges. Wien*, **15** : 433.

88. ***Odontoparia nicobarensis*** Mayr, 1865

1865. *Odontoparia nicobarensis* Mayr, *Verh. Zool.-Bot. Ges. Wien*, **15** : 433.

Distribution : Nicobar Islands.

Genus : ***Paradasynus*** China, 1934

1934. *Paradasynus* China, *Bulletin of Entomological Research*, **25** : 189.

89. ***Paradasynus rostratus*** (Distant, 1908)

1908. *Pendulinus rostratus* Distant, *The fauna of British India, including Ceylon and Burma*. Rhynchota, **4** (2) : 473.

Distribution : Maharashtra.

Division PHYSOMERARIA
Tribe **Acanthocorini** Amyot & Serville, 1843
Genus ***Physomerus*** Burmeister, 1835

1835. *Physomerus* Burmeister, *Handbuch der Entomologie*, 304, 341.

90. ***Physomerus grossipes*** (Fabricius, 1794)

1794. *Lygaeus grossipes* Fabricius, Entomologia systematica emendata et aucta secundum classes, ordines, genera, species adjectis synonymis, locis, observationibus, descriptionibus, **4** : 135.

Distribution : Assam, Jharkhand, Kerala, Sikkim and West Bengal.

91. ***Physomerus parvulus*** Dallas, 1852

1852. *Physomerus parvulus* Dallas, List of the specimens of hemipterous insects in the collection of the British Museum, **II** : 413 - 414.

Distribution : Andaman & Nicobar Islands and Uttarakhand.

Genus : ***Acanthocoris*** Amyot & Serville, 1843

1843. Amyot & Serville, *Histoire naturelle des insectes. Hémiptères* 213 - 214.

92. ***Acanthocoris scabrator*** (Fabricius, 1803)

1803. *Coreus scabrator* Fabricius, Systema Rhyngotorum secundum ordines, genera, speciesadjectis synonymis, locis, observationibus, descriptionibus, 195.

Distribution : Assam, Sikkim and West Bengal (Rohini, Darjeeling and Buxa Tiger Reserve, Jalpaiguri).

Genus ***Petalocnemis*** Stål, 1854

1854. *Petalocnemis* Stål, *Öfversigt af Kongliga Vetenskaps-Akademiens Förhandlingar*, **10** : 259.

93. ***Petalocnemis obscura*** (Dallas, 1852)

1852. *Acanthocoris obscures* Dallas, List of the specimens of hemipterous insects in the collection of the British Museum, **II** : 518.

Distribution : Andhra Pradesh, Assam, Karnataka, Maharashtra, Odisha and Tamil Nadu.

Division **Gonocerariamulsant** & Rey, 1870
Tribe **Gonocerini** Mulsant & Rey, 1870
Genus ***Plinachtus*** Stål, 1860

1860. *Plinachtus* Stål, *Öfvers. K. Vetensk Akad. Förh. Stockh*, **16** : 470.

94. ***Plinachtus acicularis*** (Fabricius, 1803)

1803. *Alydus acicularis* Fabricius, Systema Rhyngotorum secundum ordines, genera, speciesadjectis synonymis, locis, observationibus, descriptionibus, 251.

Distribution : Kerala and Maharashtra.

95. ***Plinachtus basalis*** (Westwood, 1842)

1842. *Coreus basalis* Westwood, A Catalogue of Hemiptera in the collection of the Rev. F. W. Hope, **2** : 6, 24.

Distribution : Karnataka.

Genus ***Trallianus*** Distant, 1902

1902. *Trallianus* Distant, *The fauna of British India, including Ceylon and Burma*. Rhynchota **1** (Heteroptera) : 404.

96. ***Trallianus chennelli*** Distant, 1902

1902. *Trallianus chennelli* Distant, *The fauna of British India, including Ceylon and Burma*. Rhynchota, **1** (Heteroptera) : 405.

Distribution : Assam.

Genus ***Cletus*** Stål, 1860

1860. *Cletus* Stål, Kongliga Svenska Fregattens Eugenies Resa Omkring Jorden, under befäl af C.A. Virgin. Åren 1851-53. III Zoologi, Insekter, 236.

97. ***Cletus bipunctatus*** (Herrich-Schäffer, 1840)

1840. *Gonocerus bipunctatus* Herrich-Schäffer, *Die wanzenartigen Insecten*, **6**:9-10.

Distribution : Assam, Karnataka, Manipur, Meghalaya, Sikkim, Tamilnadu and West Bengal (Gopalpur, Birbhum district; Buxa Tiger Reserve, Jalpaiguri district; Balarampur, Purulia district).

Elsewhere : Indonesia and Java.

98. ***Cletus bovillus*** Distant, 1918

1918. *Cletus bovillus* Distant, *The fauna of British India, including Ceylon and Burma*. Rhynchota. Vol. 7. (Homoptera : appendix; Heteroptera : addenda) : 158.

Distribution : Karnataka (Chikkaballapura) and West Bengal (Buxa Tiger Reserve, Jalpaiguri district).

99. ***Cletus calumniator*** (Fabricius, 1794)

1794. *Coreus calumniator* Fabricius, Entomologia systematica emendata et aucta secundum classes, ordines, genera, species adjectis synonymis, locis, observationibus, descriptionibus, **4**:131.

Distribution : Nagaland and West Bengal (Buxa Tiger Reserve, Jalpaiguri district).

100. ***Cletus feanus*** Distant, 1902

1902. *Cletus feanus* Distant, *The fauna of British India, including Ceylon and Burma*. Rhynchota, **1** (Heteroptera) : 395.

Distribution : West Bengal (Buxa Tiger Reserve, Jalpaiguri district).

Elsewhere : Burma.

101. ***Cletus punctiger*** (Dallas, 1852)

1852. *Gonocerus punctiger* Dallas, List of the specimens of hemipterous insects in the collection of the British Museum, **II**:494.

Distribution : Assam, Manipur and West Bengal.

102. ***Cletus punctulatus*** (Westwood, 1842)

1842. *Coreus punctulatus* Westwood, A Catalogue of Hemiptera in the collection of the Rev. F. W. Hope., **2**:23.

Distribution : Assam, Nagaland and Sikkim.

103. ***Cletus rubidiventris*** (Westwood, 1842)

1842. *Coreus rubidiventris* Westwood, A Catalogue of Hemiptera in the collection of the Rev. F. W. Hope. **2**:6,23.

Distribution : Karnataka and Maharashtra.

104. ***Cletus trigonus*** (Thunberg, 1783)

1783. *Cimex trigonus* Thunberg, Dissertatio entomologica novas insectorum species, sistens, cujus partem secundum, **2**:37.

Distribution : West Bengal (Buxa Tiger Reserve, Jalpaiguri district).

Genus ***Cletomorpha*** Mayr, 1866

1866. *Cletomorpha* Mayr, Reise der österreichischen Fregatte Novara um die Erde in den Jahren 1857, 1858, 1859 unter den Befehlen des Commodore B. von Wällerstorf-Urbair. Zoologischer Theil, Zweiter Band, 1. Abtheilung, B. Part 2. 120.

105. ***Cletomorpha hastata*** (Fabricius, 1787)

1787. *Cimex hastatus* Fabricius, Mantissa insectorum sistens species nuper detectas adjectis synonymis, observationibus, descriptionibus, emendationibus **2**:287.

Distribution : Maharashtra and West Bengal (Buxa Tiger Reserve, Jalpaiguri district).

106. ***Cletomorpha raja*** Distant, 1901

1901. *Cletomorpha raja* Distant, *Ann. Mag. Nat. Hist.* 77(41):423-424.

Distribution : Assam (Mungphu), Sikkim and West Bengal (Peshok, Darjeeling district).

107. ***Cletomorpha walkeri*** Kirby, 1891

1891. *Cletomorpha walkeri* Kirby, *Journal of the Linnean Society*, Zoology **24** (149-150) : 96-97.

Distribution : West Bengal (Buxa Tiger Reserve, Jalpaiguri district).

Elsewhere : Sri Lanka.

Tribe **Coreini** Leach, 1815

Genus ***Haidara*** Distant, 1908

1908. *Haidara* Distant, *The fauna of British India, including Ceylon and Burma*. Rhynchota **4** (2) : 474.

108. ***Haidara admota*** Distant, 1908

1908. *Haidara admota* Distant, *The fauna of British India, including Ceylon and Burma*. Rhynchota, **4** (2) : 475.

Distribution : Maharashtra (Mumbai).

109. ***Haidara producta*** Distant, 1908

1908. *Haidara product* Distant, *The fauna of British India, including Ceylon and Burma.* Rhynchota, **4** (2) : 474.

Distribution : Maharashtra.

Tribe **Phyllomorphini** Mulsant & Rey, 1870
Genus : ***Tongorma*** Kirkaldy, 1900

1900. *Tongorma* Kirkaldy, *Entomologist* **33** : 242.

110. ***Tongorma campbelli*** (Distant, 1918)

1918. *Craspedum campbelli* Distant, *The fauna of British India, including Ceylon and Burma.* Rhynchota. Vol. **7**. (Homoptera: appendix; Heteroptera: addenda) 159.

Distribution : Karnataka (Chikkaballapura).

111. ***Tongorma indicum*** (Westwood, 1874)

1874. *Phyllomorpha indica* Westwood, *Thesaurus entomologicus oxoniensis* **190**, Plate 36, fig. 1.

Distribution : India.

Subfamily HYDARINAE
Division HYDARIA
Genus ***Hydarella*** Bergroth, 1925

1925. *Hydarella* Bergroth, *Konowia, Vienna* **4** : 82-85.

112. ***Hydarella orientalis*** (Distant, 1902)

1902. *Hydara orientalis* Distant, *The fauna of British India, including Ceylon and Burma.* Rhynchota **1** (Heteroptera) 398-399.

Distribution : Sikkim and West Bengal.

Elsewhere : Burma, Teinzo, Bhamo.

Subfamily PSEUDOPHLOCINAE
Tribe **Clavigrallini** Stål, 1873
Genus ***Clavigralla*** Spinola, 1837

1837. *Clavigralla* Spinola, Essai sur les genres d'insectes appartenants à l'ordre des Hémiptères, Lin. ou Rhyngotes, Fab. et à la section des Hétéropères, Dufour, 200-202.

113. ***Clavigralla gibbosa*** Spinola, 1837

1837. *Clavigralla gibbosa* Spinola, Essai sur les genres d'insectes appartenants à l'ordre des Hémiptères, Lin. ou Rhyngotes, Fab. et à la section des Hétéropères, Dufour 202.

Distribution : Karnataka (Chikkaballapura), Maharashtra (Mumbai) and West Bengal (Kolkata and Oodiabani forest, Buxa Tiger Reserve, Jalpaiguri district).

114. ***Clavigralla scutellaris*** (Westwood, 1842)

1842. *Coreus scutellaris* Westwood, A Catalogue of Hemiptera in the collection of the Rev. F. W. Hope., **2** : 24.

Distribution : Rajasthan.

Genus ***Gralliclava*** Dolling, 1978

1978. *Gralliclava* Dolling, *Bull. Br. Mus. (Nat. Hist.) Entomol.* **36**(6) : 304.

115. ***Gralliclava horrens horrens*** (Dohrn, 1860)

1860. *Clavigralla horrens* Dohrn, *Stettin. Entomol. Zeit.* **21**: 403.

Distribution : Assam, Maharashtra, Manipur and West Bengal (Buxa Tiger Reserve, Jalpaiguri district).

Elsewhere : Sri Lanka.

Tribe **Pseudophloeini** Stål, 1868
Genus ***Hoplolomia*** Stål, 1873

1873. *Hoplolomia* Stål, *K. Svens. Vet.-Akad. Hand.*, **11**(2): 82.

116. ***Hoplolomia scabricula*** Stål, 1873

1873. *Hoplolomia scabricula* Stål, *K. Svens. Vet.-Akad. Hand.*, **11**(2): 84.

Distribution : Madhya Pradesh.

Genus ***Psilolomia*** Breddin, 1909

1909. *Psilolomia* Breddin, *Ann. Soc. Entomol. Belg.*, **53** : 292.

117. ***Psilolomia brevitibialis*** Breddin, 1909

1909. *Psilolomia brevitibialis* Breddin, *Ann. Soc. Entomol. Belg.*, **53** : 292.

Distribution : Karnataka (Chikkaballapura).

Elsewhere : Sri Lanka.

Family STENOCEPHALIDAE Dallas, 1852
Division **Stenocephalaria**
Genus ***Dicranocephalus*** Hahn, 1826

1826. *Dicranocephalus* Hahn, Icones ad monographium Cimicum pl. 24.

118. ***Dicranocephalus lateralis*** (Signoret, 1879)

1879. *Stenocephalus lateralis* Signoret, *Bull. Soc. Zool. France* **1879**: 72.

Distribution : Maharashtra and Tamil Nadu.

Elsewhere : Malaysia.

Family ALYDIDAE
Subfamily ALYDINAE
Genus ***Daclera*** Signoret, 1863

1863. *Daclera* Signoret, Notes sur l'île de la Réunion (Bourbon) (2nd edn) **2**: 27.

119. ***Daclera levana*** Distant, 1918

1918. *Daclera levana* Distant, *The fauna of British India, including Ceylon and Burma.* Rhynchota. Vol. 7. (Homoptera: appendix; Heteroptera: addenda) 162-163, fig. 77.

Distribution: Karnataka (Chikkaballapura).

Division **Alydaria**
Genus ***Euthetus*** Dallas, 1852

1852. *Euthetus* Dallas, List of the specimens of hemipterous insects in the collection of the British Museum, **II**: 467, 479-480.

120. ***Euthetus atomarius*** Distant, 1918

1918. *Euthetus atomarius* Distant, The fauna of British India, including Ceylon and Burma. Rhynchota. Vol. 7. (Homoptera: appendix; Heteroptera: addenda) 165.

Distribution: Karnataka (Chikkaballapura).

121. ***Euthetus fulvescens*** Distant, 1918

1918. *Euthetus fulvescens* Distant, *The fauna of British India, including Ceylon and Burma.* Rhynchota. Vol. 7. (Homoptera: appendix; Heteroptera: addenda) 164-165.

Distribution: Karnataka (Chikkaballapura).

122. ***Euthetus khandalana*** Distant, 1918

1918. *Euthetus khandalana* Distant, *The fauna of British India, including Ceylon and Burma.* Rhynchota. Vol. 7. (Homoptera: appendix; Heteroptera: addenda) 163-164.

Distribution: Maharashtra (Khandala).

123. ***Euthetus nigrellus*** Distant, 1918

1918. *Euthetus nigrellus* Distant, *The fauna of British India, including Ceylon and Burma.* Rhynchota. Vol. 7. (Homoptera: appendix; Heteroptera: addenda) 164.

Distribution : Karnataka (Chikkaballapura and Mysore districts).

124. ***Euthetus pulchellus*** Dallas, 1852

1852. *Euthetus pulchellus* Dallas, List of the specimens of hemipterous insects in the collection of the British Museum, **II**: 479-480, plate 14, figs 3, 3a,b.

Distribution: North India.

125. ***Euthetus pulcherrimus*** Bergroth, 1909

1909. *Euthetus pulcherrimus* Bergroth, *Ann. Soc. Entomol. Belg.* **53**: 186-188.

Distribution: Maharashtra (Borghat, Mumbai) and Punjab.

Genus ***Hypselopus*** Burmeister, 1835

1835. *Hypselopus* Burmeister, *Handbuch der Entomologie*, **304**, 328-329.

126. ***Hypselopus mimicus*** Distant, 1918

1918. *Hypselopus mimicus* Distant, *The fauna of British India, including Ceylon and Burma.* Rhynchota. Vol., 7. (Homoptera: appendix; Heteroptera: addenda) 168.

Distribution: Karnataka (Chikkaballapura).

127. ***Hypselopus pronotalis*** Distant, 1918

1918. *Hypselopus pronotalis* Distant, *The fauna of British India, including Ceylon and Burma.* Rhynchota. Vol., 7. (Homoptera: appendix; Heteroptera: addenda) 167, 168, fig. 78.

Distribution : Uttarakhand (Kumaon, Darmoti).

Genus ***Nariscus*** Stål, 1866

1866. *Nariscus* Stål, *Hemiptera Africana* **2**: 8, 100-101.

128. ***Nariscus fisheri*** (Distant, 1908)

1908. *Akbaratus fisheri* Distant, *The fauna of British India, including Ceylon and Burma.* Rhynchota, **4** (2) 486-487.

Distribution : Maharashtra (Mumbai), South India, Uttarakhand (Premnagar, Dehradun district).

Genus ***Riptortus*** Stål, 1860

1860. *Riptortus* Stål, *Öfvers. K. Vetensk Akad. Förh. Stockh*, **16**: 459, 460.

129. ***Riptortus linearis*** (Fabricius, 1775)

1775. *Cimex linearis* Fabricius, Systema entomologiae: sistens insectorum classes, ordines, genera, species, adiectis synonymis, locis, descriptionibus, observationibus 710.

Distribution : Assam, Karnataka, Madhya Pradesh, Sikkim, Tamil Nadu and West Bengal (Kolkata ; Buxa Tiger Reserve, Jalpaiguri district ; Darjeeling district ; Shibpur in Howrah district).

130. ***Riptortus pedestris*** (Fabricius, 1775)

1775. *Cimex pedestris* Fabricius, Systema entomologiae: sistens insectorum classes, ordines, genera, species, adiectis synonymis, locis, descriptionibus, observationibus, 727.

Distribution : Karnataka, Maharashtra, Sikkim, Uttarakhand and West Bengal (Kolkata, Sonarpur in South 24 Parganas district, Cooch Behar district, Buxa Tiger Reserve, Jalpaiguri district ; Darjeeling district ; Murshidabad and Puruliya districts).

131. ***Riptortus strenuus*** Horváth, 1889

1889. *Riptortus strenuus* Horváth, *Természetrajzi Füzetek*, **12**: 35-36.

Distribution: Himalayas.

Genus ***Tenosius*** Stål, 1860

1860. *Tenosius* Stål, *Öfvers.K. Vetensk Akad. Förh. Stockh* **16**:459, 460.

132. ***Tenosius proletarius*** (Schaum, 1853)

1853. *Alydus proletarius* Schaum, *Akademie der Wissenschaften zu Berlin* **1853**: 358.

Distribution: West Bengal.

Subfamily MICRELYTERINAE
Tribe Micrelytrini
Genus ***Acestra*** Dallas, 1852

1852. *Acestra* Dallas, List of the specimens of hemipterous insects in the collection of the British Museum II: 485, 488.

133. ***Acestra malayana*** Distant, 1903

1903. *Acestra malayana* Distant, *Fasciculi Malayenses.* Zoology Part **2:** 245, plate 15 fig. 7.

Distribution: Kerala (parambikulam, Cochin).

Genus ***Dulichius*** Stål, 1866

1866. *Dulichius* Stål, *Hemiptera Africana*, **2**: 7, 89-90.

134. ***Dulichius inflatus*** (Kirby, 1891)

1891. *Formicoris inflatus* Kirby, *Journal of the Linnean Society, Zoology*, **24** 149–150: 122-123, plate 4 figs 17, 17a.

Distribution : Odisha, Tamil Nadu and West Bengal.

Elsewhere: Sri Lanka.

Genus ***Marcius*** Stål, 1865

1865. *Marcius* Stål, *Annales de la Société Entomologique de France*, **45**: 186.

135. ***Marcius ornatulus*** (Distant, 1908)

1908. *Babaranus ornatulus* Distant, *The fauna of British India, including Ceylon and Burma.* Rhynchota, **4** (2) : 482-483.

Distribution : Assam and West Bengal (Peshok in Darjeeling district).

Elsewhere : Burma, Tenasserim and Myitta.

Division **Leptocorisaria**
Tribe **Leptocorisini**
Genus ***Leptocorisa*** Latreille, 1829

1829. *Leptocorisa* Latreille, Le Règne Animal distribué d'après son organisation, pour servir de base à l'histoire naturelle des animaux et d'Introduction à l'anatomie comparée, **5** : 196.

136. ***Leptocorisa acuta*** (Thunberg, 1783)

1783. *Cimex acuta* Thunberg, Dissertatio entomologica novas insectorum species, sistens, cujus partem secundum, **2:** 34.

Distribution : Andhra Pradesh, Bihar, Odisha, Uttarakhand, and West Bengal (Nort 24 Parganas district, Kolkata district; Buxa Tiger Reserve, Jalpaiguri district and Kalyani, Nadia district).

137. ***Leptocorisa lepida*** Breddin, 1909

1909. *Leptocorisa lepida* Breddin, *Ann. Soc. Entomol. Belg.*, **53**: 293-294, fig. 23.

Distribution : Maharashtra (Bhandara), Uttar Pradesh (Allahabad and Nandgaon) and Uttarakhand (Dehradun).

138. ***Leptocorisa varicornis*** *(Fabricius, 1783)*

Distribution : Maharashtra, Meghalaya, Odisha, Sikkim and West Bengal.

Genus ***Stenocoris*** Burmeister, 1839

1839. *Stenocoris* Burmeister, *Handbuch der Entomologie* **2**(2): 1010.

Subgenus ***Stenocoris (Stenocoris)***
Burmeister, 1839

139. ***Stenocoris (Stenocoris) tipuloides*** (De Geer, 1773)

1773. *Cimex tipuloides* De Geer, *Memoires pour servir a l'Histoire des insectes*, **3**: 354, plate 35, fig. 1.

Distribution : Punjab.

Family RHOPALIDAE Amyot & Serville, 1843
Subfamily SERINETHINAE Stål, 1873
Genus ***Boisea*** Kirkaldy, 1910

1910. *Leptocoris* (*Boisea*) Kirkaldy, *Proceedings of the Hawaiian Entomological Society*, **2**(3): 123.

140. ***Boisea coimbatorensis*** (Gross, 1960)

1960. *Leptocoris coimbatorensis* Gross, *Records of the South Australian Museum* **13**(4):417.

Distribution : Tamil Nadu (Kadamparai and Chincona in Anaimalai Hills of Coimbatore district).

Genus ***Leptocoris*** Hahn, 1833

1833. *Leptocoris* Hahn, Die Wanzenartigen Insecten, getreu nach der Natur abgebildet und beshrieben **1**:200, pl. XXXII.D-F.

141. ***Leptocoris abdominalis abdominalis*** (Fabricius, 1803)

1803. *Lygaeus abdominalis* Fabricius, Systema Rhyngotorum secundum ordines, genera, speciesadjectis synonymis, locis, observationibus, descriptionibus, 226.

Distribution : Tamil Nadu (Kadamparai and Chincona in Anaimalai Hills of Coimbatore district and Nilagiri Hills in Nilagiri district).

142. ***Leptocoris abdominalis taprobanensis*** (Dallas, 1852)

1852. *Serinetha taprobanensis* Dallas, List of the specimens of hemipterous insects in the collection of the British Museum, **II**: 461.

Distribution : Tamil Nadu (Kadamparai and Chincona in Anaimalai Hills of Coimbatore district and Nilagiri Hills in Nilagiri district).

143. ***Leptocoris augur*** (Fabricius, 1781)

1781. *Cimex augur* Fabricius, Species Insectorum exhibentes eorum differentias specificas, synonyma auctorum, loca natalia, metamorphosin adiectis observationibus, descriptionibus. 2:366.

Distribution : Andhra Pradesh, Karnataka, Kerala, Odisha, Puducherry, Tamil Nadu (Coimbatore district), Uttarakhand, Uttar Pradesh and West Bengal.

144. ***Leptocoris dispar*** (Hsiao, 1963)

1963. *Serinetha dispar* Hsiao, *Acta Entomologica Sinica*, **12**: 331, 344.

Distribution : Tamil Nadu (Kadamparai and Chincona in Anaimalai Hills of Coimbatore district and Nilagiri Hills in Nilagiri district).

145. ***Leptocoris rufomarginatus*** (Fabricius, 1794)

1794. *Lygaeus rufomarginatus* Fabricius, Entomologia systematica emendata et aucta secundum classes, ordines, genera, species adjectis synonymis, locis, observationibus, descriptionibus, **4**: 152.

Distribution: West Bengal.

Subfamily RHOPALINAE Amyot & Serville, 1843 Tribe **Rhopalini** Amyot & Serville, 1843

Genus ***Corizus*** Fallén, 1814

1814. *Corizus* Fallén, Specimen novam Hemiptera disponendi methodum exhibens 8.

146. ***Corizus fenestella subsimilis*** Horváth, 1917

1917. *Corizus limbatus* Horváth, *Ann. Mus. Hungar.* **15**:167, 173.

Distribution: South India and Uttarakhand.

147. ***Corizus hyoscyami hyoscyami*** (Linnaeus, 1758)

1758. *Cimex hyoscyami* Linnaeus, Systema naturae per regna tria naturae, secundum classes, ordines, genera, species, cum characteribus, differentiis, synonymis, locis. Editio decima, reformata, 447.

Distribution: Himalayas.

Genus ***Liorhyssus*** Stål, 1870

1870. *Corizus* (*Liorhyssus*) Stål, *K. Svens. Vet.-Akad. Hand*, **9**(1) : 222.

148. ***Liorhyssus hyalinus*** (Fabricius, 1794)

1794. *Lygaeus hyalinus* Fabricius, Entomologia systematica emendata et aucta secundum classes, ordines, genera, species adjectis synonymis, locis, observationibus, descriptionibus, **4**: 168.

Distribution: Punjab.

149. ***Liorhyssus rubicundus*** (Signoret, 1859)

1859. *Corizus rubicundus* Signoret, *Annales de la Société Entomologique de France*, **37**: 86.

Distribution : Karnataka (Chikkaballapura), Tamil Nadu (Nilagiri Hills) and Uttarakhand.

Tribe **Niesthreini** Chopra, 1967

Genus ***Peliochrous*** Stål, 1873

1873. *Peliochrous* Stål, *K. Svens. Vet.-Akad. Hand.*, **11**(2): 97, 98.

150. ***Peliochrous parvipictus*** (Distant, 1918)

1918. *Corizus parvipictus* Distant, *The fauna of British India, including Ceylon and Burma.* Rhynchota. Vol. 7. (Homoptera: appendix; Heteroptera: addenda) 168.

Distribution : Karnataka (Chikkaballapura).

Tribe **Chorosomatini** Fieber, 1860
Genus ***Agraphopus*** Stål, 1872

1872. *Agraphopus* Stål, *Öfvers. K. Vetensk Akad. Förh. Stockh*, **29**(6): 55.

151. ***Agraphopus lethierryi*** Stål, 1872

1872. *Agraphopus lethierryi* Stål, *Öfvers. K. Vetensk Akad. Förh. Stockh*, **29**(6): 56.

Distribution : Bihar (Katihar and Purnea districts), Punjab, South India and West Bengal.

DISCUSSION

The diversity of species is more in the Western Ghats region and in the Deccan plateau region when compared to the other regions of the country. About 44% of Coreoids are recorded from both the regions only. A very less number of species diversity is being seen in the Islands due to their isolation from the mainland. The habitat and climatic conditions plays an important role in determining the species diversity as well as the population density of insects. The Deccan Plateau and the Western ghats are covered by ancient forests which are older than Himalayas, the Plateau is home for rich wildlife. Several sacred evergreen groves contribute to the biodiversity of this ecoregions. These forests nourish the needs of the insects for the successful existence in their habitat. Fossils found here reveal that this region used to be a most evergreen rain forest, far different from today's dry climate forests. The gangetic plain and the Northeast region show the second most diversity of species. 41% of the coreoids were recorded from this region. Next to this, there are about 37% of the total species of the country were recorded in Himalayan region. The Trans-Himalayan, Semi-arid, Desert, Coasts and islands with a very poor diversity of species.

The species *Molipteryx hardwicki* White, *Helcomeria spinosa* (signoret), *Ochrochira aberrens* (Distant), *Neomictis filicornis* (walker), *Homoeocerus fasciolatus* (Stål), *Homoeocerus punctum* (Dallas) and *Riptortus sternus* Horvath have confined to the Himalayan area only. They were not recorded from any other place. This shows that these species have habituated or adapted to live in the hilly region only. *Prionolomia cardoni* Lethierry, *Cletus trigonus* (Thunberg), *Tenosius proletarius* Sehaum, *Hypselopus pronotalis* Distant, *Corizus hyoscyami hyoscyami* (Linnaeus), *Liorhyssus hyalinus* (Fabricius), *Liorhyssus rubicundus* (Signoret) and *Leptocoris rufomarginatus* (Fabricius) were recorded from the Gangetic plain only. *Mictis gallina* Dallas, *Aspilosterna pictor* (Fabricius), *Anoplocnemis binotata* Distant, *Homoeocerus (Tliponius) atkinsoni* Distant, *Homoeocerus (Tliponius) badgleyi* Distant, *Homoeocerus (Tliponius) indus* Distant, *Homoeocerus (Anacanthocoris) subjectus* Walker, *Notobitus abdominalis* Distant, *Cloresmus antennatus* Distant, *Hygia (Pterocolpura) noctua* (Distant), *Hygia (Colpura) sulcata* (Paiva), *Hygia (Microcolpura) terebrans* (Breddin), *Dasynus relatus* Paiva, *Trallianus chennelli* Distant and *Cletus calumniator* (Fabricius) were recorded from the Northeastern region alone. *Homoeocerus (Anacanthocoris) lacertosus* Distant, *Hoplolomia scabricula* Stål and *Liorhyssus hyalinus* (Fabricius) are seen only in the semi-arid region. *Clavigralla scutellaris* (Westwood) is the only one species recorded from the desert area but not from any other area. The species *Odontoparia nicobarensis* Mayr recorded from Nicobar islands alone.

Ochrochira albiditarsis (Westwood), *Tongorma indicum* (Westwood), *Riptortus strenuus* Horváth and *Corizus hyoscyami hyoscyami* (Linnaeus) were available in Trans-Himalaya and in many other biogegraphic regions also. The species *Ochrochira albiditarsis* (Westwood *Ochrochira biplagiata* (Walker), (*Mictis tenebrosa* Fabricius), *Anoplocnemis phasianus* (Fabricius), *Anoplocnemis protracta* (Herrich-Schäffer), *Petillopsis calcar* (Dallas), *Petillopsis patulicollis* (Walker), *Dalader acuticosta* Amyot & Serville, *Dalader planiventris* (Westwood), *Dalader planiventris* (Westwood),

Homoeocerus (Anacanthocoris) albiguttulus Stål, *Homoeocerus (Anacanthocoris) albiguttulus* Stål, *Homoeocerus (Anacanthocoris) angulatus* Westwood, *Homoeocerus (Anacanthocoris) concisus* Walker, *Homoeocerus (Anacanthocoris) simiolus* Distant, *Homoeocerus (Anacanthocoris) striicornis* Scott, *Homoeocerus (Anacanthocoris) walkeri* Kirby, *Homoeocerus (Tliponius) montanus* Distant, *Homoeocerus (Tliponius) puncticornis* (Burmeister), *Homoeocerus (Tliponius) serrifer* (Westwood), *Prismatocerus signatus* (Walker), *Anhomoeus nepalensis* (Distant), *Prismatocerus inornatus* (Stål), *Notobitus excellens* Distant, *Notobitus serripes* (Dallas), *Cloresmus khasianus* Distant, *Cloresmus nepalensis* (Westwood), *Hygia (Pterocolpura) nodulosa* (Distant), *Hygia (Colpura) funebris* (Distant), *Hygia (Colpura) lativentris* (Motschulsky), *Acanthocoris scabrator* (Fabricius), *Cletus calumniator* (Fabricius), *Cletomorpha raja* Distant, *Tongorma indicum* (Westwood), *Hydarella orientalis* (Distant), *Acestra malayana* Distant, *Marcius ornatulus* (Distant) and *Riptortus linearis* (Fabricius) are occurring both in the Himalayan region and in other regions also.

Ochrochira albiditarsis (Westwood), *Homoeocerus (Tliponius) puncticornis* (Burmeister), *Tongorma indicum* (Westwood) and *Stenocoris (Stenocoris) tipuloides* (De Geer) are recorded from the desert as well as other biogeographic zones. *Ochrochira albiditarsis* (Westwood), *Anoplocnemis phasianus* (Fabricius), *Homoeocerus (Tliponius) puncticornis* (Burmeister), *Aschistocoris brevicornis* (Dallas), *Omanocoris versicolor* (Herrich-Schäffer), *Tongorma indicum* (Westwood), *Stenocoris (Stenocoris) tipuloides* (De Geer), *Leptocorisa lepida* Breddin, *Leptocorisa varicornis (Fabricius), Euthetus khandalana* Distant, *Euthetus pulchellus* Dallas, *Euthetus pulcherrimus* Bergroth and *Riptortus linearis* (Fabricius) are concurrently occurring in the Semi-arid and various other biogeographic regions.

The following species are simultaneously occuring in the Himalayan and Gangetic Plain regions. They are : Derepteryx grayii White, *Ochrochira biplagiata* (Walker), *Anoplocnemis phasianus* (Fabricius), *Anoplocnemis protracta* (Herrich-Schäffer), *Petillopsis calcar* (Dallas), *Dalader acuticosta* Amyot & Serville, *Dalader planiventris* (Westwood), *Homoeocerus (Anacanthocoris) albiguttulus* Stål, *Homoeocerus (Anacanthocoris) angulatus* Westwood, *Homoeocerus (Tliponius) puncticornis* (Burmeister), *Prismatocerus sigillatus* (Stål), *Prismatocerus signatus* (Walker), *Homoeocerus (Anacanthocoris) striicornis* Scott, *Homoeocerus (Anacanthocoris) walkeri* Kirby, *Anhomoeus sulcatus* (Distant), *Prismatocerus inornatus* (Stål), *Cloresmus khasianus* Distant, *Cloresmus modestus* Distant, *Hygia (Hygia) erebus* **(Distant)**, *Hygia (Pterocolpura) nodulosa* (Distant), *Hygia (Colpura) lativentris* (Motschulsky), *Physomerus grossipes* (Fabricius), *Cletus bipunctatus* (Herrich-Schäffer), *Tongorma indicum* (Westwood), *Hydarella orientalis* (Distant), *Leptocorisa varicornis (Fabricius), Marcius ornatulus* (Distant) and *Riptortus linearis* (Fabricius).

The species namely Ochrochira albiditarsis (Westwood), *Mictis macra* Stål, *Anoplocnemis phasianus* (Fabricius), *Dalader planiventris* (Westwood), *Brachytes bicolor* Westwood, *Homoeocerus (Anacanthocoris) albiventris* Dallas, *Homoeocerus (Anacanthocoris) angulatus* Westwood, *Prismatocerus apicicornis* (Distant), *Prismatocerus cordiger* (Stål), *Homoeocerus (Tliponius) laevilineus* Stål, *Homoeocerus (Anacanthocoris) macula* Dallas, *Homoeocerus (Tliponius) montanus* Distant, *Homoeocerus (Tliponius) nigridorsum* Horváth, *Homoeocerus (Tliponius) picturatus* Distant, *Prismatocerus borealis* (Distant), *Prismatocerus prominulus* (Dallas), *Prismatocerus inornatus* (Stål), *Prismatocerus signatus* (Walker), *Homoeocerus (Tliponius) puncticornis* (Burmeister), *Homoeocerus (Anacanthocoris) striicornis* Scott, *Omanocoris versicolor* (Herrich-Schäffer), *Notobitus dorsalis* (Westwood), *Notobitus meleagris* (Fabricius), *Cloresmus nepalensis* (Westwood), *Dasynus antennatus* (Kirby), *Paradasynus rostratus* (Distant), *Physomerus grossipes* (Fabricius), *Petalocnemis obscura* (Dallas), *Plinachtus acicularis* (Fabricius), *Cletus bipunctatus* (Herrich-Schäffer), *Cletus bovillus* Distant, *Cletus rubidiventris*

(Westwood), *Cletomorpha hastata* (Fabricius), *Haidara admota* Distant, *Haidara producta* Distant, *Tongorma campbelli* (Distant), *Tongorma indicum* (Westwood), *Dicranocephalus lateralis* (Signoret), *Stenocoris (Stenocoris) tipuloides* (De Geer), *Leptocorisa acuta* (Thunberg), *Leptocorisa lepida* Breddin, *Leptocorisa varicornis (Fabricius), Acestra malayana* Distant, *Daclera levana* Distant, *Euthetus atomarius* Distant, *Euthetus fulvescens* Distant, *Euthetus khandalana* Distant, *Euthetus nigrellus* Distant, *Euthetus pulcherrimus* Bergroth, *Nariscus fisheri* (Distant), *Hypselopus mimicus* Distant, *Riptortus linearis* (Fabricius), *Riptortus pedestris* (Fabricius), *Boisea coimbatorensis* (Gross), *Corizus fenestella subsimilis* Horváth, *Peliochrous parvipictus* (Distant), *Leptocoris augur* (Fabricius), *Leptocoris dispar* (Hsiao), *Leptocoris rufomarginatus* (Fabricius), *Leptocoris abdominalis abdominalis* (Fabricius), *Leptocoris abdominalis taprobanensis* (Dallas) and *Agraphopus lethierryi* Stål are simultaneously occured in more than two biogeographic regions in particular their occurrence was mainly noticed in both the Western Ghats and the Deccan Plateau.

Ochrochira albiditarsis (Westwood), *Leptoglossus gonagra* (Fabricius), *Physomerus parvulus* Dallas and *Tongorma indicum* (Westwood) are being recorded from both the Islands and other biogeographic regions also. *Ochrochira albiditarsis* (Westwood), *Homoeocerus (Tliponius) puncticornis* (Burmeister) and *Tongorma indicum* (Westwood) are concurrently occurring in the coastal areas and also in the other biogeographic regions.

The species Ochrochira albiditarsis (Westwood), *Homoeocerus (Tliponius) puncticornis* (Burmeister, 1834) and *Tongorma indicum* (Westwood) are endemic to India.

SUMMARY

The present paper deals with 151 species belonging to 59 genera distributed over 14 tribes, 16 divisions, 7 subfamilies and 4 families under the Superfamily Coreoidea.

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Table Showing the Biogeographical Species Distribution of the Superfamily : Coreoidea

S. No.	Name of the species	Trans Himalayas	Himalayas	Desert	Semiarid	Western Ghat	Deccan Plateau	Ganjetic Plain	Northeast India	Coasts	Islands
1.	*Molipteryx hardwickii hardwickii* (White, 1839)		+								
2.	*Derepteryx grayii* White, 1839		+					+			
3.	*Helcomeria spinosa* (Signoret, 1851)		+								
4.	*Prionolomia cardoni* Lethierry, 1891							+			
5.	*Prionolomia fulvicornis* (Fabricius, 1787)		+					+			
6.	*Prionolomia gigas* Distant, 1879		+								
7.	*Prionolomiopsis amplicollis* (Stål, 1873)								+		
8.	*Ochrochira aberrans* (Distant, 1889)		+								
9.	*Ochrochira albiditarsis* (Westwood, 1842)	+	+	+	+	+	+	+	+	+	+
10.	*Ochrochira biplagiata* (Walker, 1871)		+						+		
11.	*Ochrochira pallescens* Distant, 1889								+		
12.	*Ochrochira palliditarsis* Stål, 1873								+		
13.	*Mictis gallina* Dallas, 1852								+		
14.	*Mictis macra* Stål, 1865				+	+					
15.	*Mictis tenebrosa* (Fabricius, 1787)		+					+	+		
16.	*Aspilosterna pictor* (Fabricius, 1794)								+		
17.	*Neomictis filicornis* (Walker, 1871)		+								
18.	*Anoplocnemis binotata* Distant, 1918								+		
19.	*Anoplocnemis phasianus* (Fabricius, 1781)		+		+	+	+	+	+		
20.	*Anoplocnemis protracta* (Herrich-Schäffer, 1850)		+					+			
21.	*Xyrophoreus cristatus* Brailovsky & Barrera, 2000					+	+				
22.	*Trematocoris lobipes* (Westwood, 1842)						+	+			
23.	*Trematocoris notatipes* Walker, 1871							+			
24.	*Petillopsis calcar* (Dallas, 1852)		+			+	+	+			
25.	*Petillopsis patulicollis* (Walker, 1871)		+						+		
26.	*Dalader acuticosta* Amyot & Serville, 1843		+					+	+		
27.	*Dalader planiventris* (Westwood, 1842)		+			+	+	+	+		
28.	*Brachytes bicolor* Westwood, 1842					+	+		+		
29.	*Aschistocoris brevicornis* (Dallas, 1852)		+		+						
30.	*Homoeocerus (Anacanthocoris) albiguttulus* Stål, 1873		+					+			
31.	*Homoeocerus (Anacanthocoris) albiventris* Dallas, 1852					+	+				
32.	*Homoeocerus (Anacanthocoris) angulatus* Westwood, 1842		+			+	+				
33.	*Homoeocerus (Anacanthocoris) biguttatus* Westwood, 1842		+								
34.	*Homoeocerus (Anacanthocoris) concisus* Walker, 1871		+						+		
35.	*Homoeocerus (Anacanthocoris) fasciolatus* Stål, 1873		+								
36.	*Homoeocerus (Anacanthocoris) graminis* (Fabricius, 1803)		+								
37.	*Homoeocerus (Anacanthocoris) javanicus* Dallas, 1852								+		
38.	*Homoeocerus (Anacanthocoris) lacertosus* Distant, 1889			+							
39.	*Homoeocerus (Anacanthocoris) macula* Dallas, 1852				+	+					
40.	*Homoeocerus (Anacanthocoris) simiolus* Distant, 1902		+						+		

S. No.	Name of the species	Trans Himalayas	Himalayas	Desert	Semiarid	Western Ghat	Deccan Plateau	Ganjetic Plain	Northeast India	Coasts	Islands
41.	*Homoeocerus (Anacanthocoris) striicornis* Scott, 1874		+			+	+	+	+		
42.	*Homoeocerus (Anacanthocoris) subjectus* Walker, 1871								+		
43.	*Homoeocerus (Anacanthocoris) tinctus* Distant, 1883								+		
44.	*Homoeocerus (Anacanthocoris) walkeri* Kirby, 1892		+					+	+		
45.	*Homoeocerus (Tliponius) atkinsoni* Distant, 1901								+		
46.	*Homoeocerus (Tliponius) badgleyi* Distant, 1908								+		
47.	*Homoeocerus (Tliponius) indus* Distant, 1918					+	+	+			
48.	*Homoeocerus (Tliponius) laevilineus* Stål, 1873					+	+		+		
49.	*Homoeocerus (Tliponius) montanus* Distant, 1901					+	+				
50.	*Homoeocerus (Tliponius) nigridorsum* Horváth, 1889		+			+	+				
51.	*Homoeocerus (Tliponius) picturatus* Distant, 1918					+	+				
52.	*Homoeocerus (Tliponius) puncticornis* (Burmeister, 1834)									+	
53.	*Homoeocerus (Tliponius) punctum* Dallas, 1852		+								
54.	*Homoeocerus (Tliponius) serrifer* (Westwood, 1842)		+						+		
55.	*Prismatocerus apicicornis* (Distant, 1918)					+	+				
56.	*Prismatocerus borealis* (Distant, 1918)					+	+				
57.	*Prismatocerus cordiger* (Stål, 1860)					+	+				
58.	*Prismatocerus inornatus* (Stål, 1873)					+	+	+			
59.	*Prismatocerus prominulus* (Dallas, 1852)					+	+				
60.	*Prismatocerus sigillatus* (Stål, 1873)		+					+			
61.	*Prismatocerus signatus* (Walker, 1871)		+			+	+	+			
62.	*Anhomoeus nepalensis* (Distant, 1908)		+					+			
63.	*Anhomoeus sulcatus* (Distant, 1908)		+					+			
64.	*Omanocoris versicolor* (Herrich-Schäffer, 1841)		+		+	+	+				
65.	*Notobitus abdominalis* Distant, 1901								+		
66.	*Notobitus dorsalis* (Westwood, 1842)					+	+	+			
67.	*Notobitus excellens* Distant, 1879		+						+		
68.	*Notobitus marginalis* (Westwood, 1842)							+	+		
69.	*Notobitus meleagris* (Fabricius, 1787)					+	+	+			
70.	*Notobitus serripes* (Dallas, 1850)		+						+		
71.	*Cloresmus antennatus* Distant, 1908							+	+		
72.	*Cloresmus khasianus* Distant, 1901		+					+	+		
73.	*Cloresmus modestus* Distant, 1901		+					+	+		
74.	*Cloresmus nepalensis* (Westwood, 1842)		+			+	+		+		
75.	*Hygia (Hygia) erebus* (Distant, 1901)		+					+	+		
76.	*Hygia (Colpura) obscura* (Dallas, 1852)							+	+		
77.	*Hygia (Colpura) funebris* (Distant, 1901)		+						+		
78.	*Hygia (Colpura) lativentris* (Motschulsky, 1866)		+					+	+		
79.	*Hygia (Colpura) sulcata* (Paiva, 1919)								+		
80.	*Hygia (Microcolpura) terebrans* (Breddin, 1906)								+		

S. No.	Name of the species	Trans Himalayas	Himalayas	Desert	Semiarid	Western Ghat	Deccan Plateau	Ganjetic Plain	Northeast India	Coasts	Islands
81.	*Hygia (Pterocolpura) noctua* (Distant, 1901)								+		
82.	*Hygia (Pterocolpura) nodulosa* (Distant, 1889)		+					+	+		
83.	*Leptoglossus gonagra* (Fabricius, 1775)								+		+
84.	*Chinadasynus orientalis* (Distant, 1889)		+						+		
85.	*Dasynus antennatus* (Kirby, 1891)					+	+				
86.	*Dasynus fumosus* (Blöte, 1935)						+				
87.	*Dasynus relatus* Paiva, 1919								+		
88.	*Odontoparia nicobarensis* Mayr, 1865										+
89.	*Paradasynus rostratus* (Distant, 1908)					+	+				
90.	*Physomerus grossipes* (Fabricius, 1794)		+			+	+	+	+		
91.	*Physomerus parvulus* Dallas, 1852							+			
92.	*Acanthocoris scabrator* (Fabricius, 1803)		+						+		
93.	*Petalocnemis obscura* (Dallas, 1852)					+	+		+		
94.	*Plinachtus acicularis* (Fabricius, 1803)					+	+				
95.	*Plinachtus basalis* (Westwood, 1842)						+				
96.	*Trallianus chennelli* Distant, 1902								+		
97.	*Cletus bipunctatus* (Herrich-Schäffer, 1840)		+			+	+	+	+		
98.	*Cletus bovillus* Distant, 1918					+	+				
99.	*Cletus calumniator* (Fabricius, 1794)								+		
100.	*Cletus feanus* Distant, 1902							+			
101.	*Cletus punctiger* (Dallas, 1852)							+	+		
102.	*Cletus punctulatus* (Westwood, 1842)		+						+		
103.	*Cletus rubidiventris* (Westwood, 1842)					+	+				
104.	*Cletus trigonus* (Thunberg, 1783)							+			
105.	*Cletomorpha hastata* (Fabricius, 1787)					+	+	+			
106.	*Cletomorpha raja* Distant, 1901		+					+	+		
107.	*Cletomorpha walkeri* Kirby, 1891							+			
108.	*Haidara admota* Distant, 1908					+	+				
109.	*Haidara producta* Distant, 1908					+	+				
110.	*Tongorma campbelli* (Distant, 1918)					+	+				
111.	*Tongorma indicum* (Westwood, 1874)	+	+	+	+	+	+	+	+	+	+
112.	*Hydarella orientalis* (Distant, 1902)		+				+	+			
113.	*Clavigralla gibbosa* Spinola, 1837					+	+				
114.	*Clavigralla scutellaris* (Westwood, 1842)			+							
115.	*Gralliclava horrens horrens* (Dohrn, 1860)					+	+	+			
116.	*Hoplolomia scabricula* Stål, 1873				+						
117.	*Psilolomia brevitibialis* Breddin, 1909					+	+				
118.	*Dicranocephalus lateralis* (Signoret, 1879)					+	+				
119.	*Daclera levana* Distant, 1918					+	+				
120.	*Euthetus atomarius* Distant, 1918					+	+				

S. No.	Name of the species	Trans Himalayas	Himalayas	Desert	Semiarid	Western Ghat	Deccan Plateau	Ganjetic Plain	Northeast India	Coasts	Islands
121.	*Euthetus fulvescens* Distant, 1918					+	+				
122.	*Euthetus khandalana* Distant, 1918				+	+	+				
123.	*Euthetus nigrellus* Distant, 1918					+	+				
124.	*Euthetus pulchellus* Dallas, 1852				+			+			
125.	*Euthetus pulcherrimus* Bergroth, 1909				+	+	+				
126.	*Hypselopus mimicus* Distant, 1918					+	+				
127.	*Hypselopus pronotalis* Distant, 1918						+				
128.	*Nariscus fisheri* (Distant, 1908)					+	+	+			
129.	*Riptortus linearis* (Fabricius, 1775)		+		+	+	+	+	+		
130.	*Riptortus pedestris* (Fabricius, 1775)		+			+	+	+			
131.	*Riptortus strenuus* Horváth, 1889	+			+			+			
132.	*Tenosius proletarius* (Schaum, 1853)							+			
133.	*Acestra malayana* Distant, 1903		+			+	+	+			
134.	*Dulichius inflatus* (Kirby, 1891)						+	+			
135.	*Marcius ornatulus* (Distant, 1908)		+				+	+			
136.	*Leptocorisa acuta* (Thunberg, 1783)					+	+	+			
137.	*Leptocorisa lepida* Breddin, 1909				+	+	+	+			
138.	*Leptocorisa varicornis (Fabricius, 1783)*		+		+	+	+	+	+		
139.	*Stenocoris (Stenocoris) tipuloides* (De Geer, 1773)			+	+						
140.	*Boisea coimbatorensis* (Gross, 1960)					+	+				
141.	*Leptocoris abdominalis abdominalis* (Fabricius, 1803)					+	+	+	+		
142.	*Leptocoris abdominalis taprobanensis* (Dallas, 1852)					+	+				
143.	*Leptocoris augur* (Fabricius, 1781)					+	+	+			
144.	*Leptocoris dispar* (Hsiao, 1963)					+	+				
145.	*Leptocoris rufomarginatus* (Fabricius, 1794)							+			
146.	*Corizus fenestella subsimilis* Horváth, 1917					+	+	+			
147.	*Corizus hyoscyami hyoscyami* (Linnaeus, 1758)	+						+			
148.	*Liorhyssus hyalinus* (Fabricius, 1794)				+						
149.	*Liorhyssus rubicundus* (Signoret, 1859)							+			
150.	*Peliochrous parvipictus* (Distant, 1918)						+				
151.	*Agraphopus lethierryi* Stål, 1872					+	+				

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STUDIES ON THE SEASONAL FLUCTUATION OF GRYLLID POPULATION IN BARDDHAMAN DISTRICT OF WEST BENGAL

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The gryllid represents the most classical type of cricket characterized by the large globular head, the tarsi compressed and the posterior tibiae armed with spines. Numerous workers like Cade (1984, 1991), Cade and Wyatt (1984), Cade and Cade (1992), French and Cade (1987), Ciceran *et al* (1994), Doherty and Storz (1992) studied on the calling behaviour of the gryllids. Some workers like Jang and Gerhardt (2005, 2006) studied on the divergence in the calling songs between sympatric and allopatric population. Works on the population fluctuation of the gryllid fauna is very rare. Only few workers like Biswas and De (2010), Veasey *et al.* (1976), Murray and Cade (1995), studied the gryllid population. So here an attempt was made to study the seasonal fluctuation of the gryllid population in the Barddhaman district of West Bengal.

MATERIAL AND METHOD

This work was undertaken between Nov. 2009 and Nov. 2011. The localities selected for the present study were at Golapbag (adjoining) forest, Aushgram forest, Katwa, Sriniketan, Ketugram, Raina and Durgapur. As the gryllids are nocturnal in habit the collections were made in evening from 6.30 pm to 9 pm in Pre-monsoon and from 6 pm to 8 pm in the Post monsoon using light source to attract the insects. To study the population of the gryllids $10m^2$ plots were selected in forests, grassland and harvested paddy fields. A lighted petromax was used as light source to collect the gryllids. The lighted petromax was put in the middle point of the selected $10m^2$ plots and the gryllids attracted by the light source collected by sweeping the insect net and by hand picking. To know the actual

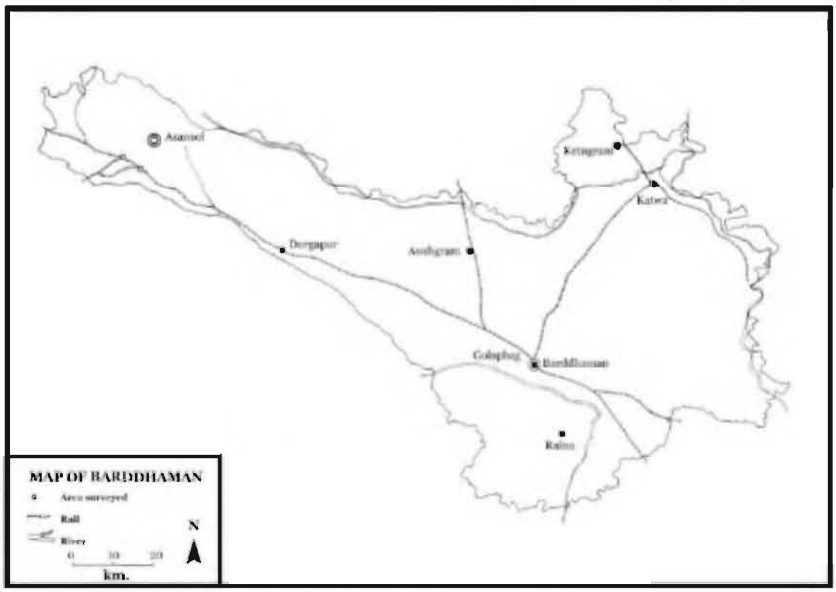


Fig. 1. : Map of Barddhaman District

population of the area seven such plots were selected and in each $10m^2$ plot the petromax was kept for half and hour. The average number of five plots in each habitat has been taken in to account to estimate the population of the gryllid fauna present per square metre.

RESULTS AND DISCUSSION

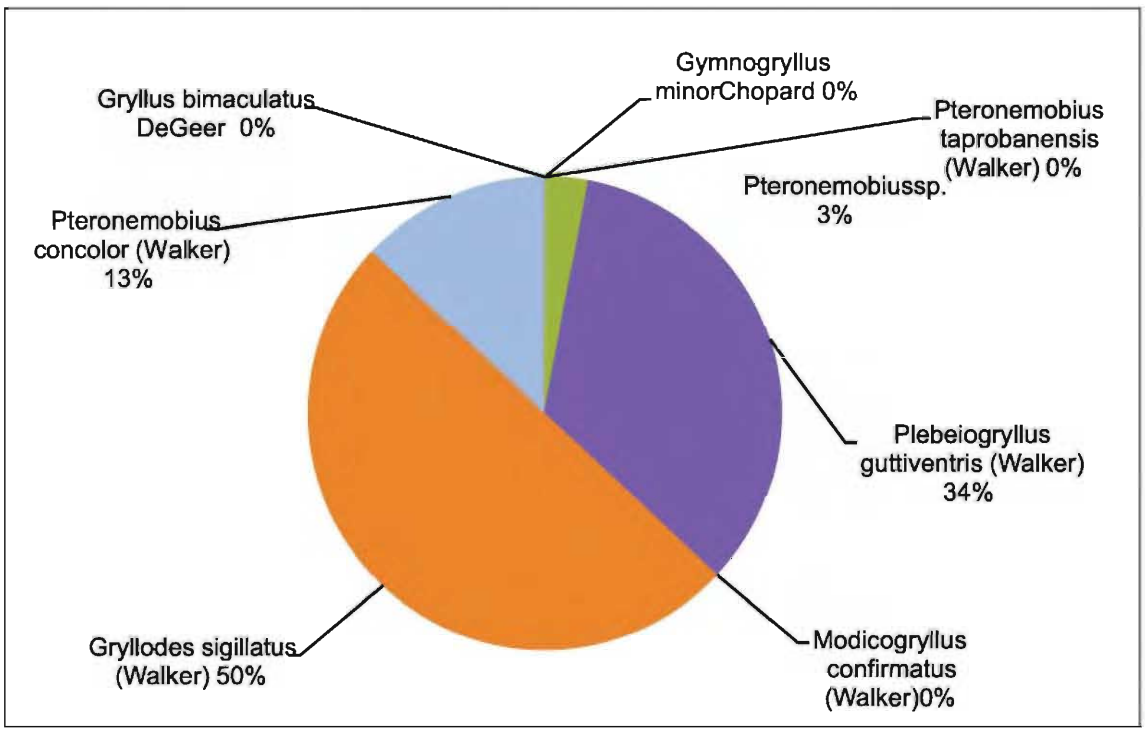
In the present study the collections were made in different seasons in different habitats. It was found that the total population of gryllids was always higher in post monsoon than that of pre-monsoon in all the habitats. It is also found that the total population of gryllids was always higher in the harvested paddy fields than that of the grassland and forest. The average number of gryllid present in three habitats in different seasons ranges from $0.05/m^2$ to $0.16/m^2$ in grassland, from $0.10/m^2$ to $0.28/m^2$ in forest and from $0.10/m^2$ to $0.56/m^2$ in harvested paddy fields (Table-2)

The rise and fall in the numbers of different species appear independent of each other. Eight species identified and their occurrences were different in different season (Fig. 1). Among the eight species *Gryllodes sigillatus* (Walker) shows the dominance in all seasons and occupying about

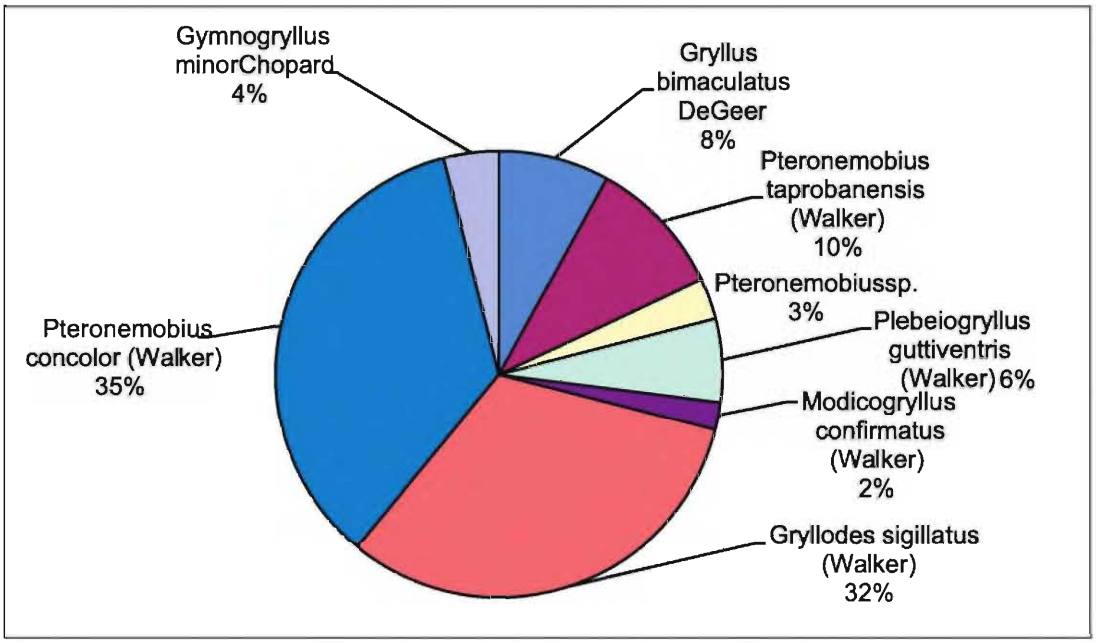
Table 1.: Gryllid Population per m^2 in different seasons in Grassland, Forests and Harvested paddy field.

Vegetation	Seasons	Average Gryllid population per m2
Grassland	Pre-monsoon	0.05
Grassland	Post-monsoon	0.16
Forest	Pre-monsoon	0.10
Forest	Post-monsoon	0.28
Harvested paddy field	Pre-monsoon	0.10
Harvested paddy field	Post-monsoon	0.56

Fig. 2.: Relative Abundance of eight species of Gryllid population in Premonsoon and Postmonsoon season.



PREMONSOON



POSTMONSOON

50% and 31.74% of the total population in premonsoon and postmonsoon respectively. As regards the abundance of the other species *Plebeiogryllus guttiventris* (Walker) occupies the second position in premonsoon having 33.33% of the population. However four species namely *Modicogryllus confirmatus* (Walker), *Gymnogryllus minor* Chopard, *Gryllus bimaculatus* De Geer and *Pteronemobius taprobanensis* (Walker) were altogether absent during premonsoon period. All eight species were recorded during postmonsoon period with *Pteronemobius concolor* (Walker) and *Gryllodes sigillatus* (Walker) showing dominance with 34.92% and 31.74% respectively of the collection during the season. The genera *Pteronemobius* and *Gryllodes* were most frequent in occurrence in all the collections of all the seasons.

As regards the adult nymph ration it was found that in the premonsoon collection the nymphs were very scanty but they were very frequent in post monsoon collection. While the premonsoon collection occupies 3.22% of the total population during postmonsoon the nymphs occupy 91.09% of the total population. The presence of large number of nymphs in the postmonsoon period suggests that the monsoon is the breeding season of this group of insects.

The comparative higher number of gryllids in forest habitat than in the grassland and harvested paddy fields may be due to the availability of the required food for their living comparatively lesser human interference. Fluctuations of different species in different seasons may be due to the favourable seasonal conditions and breeding period.

SUMMARY

Gryllid population was studies in forest, grassland and harvested paddy field in the Barddhaman district during Nov. 2009 to Nov. 2011. The population of the gryllid fauna in the harvested paddy field was always higher than that of the grassland and forest area. Eight species of gryllids were identified of which genera *Pteronemobius* and *Gryllodes* were most frequent in occurrence in all the collections of all the seasons. The availability of the nymphs is much higher in postmonsoon period than in premonsoon.

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THYSANOPTERA FAUNA OF CHHATTISGARH INDIA

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INTRODUCTION

Order Thysanoptera include approximately 6000 species across the globe in which nearly 700 species are reported from India (Thrips Wiki 2013), accounting for about 10% of the total world fauna. In spite of excellent efforts on taxonomy to reveal the biodiversity of these tiny (1-2 mm), and economically important insect (as crop pest and vectors for tospoviruses) in India, we still have geographical regions which are practically unsurveyed for thrips biodiversity; Chhattisgarh is one of them along with Gujarat, Odisha and Sikkim etc. It is to mention that till date no thrips species have been reported from Chhattisgarh state of India and even the localities from where recent collection have been made were never been surveyed as per literature (Ananthakrishnan 1980 & Bhatti 1990). During the recent survey of Chhattisgarh, 7 species of thrips have been identified and are being reported here for the first time. All these new records are in two families of Suborder Terebrantia. The members of the family Aeolothripidae of suborder Terebrantia are predators on thrips and mites and presently represented by one species namely *Franklinothrips vespiformis* (Crawford). The members of the family Thripidae of suborder Terebrantia are very injurious to crop plants and represented by six species, namely, *Frankliniella schultzei* (Trybom), *Megalurothrips usitatus* (Bagnall), *Thrips florum* Schmutz, *Thrips hawaiiensis* (Morgan), *Thrips palmi* Karny, *Thrips subnudula* (Karny).

The objective of this paper is to report seven species of thrips from Chhattisgarh for the first time. Diagnostic features, distribution details, material studied, and registration number as recorded on each slide mounted specimen housed at Zoological Survey of India in National Zoological Collections (NZC), Kolkata are provided for new records.

Specimens collected by beating method were preserved in collecting fluid (9 parts 10% alcohol + 1 part glacial acetic acid + 1 ml Triton X-100 in 1000ml of the mixture) and mounted on to the glass slides in Canada balsam (Bhatti 1999). The photographs were taken through a Leica Trinocular Microscope (Leica DM-1000) and using Leica software application suite (LAS EZ 2.1.0).

All the species are listed with their valid names, authority and the year of description. Species are listed systematically and alphabetically. The classification adopted in the article is that of Mound, Heming and Palmer (1980).

Family AEOLOTHRIPIDAE

Franklinothrips vespiformis (Crawford DL)

1909, *Aeolothrips vespiformis* Crawford DL. *Pomona, Coll. J. Ent.*, 109.

Diagnostic characters: Body bicoloured. Antennal segments yellow except IV dark. Fore wing with subapical pale area. Head rounded, basal abdominal segments narrow, appearing ant-like in females, not constricted in males. Maxillary palps 3-segmented. Antenna 9-segmented, long and thin, sense cones on segments III and IV extending along the whole length of segments. This species is widespread predator of thrips and mites.

Material studied : 3♀ , Chhattisgarh, Dantewada, 2.ii.2013, from general vegetation, Girish Kumar.

Distribution : India: Chhattisgarh (new record), Karnataka, Maharashtra.

Family THRIPIDAE

Frankliniella schultzei (Trybom)

1910, *Physothrips schultzei* Trybom. *Denksch. Med.-natur. Gesel.*, 151.

Diagnostic characters : Body brown. Ocellar setae III close together to anterior margin of hind ocelli. Abdominal tergite VIII with posteromarginal comb represented by not more than 1 to 3 hairs. This species is a widespread pest, and is a vector of Tospovirus, Tomato spotted Wilt.

Material studied : 1♀ , Chhattisgarh, Kobra, 3.vi.2012, general vegetation, No. CHCAM 3115, coll. Angshuman Raha and Party.

Distribution : India: Andaman Island, Chhattisgarh (new record), Delhi, Karnataka, Meghalaya, Tamil Nadu, Uttar Pradesh.

Megalurothrips usitatus (Bagnall)

1913, *Physothrips usitatus* Bagnall *Ann. Mag. Nat. Hist.*, (8) **12** (69): 293-294.

Diagnostic characters: Female body brown but male bicoloured with pale pronotum. Antennal segment III pale, VI brown. Fore wing banded. This species is very difficult to identify based on females as according to Palmer 1987.

Material studied: 1♀ , Chhattisgarh, Surguja, Ambikapur, 4.vi.2012, from *Lantana camara*, No. CHCAM 3458, coll. Angshuman Raha and Party.

Distribution: India: Chandigarh, Chhattisgarh (new record), Delhi, Karnataka, Tamil Nadu, Uttar Pradesh.

Thrips florum Schmutz

1913, *Thrips florum* Schmutz *Sitz.-ber. Akad. Wiss. Wein, math.-naturw.* Kl., Abt. I, **122**(7): 1003-1005.

Diagnostic characters: Female body brown, male with body pale yellow. Fore wing clavus with 5 setae on anal vein, apical veinal seta shorter than subapical veinal seta and basal discal seta longer than apical veinal seta or subequal to it. Postocular setae No. 2 and 4 distinctly shorter than No. 1 and 3, which are subequal. Metanotum completely unsculptured near to anteromedian pair of companiform sensilla. Tergite IX of male with S2 seta very slender, much thinner and shorter than S1, and inserted very close to it; sternites III-VII each with transversely elongate pore area.

Material studied: 4♀ , Chhattisgarh, Durg, 6.vi.2012, from *Lantana camara*, No. CHCAM 3625; 5♀ , Surguja, Ambikapur, 4.vi.2012, *Lantana camara*, No. CHCAM 3458; 1♀ , Kawardha, Saroda dam, 22.ix.2012, No. CHCAM 3600; 1♂ , Kobra, general vegetation, No. CHCAM 3115, coll. Angshuman Raha and Party.

Distribution: India: Andaman Island, Chhattisgarh (new record), Delhi, Karnataka, Punjab.

Thrips hawaiiensis (Morgan)

1913, *Euthrips hawaiiensis* Morgan. *Proc. U. S. Nat. Mus.*, 46: 3-5.

Diagnostic characters: Female body bicoloured, male with body pale yellow. Fore wing clavus with 5 setae on anal vein, apical veinal seta longer than subapical veinal seta and basal discal seta shorter than apical veinal seta or subequal to it. Postocular setae No.2 usually as long as 3, No. 4 shorter than No. 3. Metanotum with transeverse line of sculpture near to anteromedian pair of companiform sensilla. Tergite IX of male with S2 seta not thinner than S1, subequal and slightly shorter than S1, and inserted far away from S1; sternites III-VII each with transversely oblong and medially narrowed pore area.

Material studied: 4♀ , Chhattisgarh, Durg, 6.vi.2012, from *Lantana camara*, No. CHCAM 3625; 5♀ , Surguja, Ambikapur, 4.vi.2012, *Lantana camara*, No. CHCAM 3458; 1♀ , Kawardha, Saroda dam, 22.ix.2012, No. CHCAM 3600; 1♂ ,

Kobra, general vegetation, No. CHCAM 3115, coll. Angshuman Raha and Party.

Distribution: India: Andaman Island, Assam, Chhattisgarh (new record), Delhi, Karnataka, Meghalaya, Sikkim, West Bengal.

Thrips palmi Karny

1925, *Thrips palmi* Karny *Bull. Deli Proefst. Medan*, **23**: 10-15.

Diagnostic characters: Body bright golden yellow including wings and legs. Antenna 7-segmented. Ocellar setae III outside ocellar triangle. Metanotum with longitudinal lines of sculpture and these lines converging mesad posteriorly and middle; median pair of setae inserted far back of anterior margin; companiform sensilla present. Comb of posterior margin of tergite VIII complete. Abdominal sternites III-VII of male each with a transversely elongate pore area.

Material studied: 1♀ , Chhattisgarh, Durg, 6.vi.2012, from *Lantana camara*, No. CHCAM 3625, coll. Angshuman Raha and Party.

Distribution: India: Chhattisgarh (new record), Delhi, Karnataka, Punjab.

Thrips subnudula (Karny)

1927, *Ramaswamiahiella subnudula* Karny *Mem. Dept. Agric. India, Ent. Ser.*, **9**(6): 208-210.

Diagnostic characters: Body pale yellow. Antenna 7-segmented. Ocellar setae III inserted behind fore ocellus, with in ocellar triangle. Metanotal median pair of setae inserted far back of anterior margin. Abdominal sternites and laterotergites with accessory setae. Abdominal sternites with numerous posteromarginal setae.

Material studied: 1♀ , Chhattisgarh, Kobra, 2.vi.2012, from *Lantana camara*, No. CHCAM 3173, coll. Angshuman Raha and Party.

Distribution: India: Chhattisgarh (new record), Delhi, Haryana, Karnataka, Madhya Pradesh, Maharashtra, Orissa, Punjab, Rajasthan, Tamil Nadu, West Bengal.

Family PHLAEOTHRIPIDAE

Haplothrips ganglbaueri Schmutz

1913, *Haplothrips ganglbaueri* Schmutz *Sitz. Ber. Akad. Wiss. Wein, Math.-naturw.* KI. Abt. I, **122**(7): 1034-1036.

Diagnostic characters: Brown species. Antenna 8-segmented; III asymmetrical. Segment III with one sense cone and IV with 2+2(+1) sense cones. Notopleural sutures complete. All dorsal prothoracic setae well developed and expanded apically. Fore wing with 4-7 duplicated cilia. Tergites III to VII each with 2 pairs of wing retaining setae. S1 setae on tergite IX bluntly pointed. Tube shorter than head. Anal setae slightly shorter than tube.

Material studied: 1♀ , Chhattisgarh, Kobra, 2.vi.2012, from *Lantana camara*, No. CHCAM 3173; 1♀ , 3.vi.2012, general vegetation, No. CHCAM 3115; 1♀ , Kawardha, Saroda Dam, 22.ix.2012, *Lantana camara*, No. CHCAM 3600; 2♀ , Bilaspur, Achanakmar WLS, 11.vi.2012, *Lantana camara*, No. CHCAM 3313, coll. Angshuman Raha and Party.

Distribution: India: Andaman Island, Andhra Pradesh, Chhattisgarh (new record), Delhi, Haryana, Karnataka, Madhya Pradesh, Meghalaya, Punjab, Rajasthan, Sikkim, Tamil Nadu, Tripura, Uttar Pradesh, West Bengal.

SUMMARY

This is the first report of thrips species from Chhattisgarh so far. More extensive surveys need to be undertaken in Chhattisgarh, which may yield more species from this practically untouched area for thrips and well as other insect taxa.

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1. ***Franklinothrips vespiformis*** (Crawford)

2. ***Frankliniella schultzei*** (Trybom)

3. ***Megalurothrips usitatus*** (Bagnall)

4. ***Thrips florum*** (Schmutz)

5. ***Thrips hawaiiensis*** (Morgan)

6. ***Thrips palmi*** Karny

7. ***Thrips subnudula*** (Karny)

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A TAXONOMIC STUDY ON THE GENUS *ANTERHYNCHIUM* DE SAUSSURE (HYMENOPTERA: VESPIDAE: EUMENINAE) FROM INDIAN SUBCONTINENT

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INTRODUCTION

Saussure, 1863, proposed the name *Anterhynchium* for division I of genus *Rhynchium* Spinola in Saussure, 1852. Vecht, 1963, designated *Rygchium synagroides* Saussure, 1852, as the type species. The genus *Anterhynchium* de Saussure is distributed at Australian, Ethiopian, Oriental and Palearctic Regions of the world. Forty four species are recorded under this genus from the world (GBIF Data Portal webpage) of which five species namely *Anterhynchium (A.) abdominale* (Illiger), *A. (A.) mellyi* (de Saussure), *A. (Dirhynchium) coracinum* Vecht, *A. (D.) flavolineatum* (Smith) and *A. (D.) flavomarginatum* (Smith) are recorded from Indian subcontinent. All the species from Indian subcontinent are herewith described in detail. The male of the species *Anterhynchium (Dirhynchium) coracinum* Vecht is described here for the first time. The subspecies *A. (D.) flavomarginatum curvimaculatum* (Cameron), 1903, is synonymized under the nominate species *A (D.) flavomarginatum* (Smith). Several new distributional records are also reported in this paper.

MATERIAL AND METHODS

This study is based on about 108 specimens present in the Hymenoptera Section of the Zoological Survey of India, Kolkata. All the specimens were properly preserved and added to the 'National Zoological Collections' of the Hymenoptera Section of the Zoological Survey of India, Kolkata (NZSI).

Abbreviations used for the Museums: BMNH = British Museum (Natural History), London, England; MHNG = Muséum d'Histoire Naturelle, Genéve, Switzerland; MP = Muséum National d'Histoire Naturelle, Paris, France; NZSI = 'National Zoological Collections' of Zoological Survey of India, Kolkata, India; OUM = Oxford University Museum, Oxford, U. K.; UZMC = Universitetets Zoologiske Museum, Copenhagen, Denmark; ZMB = Zoologisches Museum der Humboldt Universität, Berlin, Germany.

Abbreviations used for the terms: F1-F2 = Flagellar segments 1 to 2; H = Head; M = Mesosoma; OOL = Ocellocular distance; POL = Post ocellar distance; SI-SVII = Metasomal sternites I to VII; TI-T2 = Metasomal tergites 1 to 2.

RESULTS

Genus *Anterhynchium* de Saussure

1863. *Anterhynchium* de Saussure, *Mém. Soc. Phys. Hist. Nat. Gèneve*, **17** (1): 205, name for division I of genus *Rhynchium* Spinola *in* de Saussure, 1852, *Ét. Fam. Vesp.*, **1**: 103, and de Saussure, 1855, *loc. cit.* **3**: 175. Type species: *Rygchium synagroides* de Saussure, 1852, by subsequent designation of van der Vecht, 1963, *Zool. Verh., Leiden*, **60**: 73.

1904. *Anterrhynchium* Dalla Torre, *Genera Insect.*, 19: 33 (incorrect spelling of *Anterhynchium* de Saussure).

Diagnosis: Clypeus of female pear-shaped, usually somewhat constricted before the narrow and slightly emarginate apex (Fig. 3); mandibles of female on inner side with four rather broad and irregularly shaped teeth, the basal tooth emarginate at apex, in the male the inner side of the mandible often considerably modified; palpal formula 6:4 (maxillary palpi with 6 segments and labial palpi with 4 segments); vertex of female with shallow post-ocellar fovea; pronotum with complete transverse carina, its anterior surface smooth, without median pits or impressions; mesoscutum and scutellum (Image 24) densely punctate throughout; tegula not evenly rounded posteriorly, emarginated adjoining parategula and shorter than parategula at apex (fig. 5); axillary fossa narrowed, slit-like; metanotum with a horizontal part, and a usually somewhat longer declivous part, the transition often not sharply indicated, more or less distinctly marked by an irregularly crenulate ridge, not projecting over propodeum, not flat but angled, not bidentate; propodeum without horizontal part behind the metanotum, the declivity at base with a more or less elongate triangle, bordered on each side by a groove, the lower half with more or less distinct median carina, which is gradually dilated towards the apex; propodeum without apical spines above the valvulae; forewing (Fig. 2) with second recurrent vein never very close to the second intercubital vein, third sub marginal cell separated from apex of marginal cell by about its own length, second sub marginal cell not petiolate, prestigma half or more the length of the pterostigma; abscissae I+ 2 of radial vein shorter than 3 + 4; first intercubital vein steep to moderately oblique; outer vein of third discoidal cell almost straight to moderately curved; anal vein of hindwing usually with short appendage running from the submedian cell in the direction of the preaxillary excision. Midtibia with 1 spur; mid femora of male not distinctly emarginate at base; metasoma (Images 4, 7 & 20) not petiolate, segment I with width more than half that of segment II, much less than twice as long as wide; T1 not transversely carinate; dilated part of SI bordered anteriorly by an arcuate carina; transverse basal groove of SII not distinctly costate; male SVII without tubercles; digitus volsellaris of male genitalia (Image 17) longer, pubescent, at base with short black denticles.

Distribution: Australian, Ethiopian, Oriental and Palearctic Regions.

Key to species/subspecies of the genus *Anterhynchium* de Saussure from Indian subcontinent

(Modified from Vecht, 1963)

1. Narrow basal part of first gastral sternite smooth (Fig. 1), or with only a narrow median band of fine short and shiny transverse striae; gastral tergites only finely punctate at base; mandibles of male deeply emarginate on inner side near the middle. Subgenus ***Anterhynchium*** s. str. 2

- Narrow basal part of first gastral sternite densely transversely striate over almost its entire width (Fig. 6); third and following gastral tergites very coarsely punctate at base (visible only when the segments are unusually extended); mandibles of male not deeply emarginate on inner side. Subgenus ***Dirhynchium***. 4

2. Basal two thirds of second gastral tergite distinctly punctate, except in the middle, the interspaces generally larger than the punctures. ..... ***mellyi*** (de Saussure).

- Basal two thirds of second gastral tergite very finely and shallowly punctate, the interspaces everywhere much larger than the punctures. ***abdominale*** (Illiger) 3

3. Gaster (Image 4) mostly red except the following black markings: a narrow transverse band at the apex of first gastral tergite, a spot on the middle of posterior apex of the second tergite and sternite (sometimes third, fourth and fifth tergites and sternites also), last tergite and sternite usually entirely black..... ***abdominale abdominale*** (Illiger)

- Gaster (Image 7) entirely black (in some specimens the apical margins of the second and following tergites, as well as the sides of the

first and second are partly blackish brown)...***abdominale bengalense*** (de Saussure)

4. Mesoscutum (Image 24) posteriorly very densely punctate, the interspaces showing a tendency to run into irregular longitudinal striae; gaster (Image 22) black except first and second gastral tergites with narrow pale yellow apical band, both narrow yellow apical bands complete.....***flavomarginatum*** (Smith)

- Mesoscutum posteriorly more sparsely punctate, here several interspaces at least as large as the diameter of the punctures. 5

5. Gaster black (Image 11) (in some specimens only first gastral tergites with narrow pale yellow medially interrupted apical band, in some other specimens first and second gastral tergites with narrow pale yellow medially interrupted apical band); thorax with sparse yellowish white markings (Image 11); wings brown with violaceous reflections; temple strongly punctured; lower metapleuron with rugose punctures and irregular transverse striations; declivity of propodeum bordered dorsally by a somewhat strong irregular carina.....***coracinum*** Vecht

- Gastral tergites with yellow apical bands (Image 20), the bands on tergites 1 and 2 dilated laterally; thorax extensively marked with yellow (Image 18); wings fusco-hyaline, darkest at anterior margin of forewing; temple not strongly punctured; lower metapleuron almost smooth with very fine punctures and irregular striations; declivity of propodeum without such carina dorsally.....***flavolineatum*** (Smith)

Subgenus *Anterhynchium* de Saussure s. str.

Diagnosis: Narrow basal part of first gastral sternite smooth, or with only a narrow median band of fine short and shiny transverse striae; gastral tergites only finely punctate at base; mandibles of male deeply emarginate on inner side near the middle.

1. ***Anterhynchium (Anterhynchium) abdominale*** (Illiger)

There are two distinct colour forms are present under this species which have usually been regarded as different species by many old workers. Vecht (1963) treated these two colour forms as two subspecies of *A. abdominale* (Illiger) such as *A. (A.) abdominale abdominale* (Illiger) and *A. (A.) abdominale bengalense* (de Saussure). Both of them are very close to each other in their structure and sculpture. But the colours of metasoma of these two forms are distinctly different. The metasoma of *A. abdominale* is predominantly orange-red with some black markings but the metasoma of *A. bengalense* is entirely black. While studying a large collection from different localities of the Indian subcontinent, I found that these forms are not geographically segregated. So, it requires further studies for the confirmation of species status of each colour form. For the time being I am following the concept of van der Vecht and considering them as two colour forms (subspecies) of the same species.

Diagnostic characters: This species differ from all other Indian subcontinent species of this genus by the following combination of characters: clypeus with weak punctures, from the middle of clypeus to apex with few irregular longitudinal striations; narrow basal part of first gastral sternite smooth (Fig. 1); gastral tergites only finely punctate at base; basal two thirds of second gastral tergite very finely and shallowly punctate, the interspaces everywhere much larger than the punctures; mandibles of male deeply emarginate on inner side near the middle.

(a). ***Anterhynchium (Anterhynchium) abdominale abdominale*** (Illiger)

(Figs. 1-2; Images 1-6)

1802. *Vespa abdominalis* Illiger, *Magaz. Insektenk*, 1: 192, "Bengalen" (? ZMB).

1804. *Vespa transversa* Fabricius, *Syst. Piez.*: 257, "Tranquebar" (UZMC).

1852. *Rhygchium dichotomum* de Saussure, *Et. Fam. Vesp.*, 1: 116, male, female, "Indes Orientales" (MP).

1852. *Rygchium transversum*; de Saussure, *Et. Fam. Vesp.*, 1: 117, pl. XIV fig. 7, (female; ? Madagascar; Indes Orientales).

1855. *Rhynchium abdominale*; de Saussure, *Et. Fam. Vesp.*, 3: 172 (syns.: *R. transversum* (Fabricius); *R. dichotomum* de Saussure is a variety).

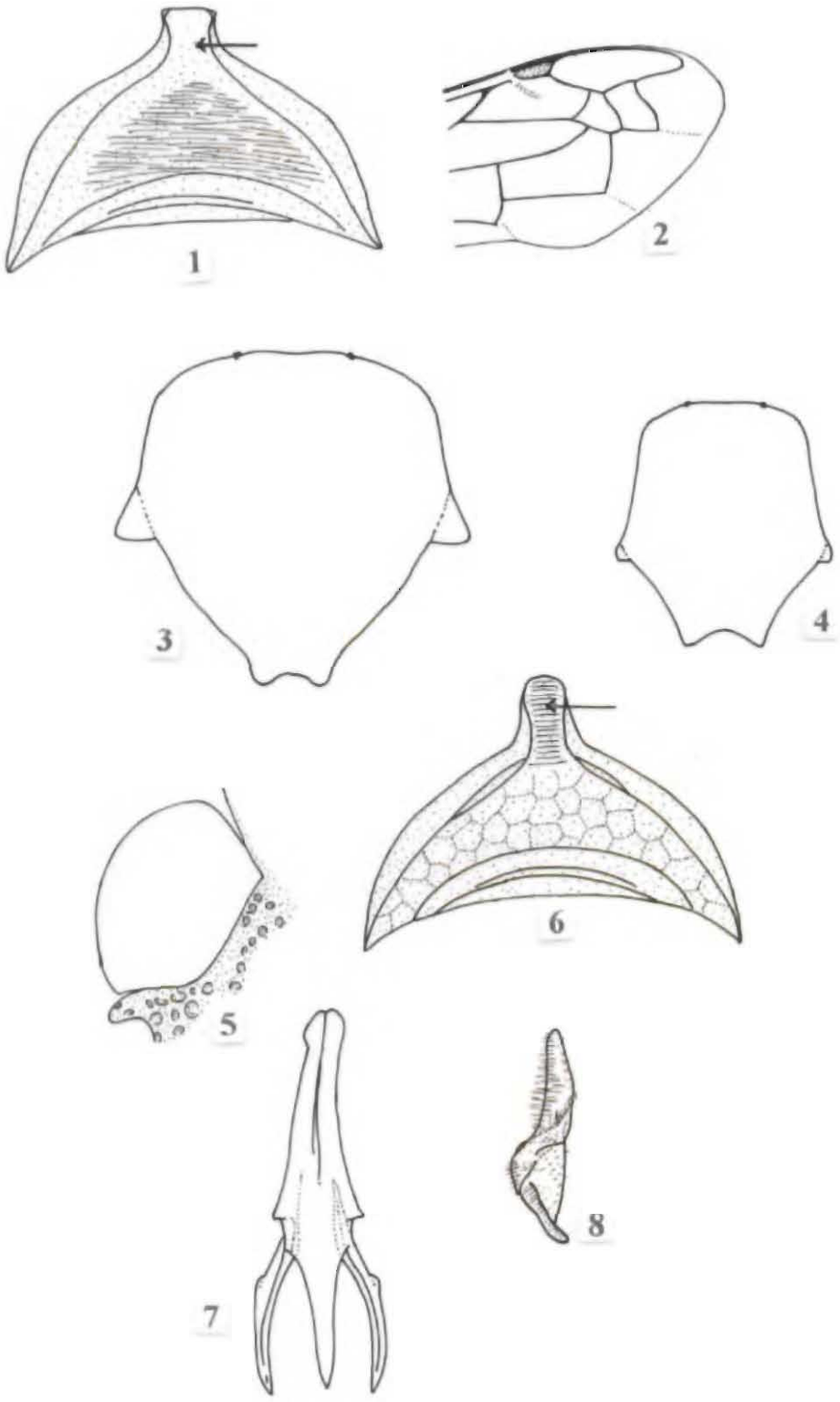

Fig. 1 : ***Anterhynchium (Anterhynchium) abdominale abdominale*** **(Illiger)** Female first gastral sternite; **Fig. 2.** ***A. (A.) abdominale abdominale*** **(Illiger)** Male apical half of Forewing (Courtesy, Vecht, 1963); **Fig. 3.** ***A. (Dirhynchium) coracinum*** **Vecht** Female clypeus; **Fig. 4.** ***A. (D.) coracinum*** **Vecht** Male clypeus; **Fig. 5.** ***A. (D.) coracinum*** **Vecht** Male tegula and parategula; **Fig. 6.** ***A. (D.) coracinum*** **Vecht** Male first gastral sternite; **Fig. 7.** ***A. (D.) flavomarginatum*** **(Smith)** Male aedeagus (Courtesy, Vecht, 1963); **Fig. 8.** ***A. (D.) flavomarginatum*** **(Smith)** Male Volsella (Courtesy, Vecht, 1963).

1855. *Rhynchium abdominale* var. *dichotomum*; de Saussure, *Et. Fam. Vesp.*, **3**: 172.

1857. *Rhynchium transversum*; Smith, *Cat. Hym. Brit. Mus. V, Vesp.*: 48 (?Madagascar).

1918. *Odynerus abdominalis*; Bequaert, *Bull. Am. Mus. Nat. Hist.*, **39**: 292 (in subgenus *Rygchium*; cat.).

1963. *Anterhynchium abdominale*; van der Vecht, *Zool. Verh., Leiden*, **60**: 75, fig. 5e (forewing) (Calcutta, Walayar forest, Cinchona, Ceylon).

Female: Body length (H+M+T1+T2) 12-14.5 mm; Forewing length 12-14 mm. Head and mesosoma black; metasoma (Image 4) dull orange-red with variegated black markings as follows: the basal segment with a transverse black apical band (in some specimens, the black colour on T1 more pronounced and in few specimens T1 completely black), T2 with or without a transverse black spot in the middle of its apical margin (in few specimens, the black colour is more pronounced), the remaining segments usually orange-red except last segment black, gastral sternites usually orange-red with varying degree of black colour except last segment entirely black. Brown colouration as follows: ventral side of antenna and tarsal segments (sometimes black). Wings dark fuscous with purple reflections.

Head: 1.05x as wide as long in front view (Image 1); clypeus pear-shaped, somewhat constricted before the narrow and emarginate apex, maximum width 1.05x length medially, with weak punctures, from the middle of clypeus to apex with few irregular longitudinal striations; mandibles on inner side with four rather broad and irregularly shaped teeth, the basal tooth emarginate at apex; labrum elongate rounded at apex; interantennal space almost smooth with few weak punctures; a short but distinct strong carina is present at the middle of interantennal space; frons closely, strongly and rugosely punctured, the diameters of the punctures greater than the distance between the punctures; ocular sinus with weak punctures; area between the antennal toruli and inner eye margin smooth; POL 0.84x OOL (Image 2); diameter of anterior ocellus 2.11x longer than the distance between anterior ocellus and posterior ocelli; vertex with moderately strong punctures except at shallow post ocellar fovea and area towards occipital carina less punctured; temple with moderately strong punctures, 1.11x narrower than eye in profile (measured through its ocular sinus); interocular distance 0.89x greater on vertex than at clypeus; occipital carina strong, complete and narrowed ventrally. Antenna (Image 3) 2.40x farther from each other than from eyes; antennal scrobe granulately punctured; scape 1.81x as long as F1, 3.88x as long as wide; pedicel 0.37x F1, 0.92x as long as wide; F1 1.77x as long as F2, 2.10x as long as wide; flagellar segments slightly widening towards apex except last segment; apical antennal segment 1.17x as long as wide.

Mesosoma: Anterior face of pronotum smooth without punctures; pronotal carina strong and almost reaching the lateral margin of pronotum; posterior face and lateral sides of pronotum, mesoscutum and scutellum strongly, closely and rugosely punctate, scutellum smooth at lateral sides with indistinct weak traces of longitudinal striations, mesoscutum 0.98x as long as wide; metanotum gibbous, strongly and irregularly punctate basally, smooth apically; lateral side of propleuron almost smooth, ventral side smooth with scattered punctures; mesopleuron rugosely punctured except epicnemium and posterior margin smooth; epicnemial carina distinct, complete; upper metapleuron smooth posteriorly and distinctly punctate anteriorly, lower metapleuron smooth with irregular weak transverse striations at lateral sides. Propodeum vertical, concavo-truncate posteriorly, declivity of propodeum not bordered dorsally by a somewhat strong irregular carina, dorsolateral margin of propodeum ending posteriorly with a sharp teeth-like projection, the triangular area at the base of propodeum as long as wide, bordered on each side by a deep groove, punctures on dorsolateral area strong and rugose, posterior concave area of propodeum with irregular transverse striations, lateral sides of propodeum transversely striated with few rugose punctures at upper and posterior sides. Tegula not evenly rounded posteriorly, emarginated adjoining parategula and shorter than parategula at apex; axillary fossa narrowed, slit-like. Midtibia with 1

spur. Forewing (Fig. 2) length 2.83x its maximum width, prestigma 0.71x pterostigma.

Metasoma (Image 4): T1 1.55x as wide as long, 0.89x as wide as T2; T1 almost smooth with minute scattered punctures on lateral sides; basal two thirds of T2 very finely and shallowly punctate, the interspaces everywhere much larger than the punctures, coarsely punctate near the apical margin; visible part of remaining tergites except last tergite with distinct punctures; the narrow basal part of S1 smooth (Fig. 1), posterior transverse area of S1 rather irregularly transversely striate, S2 and visible part of remaining sternites except last sternite with distinct punctures; last tergite and sternite almost smooth with few fine scattered punctures.

Male (Image 5): Body length (H+M+T1+T2) 9-12 mm; Forewing length 9.5-12 mm. Colour pattern is almost same as that of female except clypeus almost entirely yellow with the lateral and apical margins black and scape in front yellow. Head (Image 6) 1.23x as wide as long in front view; interocular distance 1.19x greater on vertex than at clypeus; clypeus more elongate and the apex between two teeth more deeply emarginated than female, width 1.04x length medially; POL 1.15x OOL; antenna with the last segment hooked apically and almost reaches the apex of tenth antennal segment in curved position; apical tip of aedeagus rounded, parallel spines elongate without hairs. Other characters almost same as in female.

Material examined: INDIA: Delhi: Delhi University campus, 3♀ & 4♂, 4.ix.1954 (2 exs.), 23.ix.1962 (1 ex.), 30.vi.1971 (1 ex.), 20.ix.1976 (3 exs.), Coll. V. K. Gupta & Party, NZSI Regd. Nos. 13253/H3 to 13259/H3. Jharkhand: Ranchi, 1♂, date of collection unknown, Coll. W. H. Irwine, 13260/H3. Karnataka: Bengaluru, 1♀ & 2♂, date of collection unknown, Coll. J. Cameron, 13261/H3 to 13263/H3. Kerala: Thiruvananthapuram, 1♂, April 1888, name of collector unknown, 13264/H3. Odisha: Ganjam district, Balighai, 1♀, 20.viii.1911, Coll. F. H. Graveli, 13265/H3. Sikkim: exact locality not known, 1♀, August, 1897, Coll. Dudgeon, 13266/H3. Tripura: West Tripura district, Teliamura, 1♀ & 1♂, 20.v.1978, Coll. J. K. Jonathan & Party, 13267/H3 & 13268/H3; Baramura, 1♀, 22.v.1978, Coll. J. K. Jonathan & Party, 13269/H3; Dhalai district, 6♀ & 4♂, 26.v.1978, Coll. J. K. Jonathan & Party, 13270/H3 to 13279/H3. Uttar Pradesh: Jhansi, 1♂, 2.viii.1905, Coll. Brunetti, 13280/H3; Rae Bareily district, Malikmau, 1♂, 13.ix.2006, Coll. M. Sil & Party, 13281/H3; Chitrakoot, 1♂, 22.x.2007, Coll. S. Sheela & Party, 13282/H3; Ghaziabad district, Chaprola, 1♀, 16.xi.2007, Coll. S. I. Kazmi & Party, 13283/H3. West Bengal: Kolkata, 4♀ & 8♂, date of collection and name of collectors unknown, 13284/H3 to 13295/H3; Kolkata environs, 3♂, 17.vii.1904, Coll. Brunetti, 13296/H3 to 13298/H3; Kolkata, 3♀ & 5♂, 13.ix.1906 (1 ex.), 19.ix.1907 (3 ex.), 26.ix.1907 (2 exs.), 18.x.1907 (2 exs.), name of collectors unknown, 13299/H3 to 13306/H3; Murshidabad, 2♀ & 1♂, date of collection and name of collectors unknown, 13307/H3 to 13309/H3; Purulia district, Adra, 1♀, 2.x.1909, Coll. J. T. Jenkins, 13310/H3; S-24 Parganas district, Sunderbans Biosphere Reserve, Sagar Islands, 1♂, 17.vi.1977, Coll. R. C. Basu & Party, 13311/H3; Paschim Medinipur district, Rajbari, 1♀, 3.x 1983, Coll. A. K. Hazra & Party, 13312/H3; Purulia district, Ajodhya Hills, 1♂, 4.xi.1985, Coll. M. Dutta & Party, 13313/H3; Purba Medinipur district, Tamluk, 1♀, 13.viii.1988, Coll. B. C. Das & Party, 13314/H3. PAKISTAN: Karachi, 1♀, date of collection unknown, Coll. Cumming, 13315/H3.

Distribution: India: Chhattisgarh, Delhi (new record), Jharkhand (new record), Karnataka (new record), Kerala, Odisha (new record), Rajasthan, Sikkim, Tamil Nadu, Tripura (new record), Uttar Pradesh, West Bengal. Elsewhere: Myanmar, Pakistan, Sri Lanka. *Nest*: See Krombein, 1991.

(b). *Anterhynchium (Anterhynchium) abdominale bengalense* (de Saussure) (Image 7)

1852. *Rygchium argentatum* (Fabricius); Saussure, *Ét. Farn. Vesp.*, vol. 1, p. 115 ("Les Indes Orientales. Le Bengale") [misidentification].

1855. *Rhynchium bengalense* Saussure, *Ét Fam. Vesp.*, vol. 3, p. 176, pl. 9 fig. 8, "Le Bengale" (MP).

1894. *Rhynchium argentatum* var. *bengalense*; Dalla Torre, *Cat. Hym.*, vol. 9, p. 43 (cat).

1963. *Anterhynchium abdominale bengalense*; van der Vecht, *Zool. Verh., Leiden*, **60**: 76, (Bengal (Barrackpore), United provinces (Benares), Kerala (Walayar forest)).

Female: Body length (H+M+T1+T2) 13-14 mm; Forewing length 12-14 mm. Body black (sometimes ventral side of antenna, apical tarsal segments and lateral sides of tergites reddish brown except last segment). Wings dark fuscous with violet reflections.

Male: Body length (H+M+T1+T2) 11-11.5 mm; Forewing length 10.5-12 mm. Colour pattern is almost same as that of female except clypeus almost entirely yellow with the lateral and apical margins black and scape in front yellow.

Material examined: INDIA: Delhi: Delhi University Ridge, 1♂, 9.x.1975, Coll. V. K. Gupta & Party, NZSI Regd. No. 13316/H3. Tamil Nadu: Nagapattanam district, Mettupakkam, 1♂, 10.xi.1963, Coll. V. K. Gupta & Party, 13317/H3 Tripura: South Tripura district, Bankar, 1♂, 2.x.1977, Coll. N. Muraleedharan & Party, 13320/H3. Uttarakhand: Rishikesh, 1♂, 28.vii.1970, Coll. J. C. Trilock, 13321/H3; Almora district, Ranikhet, 1♂, 29.ix.2001, Coll. Animesh Bal & Party, 13322/H3; Pithoragarh district, Dharchula, 1♀, 26.ix.2004, Coll. B. Mitra & Party, 13323/H3. Uttar Pradesh: Bareily, 1♀, 1.ix.1905, Coll. Brunetti, 13324/H3; Sultanpur district, Bahadhurpur, 1♀, 17.ix.2006, Coll. R. S. Mridha & Party, 13325/H3. West Bengal: Kolkata, 2♀ & 2♂, date of collection and name of collectors unknown, 13327/H3 to 13330/H3. NEPAL: Katmandu, 1♀, date of collection and name of collector unknown, 13331/H3.

Distribution: India: Bihar, Delhi (new record), Kerala, Punjab, Rajasthan, Tamil Nadu (new record), Tripura (new record), Uttarakhand (new record), Uttar Pradesh, West Bengal.

Elsewhere: Nepal (new record). ***Nest***: See Batra, 1979.

2. *Anterhynchium (Anterhynchium) mellyi* (de Saussure)
(Images 8-10)

1852. *Rygchium mellyi* de Saussure, *Ét. Fam. Vesp.*, **1**: 116, female, "Les Indes, La Chine" (MP and MHNG).

1855. *Rhynchium mellyi*; de Saussure, *Ét. Fam. Vesp.*, **3**: 172 (description of male; China).

1929. *Odynerus mellyi*; Dover, *Bull. Raffles Mus.*, **2**: 44 (in subgenus *Rygchium*; Rangoon).

1963. *Anterhynchium mellyi*; van der Vecht, *Zool. Verh., Leiden*, 60: 76 (China, Indo-China, Siam).

Diagnostic characters: This species differ from all other Indian subcontinent species of this genus by the following combination of characters: clypeus with weak punctures, from the middle of clypeus to apex with few irregular longitudinal striations; narrow basal part of first gastral sternite smooth; gastral tergites only finely punctate at base; basal two thirds of second gastral tergite distinctly punctate, except in the middle the interspaces generally larger than the punctures; mandibles of male deeply emarginate on inner side near the middle.

Female (Image 8): Body length (H+M+T1+T2) 14-15 mm; Forewing length 13.5-14.5 mm. Body black (sometimes apical tarsal segments reddish brown). Wings fuscous with purple reflections.

Head: 1.09x as wide as long in front view (Image 9); clypeus pear-shaped, somewhat constricted before the narrow and emarginate apex, maximum width 1.07x length medially, with weak punctures, from the middle of clypeus to apex with few irregular longitudinal striations; mandibles on inner side with four rather broad and irregularly shaped teeth, the basal tooth emarginate at apex; labrum elongate rounded at apex; interantennal space almost smooth with few weak punctures; a short but distinct strong carina is present at the middle of interantennal space; frons closely, strongly and rugosely punctured, the diameters of the punctures greater than the distance between the punctures; ocular sinus with weak punctures; area between the antennal toruli and inner eye margin smooth; POL 0.88x OOL; diameter of anterior ocellus 1.92x longer than the distance between anterior ocellus and posterior

ocelli; vertex with moderately strong punctures except at shallow post ocellar fovea and area towards occipital carina less punctured; temple with moderately strong punctures, 1.10x narrower than eye in profile (measured through its ocular sinus); interocular distance 0.90x greater on vertex than at clypeus; occipital carina strong, complete and narrowed ventrally. Antenna 2.04x farther from each other than from eyes; antennal scrobe granulately punctured; scape 2.02x as long as F1, 3.49x as long as wide; pedicel 0.35x F1, 0.83x as long as wide; F1 1.81x as long as F2, 2.05x as long as wide; flagellar segments slightly widening towards apex except last segment; apical antennal segment 1.27x as long as wide.

Mesosoma: Anterior face of pronotum smooth without punctures; pronotal carina strong and almost reaching the lateral margin of pronotum; posterior face and lateral sides of pronotum, mesoscutum and scutellum strongly, closely and rugosely punctate, scutellum smooth at lateral sides with distinct longitudinal striations, mesoscutum 0.96x as long as wide; metanotum gibbous, strongly and irregularly punctate basally, smooth apically; lateral side of propleuron almost smooth, ventral side smooth with scattered punctures; mesopleuron rugosely punctured except epicnemium and posterior margin smooth; epicnemial carina distinct, complete; upper metapleuron smooth posteriorly and distinctly punctate anteriorly, lower metapleuron smooth with irregular weak transverse striations at lateral sides. Propodeum vertical, concavo-truncate posteriorly, declivity of propodeum not bordered dorsally by a somewhat strong irregular carina, dorsolateral margin of propodeum ending posteriorly with a sharp teeth-like projection, the triangular area at the base of propodeum as long as wide, bordered on each side by a deep groove, punctures on dorsolateral area strong and rugose, posterior concave area of propodeum with irregular transverse striations, lateral sides of propodeum transversely striated with few rugose punctures at upper and posterior sides. Tegula not evenly rounded posteriorly, emarginated adjoining parategula and shorter than parategula at apex; axillary fossa narrowed, slit-like. Midtibia with 1 spur. Forewing length 3.03x its maximum width, prestigma 0.7x pterostigma.

Metasoma: T1 1.69x as wide as long, 0.93x as wide as T2; T1 with distinct weak punctures; basal two thirds of T2 very finely and shallowly punctate, the interspaces everywhere much larger than the punctures, coarsely punctate near the apical margin; visible part of remaining tergites except last tergite with distinct punctures; the narrow basal part of S1 densely transversely striate, posterior transverse area of S1 rather irregularly transversely striate, S2 and visible part of remaining sternites except last sternite with distinct punctures; last tergite and sternite almost smooth with few fine scattered punctures.

Male: Body length (H+M+T1+T2) 12-12.5 mm; Forewing length 12 mm. Colour pattern is almost same as that of female except clypeus almost entirely yellow with the lateral and apical margins black (Image 10) and scape in front yellow. Head 1.17x as wide as long in front view; interocular distance 1.14x greater on vertex than at clypeus; clypeus more elongate and the apex between two teeth more deeply emarginated than female, width 1.20x length medially; POL 1.24x OOL; antenna with the last segment hooked apically and almost reaches the apex of tenth antennal segment in curved position; apical tip of aedeagus rounded, parallel spines elongate without hairs. Other characters almost same as in female.

Material examined: INDIA: Assam: North Cachar district, Dehangi, 1♂, 24.iv.1979, Coll. S.B. Roy & Party, NZSI Regd. No. 13380/H3. Karnataka: Bengaluru, 1♀ & 1♂, date of collection Unknown, Coll. Cameron, 13381/H3 & 13382/H3. Meghalaya: Garo Hills district, Dainadubi, 1♀, 13.v.1979, Coll. J.K. Jonathan & Party, 13400/H3.

Distribution: India: Assam (new record), Karnataka (new record), Meghalaya (new record), Uttar Pradesh, West Bengal. Elsewhere: China, Myanmar, Thailand, Vietnam (Tonkin).

Subgenus ***Dirhynchium*** van der Vecht

1963. *Dirhynchium* van der Vecht, *Zool. Verh., Leiden*, **60**: 74 (key), 77, subgenus of *Anterhynchium* de Saussure.

Type species: *Ancistrocerus flavopunctatus* Smith, 1852, by original designation.

Diagnosis: The narrow basal part of the first gastral sternite is densely transversely striate and rather dull. As a rule the declivity of the propodeum is bordered dorsally by a somewhat irregular carina, which forms a tooth on each side behind the postscutellum; these teeth are much closer together than the lateral, short, longitudinal carinae of the postscutellum. In some forms, however, these carinae show a tendency to disappear. The triangular area at the base of the propodeum is much longer than wide, bordered on each side by a deep groove.

3. ***Anterhynchium (Dirhynchium) coracinum*** Vecht
(Figs. 3-6; Images 11-17)

1963. *Anterhynchium coracinum* Vecht, *Zool. Verh., Leiden*, **60**: 78 (key), 86, Female (subgenus *Dirhynchium*), Tenmalai, Travancore (BMNH); also from Nilgiri Hills, Devala.

Diagnostic characters: This species differ from all other Indian subcontinent species of this genus by the following combination of characters: the narrow basal part of the first gastral sternite is densely transversely striate; the triangular area at the base of the propodeum is much longer than wide, bordered on each side by a deep groove; sculptures on head and mesosoma moderately stronger; declivity of propodeum bordered dorsally by a somewhat strong irregular carina, which forms a tooth at the lateral end and another tooth behind each posterior angle of the convex part of the metanotum; metanotum and propodeum completely black; T1 usually with a broadly interrupted narrow yellow band posteriorly.

Female (Image 11): Body length (H+M+T1+T2) 12-14 mm; Forewing length 12-14 mm. Body black with some yellow and brown colourations. Yellow colouration as follows: a short and narrow transverse line at the base of the clypeus (sometimes interrupted in the middle or absent), a spot at interantennal space, a mark on the upper portion of temple near to eye (usually reduced or disappear), scape in front, two transverse spots at the anterior margin of dorsal area of pronotum (sometimes absent); a spot on each side of dorsal lateral side of propodeum (usually absent), T1 with a broadly interrupted narrow band posteriorly (sometimes absent); T2 with a broadly interrupted narrow band posteriorly (in most cases it is absent). Brown colouration as follows: tegula on outer side, mid and hind femora at apex, tarsal spines and claws. Wings brown with violaceous reflections, veins dark brown. Body with rather sparsely to moderately dense fine silvery white pubescence.

Head: 0.99x as wide as long in front view (Image 12); clypeus (Fig. 3) pear-shaped, somewhat constricted before the narrow and emarginate apex, maximum width 1.02x length medially, with moderately deep rugose punctures, larger punctures on middle and smaller on sides, from the middle of clypeus to apex the interspaces showing to run into irregular longitudinal striae; mandibles on inner side with four rather broad and irregularly shaped teeth, the basal tooth emarginate at apex; labrum elongate rounded at apex; interantennal space almost smooth with few irregular weak punctures; a short but distinct strong carina is present at the middle of interantennal space; frons closely, strongly and rugosely punctured, the diameters of the punctures greater than the distance between the punctures; ocular sinus with weak punctures; area between the antennal toruli and inner eye margin smooth; POL 1.31x OOL; diameter of anterior ocellus 1.11x longer than the distance between anterior ocellus and posterior ocelli; vertex strongly punctured except at shallow post ocellar fovea and area towards occipital carina; temple strongly punctured, 0.76x narrower than eye in profile (measured through its ocular sinus); interocular distance 0.92x greater on vertex than at clypeus; occipital carina strong, complete and narrowed ventrally. Antenna (image 13) 2.96x farther from each other than from eyes; antennal scrobe granulately punctured;

scape 2.32x as long as F1, 4.95x as long as wide; pedicel 0.37x F1, 0.83x as long as wide; F1 1.68x as long as F2, 2.13x as long as wide; flagellar segments slightly widening towards apex except last antennal segment; apical antennal segment 1.22x as long as wide.

Mesosoma: Anterior face of pronotum smooth without punctures; pronotal carina strong and almost reaching the lateral margin of pronotum; posterior face and lateral sides of pronotum, mesoscutum and scutellum strongly, closely and rugosely punctate, mesoscutum 0.99x as long as wide; metanotum gibbous, strongly and irregularly punctate basally and separated from the posterior portion by an irregularly crenulate ridge at middle; lateral side of propleuron almost smooth, ventral side smooth with scattered punctures; mesopleuron rugosely punctured except epicnemium and posterior margin smooth; epicnemial carina distinct, complete; upper metapleuron smooth posteriorly and distinctly punctate anteriorly, lower metapleuron with irregular weak striations and few punctures. Propodeum vertical, concavo-truncate posteriorly, declivity of propodeum bordered dorsally by a somewhat strong irregular carina, which forms a tooth at the lateral end and another tooth behind each posterior angle of the convex part of the metanotum, the triangular area at the base of propodeum is much longer than wide, bordered on each side by a deep groove, punctures on dorsolateral area strong and rugose, posterior concave area of propodeum with irregular transverse striations, lateral sides of propodeum strongly rugose at upper half, weakly rugose to irregular transverse striations at lower half except at posterior margin, smooth. Tegula not evenly rounded posteriorly, emarginated adjoining parategula and shorter than parategula at apex; axillary fossa narrowed, slit-like. Midtibia with 1 spur. Forewing length 3.53x its maximum width, prestigma 0.76x pterostigma.

Metasoma: T1 1.43x as wide as long, 0.88x as wide as T2; T1, T2 and S2 with distinct punctures, the diameter of most of the punctures less than interspace; visible part of T3 to T5 with close punctures, the diameter of most of the punctures greater than interspace; basal part of S3 to S5 with deep pit-like punctures, which are usually not visible externally; T6 and S6 with few scattered fine punctures; the narrow basal part of S1 densely transversely striate, posterior transverse area of S1 rather irregularly transversely striate to rugose.

Male (Described for the first time): Body length (H+M+T1+T2) 9-10 mm; Forewing length 9-10 mm. Colour pattern is almost same as that of female except clypeus almost entirely yellow with the lateral and apical margins black. Head (Image 14) 1.06x as wide as long in front view; interocular distance 1.25x greater on vertex than at clypeus; clypeus (Fig. 4) more elongate and the apex between two teeth more deeply emarginated than female, width 0.81x length medially; POL 1.56x OOL; occipital carina almost touching to the eye at the lower side; antenna (Image 15 & 16) with the last segment hook like, almost reaches the apex of tenth antennal segment in curved position; apical margin of SVII with spine-like stiff and stout hairs; genitalia as in image 17, apical tip of aedeagus rounded, parallel spines elongate without hairs. Other characters almost same as in female.

Material examined: INDIA: Delhi: Delhi University Campus, 1♀, 30.xi.1978, Coll. V.K. Gupta & Party, NZSI Regd. No. 13386/H3. Himachal Pradesh: Solan district, Kasauli, 1♀, 20.vi.1979, Coll. V.K. Gupta & Party, 13387/H3. Jammu & Kashmir: Srinagar district, Shalimar Garden, 1♀, 11.ix.1977, Coll. R.C. Basu & Party, 13388/H3; Anantnag district, Bijbehara, 5♀, 22.ix.1977, Coll. R.C. Basu & Party, 13389/H3 to 13393/H3. Meghalaya: East Garo Hills district, Songsak Reserve Forest, 1♀, 20.ix.1975, Coll. N. Muraleedharan & Party, 13394/H3; East Garo Hills district, Songsak Reserve Forest, 1♂, 6.v.1979, Coll. J.K. Jonathan & Party, 13395/H3. Sikkim: exact locality not known, 1♂, date of collection unknown, Coll. Knyvett, 13396/H3. Uttarakhand: Almora district, Someshwar, Kausani, 1♀, 18.x.2001, 13397/H3. West Bengal: Darjeeling district, Singla, 1♀, 1912, Coll. Lord

Carmichael, 13398/H3. PAKISTAN: Azad Kashmir, Muzaffarabad district, Jhelum Valley, 1♂, 10.vii.1916, Coll. H.T. Pease, 13399/H3.

Distribution: India: Delhi (new record), Himachal Pradesh (new record), Jammu & Kashmir (new record), Kerala, Meghalaya (new record), Sikkim (new record), Tamil Nadu, Uttarakhand (new record), West Bengal (new record). Elsewhere: Pakistan (new record).

4. ***Anterhynchium (Dirhynchium) flavolineatum*** (Smith)
(Images 18-21)

1857. *Odynerus flavolineatus* Smith, *Cat. Hym. Br. Mus.*, **5**: 60, male, Java (BMNH, type no 18. 454).

1897. *Rynchium flavolineatum*; Bingham, *Fauna Br. India, Hym.*, **1**: 353 (key), 360, male (Skkim; Tenasserim; Java.).

1963. *Anterhynchium flavolineatum flavolinatum*; van der Vecht, *Zool. Verh., Leiden*, **60**: 78 (key), 84 (subgenus *Dirhynchium*; Malaya; Borneo; sumatra; Java; Sumba; Flores).

Diagnostic characters: This species differ from all other Indian subcontinent species of this genus by the following combination of characters: the narrow basal part of the first gastral sternite is densely transversely striate; the triangular area at the base of the propodeum is much longer than wide, bordered on each side by a deep groove; this species is comparatively smaller than other species; sculptures on head and thorax are not so stronger compared to other species; declivity of propodeum not bordered dorsally by a carina, a large sub ovate yellow spot on each side of propodeum; broad yellow stripe on all tibiae; gastral tergites except last segment with apical yellow bands, the bands on T1 and T2 dialated laterally.

Female (Image 18): Body length (H+M+T1+T2) 10-13 mm; Forewing length 10.5-13.5mm. Body black with some yellow and brown colourations. Yellow colouration as follows: clypeus except apical and lateral sides (in some specimens yellow markings reduced), a spot at interantennal space, a spot at the ocular sinus, a mark on the upper portion of temple near to eye (sometimes reduced or disappear), a line on the front of the scape, two spots on dorsal side of pronotum (sometimes reduced), a mark on tegula posteriorly (sometimes absent), a mark on parategula (sometimes absent), a transverse band on metanotum, a large sub ovate spot on each side of propodeum, a spot on mesopleuron under the base of forewing (sometimes absent), s spot on mid and hind coxa (sometimes absent), a broad stripe on femora in front (sometimes reduced or absent), a broad stripe on tibiae on outside, gastral tergites except last segment with apical bands, the bands on T1 and T2 dilated laterally, S2-S4 with a spot on postero-lateral corner (sometimes absent on S4). Brown colouration as follows: apical antennal segments, tegula partly and apical tarsal segment. Wings fusco-hyaline, darkest at anterior margin of forewing, veins dark brown. Body with rather sparsely to moderately dense fine silvery white pubescence.

Head: 1.02x as wide as long in front view (Image 19); clypeus pear-shaped, somewhat constricted before the narrow and emarginate apex, maximum width 0.86x length medially, with moderately deep rugose punctures, larger punctures on middle and smaller on sides, from the middle of clypeus to apex the interspaces showing to run into irregular longitudinal striae; mandibles on inner side with four rather broad and irregularly shaped teeth, the basal tooth emarginate at apex; labrum elongate rounded at apex; interantennal space almost smooth with few irregular weak punctures; a short but distinct strong carina is present at the middle of interantennal space; frons closely, strongly and rugosely punctured, the diameters of the punctures greater than the distance between the punctures; ocular sinus with weak punctures; area between the antennal toruli and inner eye margin smooth; POL 1.11x OOL; diameter of anterior ocellus 1.30x longer than the distance between anterior ocellus and posterior ocelli; vertex strongly punctured except at shallow post ocellar fovea and area towards occipital carina; temple somewhat weakly punctured, 0.86x narrower than eye in profile (measured through its ocular sinus); interocular distance 0.99x greater on vertex than at clypeus; occipital carina strong,

complete and narrowed ventrally. Antenna 3.02x farther from each other than from eyes; antennal scrobe granulately punctured; scape 2.30x as long as F1, 4.62x as long as wide; pedicel 0.30x F1, 0.65x as long as wide; F1 1.55x as long as F2, 1.95x as long as wide; flagellar segments slightly widening towards apex except last segment; apical antennal segment 1.03x as long as wide.

Mesosoma: Anterior face of pronotum smooth without punctures; pronotal carina strong, reaching up to the level of pronotal spiracle; posterior face and lateral sides of pronotum, mesoscutum and scutellum strongly, closely and rugosely punctate, mesoscutum 0.97x as long as wide; metanotum gibbous, strongly and irregularly punctate basally and separated from the posterior portion by an irregularly crenulate ridge at middle; lateral side of propleuron almost smooth, ventral side smooth with scattered punctures; mesopleuron rugosely punctured except epicnemium and posterior margin smooth; epicnemial carina distinct, complete; upper metapleuron smooth posteriorly and distinctly punctate anteriorly, lower metapleuron almost smooth with irregular weak striations and few punctures. Propodeum vertical, concavo-truncate posteriorly, declivity of propodeum not bordered dorsally by a carina, dorsolateral margin of propodeum somewhat carinate, ending posteriorly with a sharp teeth-like projection; the triangular area at the base of propodeum is much longer than wide, bordered on each side by a deep groove, punctures on dorsolateral area strong and rugose, posterior concave area of propodeum with irregular transverse striations, lateral sides of propodeum strongly rugose at upper half, weakly rugose to irregular transverse striations at lower half except at posterior margin, smooth. Tegula not evenly rounded posteriorly, emarginated adjoining parategula and shorter than parategula at apex; axillary fossa narrowed, slit-like. Midtibia with 1 spur. Forewing length 3.34x its maximum width, prestigma 1.07x pterostigma.

Metasoma (Image 20): T1 1.26x as wide as long, 0.91x as wide as T2; T1, T2 and S2 with distinct punctures, the diameter of most of the punctures less than interspace; visible part of T3 to T5 with close punctures, the diameter of most of the punctures greater than interspace; basal part of S3 to S5 with deep pit-like punctures, which are usually not visible externally; T6 and S6 with few scattered fine punctures; the narrow basal part of S1 densely transversely striate, posterior transverse area of S1 rather irregularly transversely striate to rugose.

Male: Body length (H+M+T1+T2) 9.5 mm; Forewing length 9 mm. Colour pattern is almost same as that of female except clypeus almost entirely yellow. Head (Image 21) 1.05x as wide as long in front view; interocular distance 1.27x greater on vertex than at clypeus; clypeus more elongate than female, width 0.84x length medially; POL 1.09x OOL; genitalia with volsellar digitus much less tapering towards the tip; Other characters almost same as in female.

Material examined: INDIA: Arunachal Pradesh: Papumpare district, Chimpu, 2♀ & 1♂, 12.iv.2001, Coll. S. Sheela & Party, NZSI Regd. Nos. 13220/H3, 13459/H3 & 13460/H3; West Siang district, Malinithan, 1♀, 30.ix.2001, Coll. B. Mitra & Party, 13221/H3. Meghalaya: East Garo Hills district, Songsak Reserve Forest, 1♀, 20.ix.1975, Coll. N. Muraleedharan & Party, 13222/H3. Sikkim: exact locality not known, 1♀, May, 1912, name of collector unknown, 13223/H3. West Bengal: Darjeeling district, Singla, 2♀, July 1912, Coll. Lord Carmichael, 13224/H3 & 13225/H3.

Distribution: India: Arunachal Pradesh (new record), Meghalaya (new record), Sikkim, West Bengal (new record).

Elsewhere: Borneo, Indonesia (Java, Flores, Sumatra, Sumba and Wallace), Malaysia (Mt. Ophir), Myanmar and Taiwan.

5. *Anterhynchium (Dirhynchium) flavomarginatum* (Smith)
(Figs. 7-8; Images 22-24)

1852. *Rhynchium flavo-marginatum* Smith, *Trans. Entomol. Soc. Lond.*, (2) **2**: 35, male, China (BMNH).

1857. *Odynerus nigrifrons* Smith, *Cat. Hym. Br. Mus.*, **5**: 62, "North China (Shanghai)" (BMNH, type no. 18. 325).

1903. *Rhynchium curvimaculatum* Cameron, *Ann. Mag. Hist.*, (7) **11**: 328, male, "Khasia Hills, Assam, leg. Rothney" (OUM).

1903. *Rynchium collinum* Cameron, *Ann. Mag. Nat. Hist.*, (7) **11**: 329, male, female, "Khasia Hills, Assam, leg. Rothney" (OUM).

1936. *Odynerus flavomarginatu*; Liu, *Peking Nat. Hist. Bull.*, **11**: 107 (cat.).

1963. *Anterhynchium flavomarginatum flavomarginatum*; van der Vecht, *Zool. Verh., Leiden* 60: 78 (key), 80, figs. 5f, 6b (in subgenus *Dirhynchium*; China; Sikkim).

1963. *Anterhynchium flavomarginatum curvimaculatum*, van der Vecht, *Zool. Verh., Leiden*, **60**: 78 (key), 81 (in subgenus *Dirhynchium*; syn. *R. collinum*). New synonymy.

This is a polytypic species consists of 13 subspecies and widely distributed in southern and eastern Asia (Yamane, 1990). Out of this 13 subspecies, 2 subspecies are reported from Indian subcontinent, namely, the nominotypical subspecies *A. flavomarginatum flavomarginatum* (Smith) and *A. flavomarginatum curvimaculatum* (Cameron). The subspecies *A. flavomarginatum curvimaculatum* reported from Assam by Cameron in 1903 is similar to the nominotypical subspecies *A. flavomarginatum flavomarginatum* (Smith) except the postscutellum with yellow line (in *A. flavomarginatum curvimaculatum* postscutellum entirely black). This character is highly variable. I studied three female specimens from Sikkim in which one specimen with yellow marks on postscutellum strongly pronounced, in second specimen it is less pronounced and in the third specimen studied it is almost entirely absent. So, I consider that it will be no more than an individual colour variation. Thus, I propose to synonymize *A. flavomarginatum curvimaculatum* under the nominate species.

Diagnostic characters: This species differ from all other Indian subcontinent species of this genus by the following combination of characters: the narrow basal part of the first gastral sternite is densely transversely striate; the triangular area at the base of the propodeum is much longer than wide, bordered on each side by a deep groove; this species is comparatively larger than other species; sculptures on head and thorax are stronger than other species; declivity of propodeum bordered dorsally by a somewhat strong irregular carina, which forms a tooth at the lateral end; narrow uninterrupted sub apical yellow lines on the posterior margins of T1 and T2.

Female (Image 22): Body length (H+M+T1+T2) 16-17 mm; Forewing length 17 mm. Body black with some yellow and brown colourations. Yellow colouration as follows: a medially interrupted transverse band on clypeus basally, a spot at interantennal space, a line on the front of the scape, an interrupted line (sometimes absent) on the pronotum, a mark on parategula (sometimes absent), a transverse band on metanotum, a spot on each side of dorsal lateral side of propodeum, another spot on dorsolateral angle of propodeum posteriorly, a spot on mesopleuron under the base of forewing, a narrow uninterrupted sub apical line on the posterior margins of T1 and T2, a spot on S2 at posterolateral corner. Brown colouration as follows: tegula mostly, all femora at apex and tarsal segments. Wings fusco-hyaline, iridescent in certain lights, veins dark brown. Body with rather sparsely to moderately dense fine silvery white pubescence.

Head: 1.06x as wide as long in front view (Image 23); clypeus pear-shaped, somewhat constricted before the narrow and emarginate apex, maximum width 1.09x length medially, with moderately deep rugose punctures, larger punctures on middle and smaller on sides, from the middle of clypeus to apex the interspaces showing to run into irregular longitudinal striae; mandibles on inner side with four rather broad and irregularly shaped teeth, the basal tooth emarginate at apex; labrum elongate rounded at apex; interantennal space almost smooth with few irregular weak punctures; a short but distinct strong carina is present at the middle of interantennal space; frons closely, strongly and rugosely punctured, the diameters of the punctures greater than the distance between the punctures; ocular sinus with weak punctures; area between the antennal toruli and inner eye margin smooth; POL 0.90x OOL; diameter of

anterior ocellus 1.32x longer than the distance between anterior ocellus and posterior ocelli; vertex strongly punctured except at shallow post ocellar fovea and area towards occipital carina; temple strongly punctured, 1.1x as wide as eye in profile (measured through its ocular sinus); interocular distance 0.91x greater on vertex than at clypeus ; occipital carina strong, complete and narrowed ventrally. Antenna 2.13x farther from each other than from eyes; antennal scrobe granulate punctured; scape 2.48x as long as F1, 4.41x as long as wide; pedicel 0.26x F1, 0.61x as long as wide; F1 1.62x as long as F2, 1.85x as long as wide; flagellar segments slightly widening towards apex; apical antennal segment 1.08x as long as wide.

Mesosoma (Image 24): Anterior face of pronotum smooth without punctures; pronotal carina strong and almost reaching the lateral margin of pronotum; posterior face and lateral sides of pronotum, mesoscutum and scutellum strongly, closely and rugosely punctate, mesoscutum 1.01x as long as wide, posteriorly very densely punctate, the interspaces showing a tendency to run into irregular longitudinal striae; metanotum gibbous, strongly and irregularly punctate basally and separated from the posterior portion by an irregularly crenulate ridge at middle; lateral side of propleuron almost smooth, ventral side smooth with scattered punctures; mesopleuron rugosely punctured except epicnemium and posterior margin smooth; epicnemial carina distinct, complete; upper metapleuron smooth posteriorly and distinctly punctate anteriorly, lower metapleuron with irregular weak striations and few punctures. Propodeum vertical, concavo-truncate posteriorly, declivity of propodeum bordered dorsally by a somewhat strong irregular carina, which forms a tooth at the lateral end, the triangular area at the base of propodeum is much longer than wide, bordered on each side by a deep groove, punctures on dorsolateral area strong and rugose, posterior concave area of propodeum with irregular transverse striations, lateral sides of propodeum strongly rugose except at posterior area, smooth. Tegula not evenly rounded posteriorly, emarginated adjoining parategula and shorter than parategula at apex; axillary fossa narrowed, slit-like. Midtibia with 1 spur. Forewing length 3.43x its maximum width, prestigma 1.03x pterostigma.

Metasoma: T1 1.52x as wide as long, 0.87x as wide as T2; T1, T2 and S2 with distinct punctures, the diameter of most of the punctures less than interspace; visible part of T3 to T5 with close punctures, the diameter of most of the punctures greater than interspace; basal part of S3 to S5 with deep pit-like punctures, which are usually not visible externally; T6 and S6 with few scattered fine punctures; the narrow basal part of S1 densely transversely striate, posterior transverse area of S1 rather irregularly transversely striate to rugose.

Male: Not studied. Body length (H+M+T1+T2) 9-12.5 mm; Forewing length 8.5-11.5 mm (Yamane, 1990). Almost similar to female except the clypeus almost entirely yellow and a line on the fore tibiae above yellowish white (Bingham, 1897); inner side of the mandible often considerably modified (Vecht, 1963); aedeagus as in figure 7; volsella as in figure 8.

Material examined: INDIA: Sikkim: Exact locality not known, 3♀ , June 1912, name of collector unknown, NZSI Regd. Nos. 13383/H3 to 13385/H3.

Distribution: India: Assam, Sikkim, Uttarakhand, West Bengal. Elsewhere: Borneo, China and Myanmar.

SUMMARY

The genus *Anterhynchium* de Saussure from Indian subcontinent is reviewed, recognizing 5 species in the subcontinent. An illustrated key to species/subspecies of the genus from Indian subcontinent is provided. Detailed description of each species is provided. The male of the species *Anterhynchium (Dirhynchium) coracinum* Vecht is described here for the first time. The subspecies *A. (D.) flavomarginatum curvimaculatum* (Cameron), 1903, is synonymized under the nominate species *A (D.) flavomarginatum* (Smith). The subspecies *Anterhynchium (Anterhynchium) abdominale*

abdominale (Illiger) is reported here for the first time from Delhi, Jharkhand, Karnataka, Odisha and Tripura. The subspecies *A. (A.) abdominale bengalense* (de Saussure) is reported here for the first time from Delhi, Tamil Nadu, Tripura and Uttarakhand. This species is recorded here for the first time from Nepal. The species *A. (A.) mellyi* (de Saussure) is reported here for the first time from Assam, Karnataka and Meghalaya. The species *A. (D.) coracinum* Vecht is so far recorded from its type localities in south India such as Tenmalai (Kerala) and Devala (Tamil Nadu). In the present study, the extended distribution of this species to Delhi, Himachal Pradesh, Jammu & Kashmir, Meghalaya, Sikkim, Uttarakhand and West Bengal is newly recorded. This species is herewith recorded for the first time from Pakistan also. The species *A. (D.) flavolineatum* (Smith) is herewith recorded for the first time from Arunachal Pradesh, Meghalaya and West Bengal.

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PLATE I

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Images 1-6 : *Anterhynchium (Anterhynchium) abdominale abdominale* (Illiger); Images 1-4 Female; Image 1 Head front view; Image 2 Head dorsal view showing ocellar area; Image 3 Antenna; Image 4 Gaster. Images 5 & 6 Male; Image 5 Body profile; Image 6 Head front view.

PLATE II

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Image 7 : ***Anterhynchium (Anterhynchium) abdominale bengalense*** **(de Saussure)** Female Gaster. Images 8-10. ***Anterhynchium (Anterhynchium) mellyi*** **(de Saussure);** Images 8 & 9 Female. Image 8 Body dorsal view; Image 9 Head front view; Image 10 Male Head front view. Images 11 & 12. ***Anterhynchium (Dirhynchium) coracinum*** **Vecht** Female, Image 11 Body profile; Image 12 Head front view.

PLATE III

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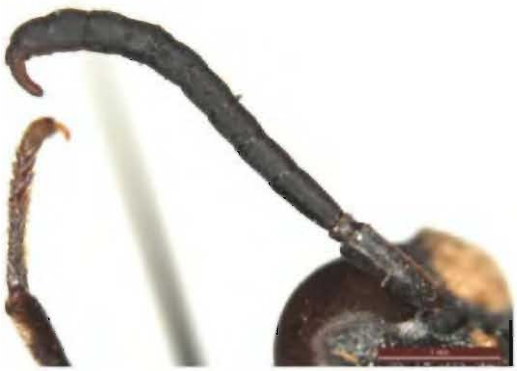

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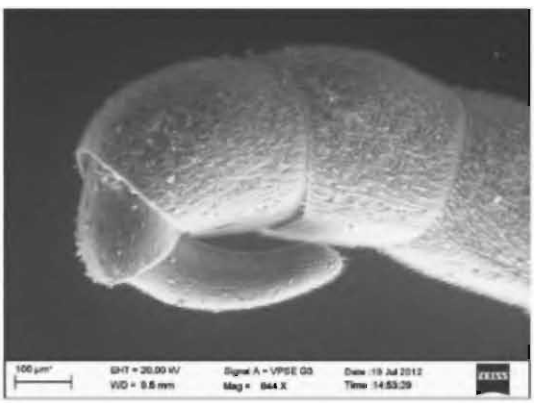

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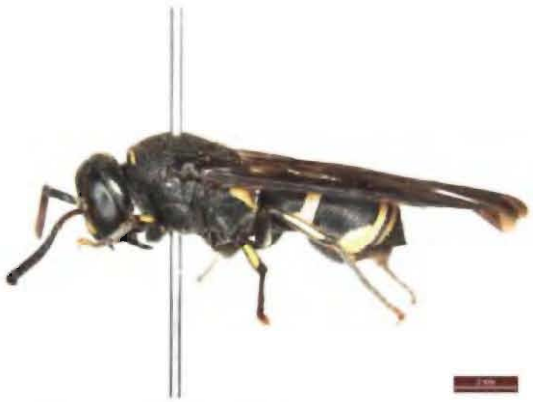

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Images 13-17 : *Anterhynchium (Dirhynchium) coracium* Vecht. Image 13 Female Antenna. Images 14-17 Male. Image 14. Head front view; Image 15 Antenna; Image 16 Apical antennal segments; Image 17 Genitalia. Image 18 ***Anterhynchium (Dirhynchium) flavolineatum* (Smith)** Female Body profile.

PLATE IV

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Images 19-21 : ***Anterhynchium (Dirhynchium) flavolineatum*** (Smith). Images 19 & 20 Female. Image 19 Head front view; Image 20 Gaster; Image 21 Male Head front view. Images 22-24. ***Anterhynchium (Dirhynchium) flavomarginatum*** (Smith) Female. Image 22 Body dorsal view; Image 23 Head front view; Image 24 Mesosoma dorsal view.

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AN ANNOTATED LIST OF PROTOZOAN PARASITES BELONGING TO THE GENUS *MONOCYSTIS VON* STEIN, 1848 (APICOMPLEXA: CONOIDASIDA: EUGREGARINIDIDA: MONOCYSTIDAE) DESCRIBED FROM OLIGOCHAETE HOSTS

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INTRODUCTION

Apicomplexan are parasitic, with the gregarines exclusively infecting invertebrate hosts. Gregarines are a group with two forms, septate and aseptate. Aseptate gregarines contains 400 species while the septate gregarines contains about 900 species (Levine, 1977). In the aseptate gregarines (acephaline) the trophozoite has one compartment while in the septate forms (cephaline) there are several compartments. Gregarines are certainly significant from an evolutionary point of view because of their suspected early diverging position. The genus *Monocystis* was established by Von Stein in 1848. They are chiefly coelozoic or lumen dwelling protozoan of invertebrates, especially arthropods and annelids, considered as aseptate gregarines. Genus *Monocystis* Von Stein, 1848, are characterized by, without any mucorn, ovoid gamonts, short or elongated body, solitary, biconical oocysts, and symmetrical (Levine, 1988). Some species are especially important because they can cause diseases in invertebrates. Only few reports are available concerning biodiversity among *Monocystis* species based on morphological characterization. Levine, 1988 listed seventy four species of the genus *Monocystis* under the family Monocystidae, two of them have been described from non oligochaete hosts. Later on, many scientists worked on the aseptate gregarines. Many species of the genus *Monocystis* have been described from different oligochaete hosts of different geographical region. Till date eighty five species of *Monocystis* have so far been established throughout the world from the oligochaete hosts. But there is no systematic checklist of the species. In view of this it is considered useful to prepare a updated checklist of the species. The checklist is presented below in Table: 1. Tabulated are the type hosts, distribution, site of infection and the original reference to the data.

REMARKS

The paper contains the name of eighty six described species of the genus *Monocystis* under the family Monocystidae from oligochaete hosts.

SUMMARY

In this communication, eighty six species belonging to the genus *Monocystis* Von Stein, 1848 have been incorporated. The species have been described from different oligochaete hosts from different geographical distribution. The sites of infections have also been indicated. The paper will throw some light on the systematics of *Monocystis* species, since study of *Monocystis* is important from the evolutionary point of view.

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Table 1 : An annotated list of *Monocystis* species, type hosts, distribution, site of infection and original references are tabulated below. Sv=Seminal Vesicles, C=Coelom, Ints=Intestine, Ovr=Ovary, T= Testes

Name of the *Monocystis* species	Host (s)	Distribution	Site of infections
M. agilis Von Stein, 1848	*Lumbricus terrestris, L. rubellus L. castaneus, Allolobophora longa, Pheretima hypeiensis, Eisenia foetida*	England, France, Germany, Hungary, Poland, Sweden, USSR, Mexico	SV
M. perichaetae (Beddard, 1888) Labbé, 1899	*Megascolex (Syn., Perichaeta) novaezealandiae, M. mauritii, Diporochaeta intermedia, M. armatus*	New Zealand, Mauritius	C
M. lumbrici (Henle, 1845) Cuénot, 1901	*Lumbricus terrestris, L. rubellus, L. castaneus, Eisenia foetida*	Poland, Sweden, England France, Germany	SV
M. ciliata Drzhevetskii, 1907	*Allolobophora longa*	USSR	SV and C
M. crenulata Hesse, 1909	*Allolobophoro longa, A. caliginosa, A. caliginosa var. trapezoides*	France, Hungary	SV
M. hirsuta Hesse, 1909	*Lumbricus casteneus*	France, Germany	SV
M. lememei Hesse, 1909	*Allolobophora caliginosa, Octolasium complanatum*	France, Algeria	SV
M. duboscqi Hesse, 1909	*Lumbricus variegates*	France	SV
M. bretscheri Hesse, 1909	*Fridericia polycheta*	France	C
M. macrospora Hesse, 1909	*Pheretima hawayana, P. rodericensis*	France	C
M. striata Hesse, 1909	*Lumbricus terrestris, L. rubellus, L. castaneus,*	England, France, Germany	SV
M. turbo Hesse, 1909	*Octolasium lacteum, Eisenia foetida*	France, Germany	SV
M. arcuata Boldt, 1910a	*Lumbricus castaneus, L. rubellus, Eisenia foetida*	Sweden, England, Germany	SV
M. piriformis Boldt, 1910b	*Octolasium complanatum, O. transpadanum, Fridericia galba, F. Hegemon*	Germany, France, Hungary	SV and C
M. catenata Mulsow, 1911	*Lumbricus terrestris* and *L. rubellus*	Germany	C
M. thamnodrili Cognetti de martiis, 1911	*Thamnodrilus incertus*	Equador	C
M. perforans Pinto, 1918	*Glossoscolex wiengreeni*	Brazil	T
M. naidis von Voss, 1921	*Nais elinguis or N. obtusa*	Germany	C
M. beddardi Ghosh, 1923	*Eutyphaeus nicholsoni*	India	SV
M. bengalensis Ghosh, 1923	*Pheretima posthuma*	India	SV
M. suecica Berlin, 1923	*Eisenia foetida, L. terrestris, L. rubellus*	Sweden	SV and C
M. tubiformis Berlin, 1923	*Lumbricus rubellus, L. castaneus*	Sweden	SV
M. acuta Berlin, 1924	*Lumbricus rubellus, L. castaneus*	Poland, Sweden	SV and C

M. carlgrenii Berlin, 1924	*Lumbricus terrestris, L. rubellus*	Sweden	SV
M. caudata Berlin, 1924	*Lumbricus rubellus, L. castaneus, Allolobophora longa*	Poland, Sweden	SV
M. densa Berlin, 1924	*Lumbricus terrestris, L. rubellus, L. castaneus, Eisenia foetida, Allolobophora longa, A. caliginosa,* and *A. chlorotica*	Poland, Sweden, England	SV
M. hessei Berlin, 1924	*Lumbricus terrestris, L. rubellus*	Sweden, England	SV
M. oblonga Berlin, 1924	*Lumbricus terrestris, L. rubellus, L. castaneus, Allolobophora longa*	Sweden	SV and C
M. polymorpha Berlin, 1924	*Lumbricus rubellus*	Poland, Sweden	SV
M. securiformis Berlin, 1924	*Allolobophora caliginosa*	Sweden	SV
M. ventrosa Berlin, 1924	*Lumbricus rubellus, L castaneus, Eisenia foetida*	Sweden, France, Germany, Hungary	SV and C
M. wallengrenii Berlin, 1924	*Allolobophora c. caliginosa, A. longa, Lumbricus rubellus*	England, Poland, Sweden, France, Germany	SV
M. pheretimae Bhatia and Chatterjee, 1925	*Pheretima posthuma*	India	SV and C
M. mrazeki Hahn, 1928	*Rhynchelmis limosella, R. komareki*	Czechoslovakia	SV
M. criodrilii Sciacchitano, 1931	*Criodrilus lacuum*	Italy	SV
M. banyulensis Tuzet and Loubatiers, 1946	*Octolasium complanatum* and *Dichrogaster baeri*	France	SV
M. octolasii Tuzet and Loubatiéres, 1946	*Octolasium complanatum*	France	SV
M. setosa Tuzet and Loubatiéres, 1946	*Allolobophora gigas*	France	SV
M. buccalis Tuzet and Loubatiéres, 1948	*Allolobophora gigas*	France	SV
M. lloydi Ghosh, 1923 emend, Loubatiéres, 1955	*Pheretima posthuma*	India	SV
M. dichogasteri Tuzet and Zuber-Vogeli, 1955	*Dichogaster inermis*	France, West Africa	SV
M. hederacea Loubatiéres, 1955	*Allolobophora rosea*	France	SV
M. lopadiformis Loubatiéres, 1955	*Eisenia foetida*	France	SV
M. proteiformis Loubatiéres, 1955	*Eisenia foetida*	France	SV
M. capillata Tuzet and Vogeli, 1956	*Millsonia anomala*	France, West Africa	SV
M. eudrilii Tuzet and Vogeli, 1956	*Eudrilus eugeniae*	Ivory Coast	VS and C
M. lumbricoides (Hesse, 1909), Meier, 1956	*Allolobophora c. caliginosa, A. longa, A. r. rosea, Dendrobaena tenuis, Eisenia foetida* and *Pheretima heterochaeta*	England, France, Germany, India	SV

Name of the *Monocystis* species	Host (s)	Distribution	Site of infections
M. lobosa Tuzet and Vogeli, 1956	*Millsonia anomala*	France, West Africa	SC
M. omodeoi Tuzet and Vogeli, 1956	*Dichogaster baeri*	France, West Africa	SV
M. longispora Boisson, 1957	*Perionyx excavates*	Indo-China	SV
M. biacuminata Boisson, 1957	*Glossoscolex corethrurus*	Indo-China	SV
M. minor Boisson, 1957	*Pheretima peguana*	Indo-China	SV
M. nidata Boisson, 1957	*Pontodrilus ephippiger*	Indo-China	SV
M. radiata Boisson, 1957	*Glossoscolex corethrurus*	Indo-China	-
M. cambrensis Rees, 1961	*Eisenia foetida*	Wales	C
M. lanceata Rees, 1961	*Allolobophora caliginosa*	Wales	SV
M. mollis Bereczky, 1967	*Dendrobaena platyura var. montana*	Hungary	SV
M. mammillae Segun, 1968	*Dendrobaena mammalis*	England	C
M. rhabdota Giere, 1971	*Lumbricillus lineatus*	Germany	SV and C
M. lumbricilli Giere, 1971	*Lumbricillus lineatus*	Germany	SV and C
M. tupi Righi, 1974	*Tupidrilus lacteus, Guaranidrilus oiepe*	Brazil	SV
M. loubatiersi Levine, 1977	*Eisenia foetida*	France	SV
M. saigonensis Boisson, 1957, emend. Levine, 1977	*Pheretima saigonensis*	Indo-China	-
M. tuzetae Levine, 1977	*Octolasium complanatum*	France	SV
M. berlini Levine, 1977	*Lumbricus rubellus*	Sweden	SV
M. boissoni Levine, 1977	*Pheretima posthuma*	Indo-China	SV
M. eiseniae Levine, 1977	*Eisenia foetida*	France	SV and C
M. abegbei Segun, 1978	*Libyodrilus violaceus*	Nigeria	Haemocoel
M. libyodrili Segun, 1978	*Libyodrilus violaceus*	Nigeria	C and Body Muscle
M. pontodrili Subbarao, Kalavati and Narasimhamurti, 1979	*Pontodrilus barmudensis*	Lalbag, Murshidabad, West Bengal, India	SV
M. senchalensis Pradhan and Dasgupta, 1982	*Apporectodae trapezoides*	Darjeeling, India	SV
M. lalbagensis Bandyopadhyay *et al*, 2001	*Metaphire posthuma*	Lalbag, Murshidabad, West Bengal, India	SV
M. nadiensis Bandyopadhyay and Biswas, 2002	*Metaphire posthuma*	Fulia, Nadia, India	C

M. darjeelingensis Bandyopadhyay and Mitra, 2005a	*Amynthus robusta*	Senchal, Darjeeling, India	SV
M. ranaghatensis Bandyopadhyay and Mitra, 2005a	*Eutyphoeus valtoni*	Ranaghat, West Bengal, India	SV
M. levinei Bandyopadhyay *et al.*, 2005b	*Eutyphoeus incommodus*	Kalyani, West Bengal, India	SV
M. clubae Bandyopadhyay, *et al.*, 2006a.	*Lampito mauritii*	West Bengal, India	SV
M. apporectodae Bandyopadhyay *et al.*, 2006b	*Apporectodae trapezoides*	Bankura, West Bengal, India	SV
M. metaphire Bandyopadhyay *et al.*, 2006c	*Metaphire houlleti*	Madhyamgram, North 24 pgs, West Bengal, India	SV
M. amynthae Bandyopadhyay *et al.*, 2006d	*Amynthas hawayanus*	Darjeeling	SV
M. arabindae Bandyopadhyay *et al.*, 2007	*Eutyphoeus incommodus*	West Midnapur, West Bengal, India	SV
M. elongatum Bandyopadhyay *et al.*, 2008	*Perionyx excavates*	Murshidabad, West Bengal, India	SV
M. septum Bandyopadhyay *et al.*, 2009a	*Eutyphoeus orientalis*	Murshidabad, West Bengal, India	SV
M. constricta Bandyopadhyay *et al.*, 2009b	*Eutyphoeus quaripallatus*	Calcutta, West Bengal, India	SV
M. lampitae Bhowmik *et al.*, 2011a	*Lampito mauritii*	Bagdaha, West Bengal, India	SV
M. ayeshae Sarkar and Bandyopadhyay, 2011b	*Metaphire posthuma*	Satkhira, Bangladesh	SV

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FISH DIVERSITY IN TWO SOUTH-WESTERN DISTRICTS OF WEST BENGAL -BANKURA AND PURULIA

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INTRODUCTION

The area lies in between the latitudes of 22°44'4"-23°44'4" North and longitudes of 85°44'4"-85°44'4" East, covering an area of 13232 km^2. It is situated in the lower parts of upper ridges at right flank of Damodar River in West Bengal. Once known as "Jangale mahal" cover with thick mixed dense forest mainly sal (*Shorea robusta*), palas (*Butia monosperma*), and ber (*Ziziphus zuzubi*) in uneven terrain land.

The Drainage system is mainly controlled by Damodar, Dwarakeswar and the Kangsabati river along with their network of tributaries and its feeder channels, sloping in south east direction. The courses of the principal rivers are approximately parallel to each other. Silabati (56 km.), popularly known as Silai is the largest tributary of Dwarakeswar, Joypanda (44 km) is the principal tributary of the Silabati. Kangsabati which rises in the hilly terrain of Jhalda block in the district of Purulia enters Bankura district in Khatra block. It has flows south easterly for a distance of about 56 km. across the southern part of the district and enters Midnapore district at the south east corner. Some other rivers and tributaries, like Gandheswari, Sali (74 km.), Arkasha, Birai (30 km.), Bodai (16 km.), Dangra etc. plays an important role in the district's irrigation and drainage systems. All the rivers are seasonal hence the region is drought prone.

ENVIS (2007) has reported that state possesses 171 fresh water fishes. This region consists of more than 100 small and medium reservoir/tank (>10ha) mainly utilized for irrigation and to generate hydroelectric power. These are serving as home-ground of varieties of indigenous fishes. Many of them are not recorded before and are going to decline from their stock. As parts of West Bengal where people are in general depend upon fish, pressure to water regime increasing day after day.

Very few literatures have been made on fish diversity from this region. According to Bhatt *et. al.*, (2001) 9 species were identified from Kesto-Bazar nalla of district Purulia. Mishra *et al.*, (2009) reported that 25 species of fishes belonging to 18 genera, 7 families under the order Siluriformes have been recorded from different freshwater and brackish water wetlands of South West Bengal. Mukherjee and Praharaj (2009) reported that 47 species have been recorded from Kangsaboti reservoir which is situated in between Bankura and Purulia district.

MATERIALS AND METHODS

Field survey were conducted during the period from 2005-2008 through sample survey from randomly selected locations based on the thematic map and database of the study area. Total 625 numbers of closed water bodies and 37 sites in 2 main river systems were investigated.

Key word: Fish diversity, Threatened species, Fish distribution.

Especially large closed water bodies and deep pool in river system had been surveyed which shows maximum diversity of fishes.

The specimens were collected using different types of fishing methods such as cast nets, gill nets, drag nets, scoop nets and other tools like use of "Changi" (living murrel fish used at the end of fishing line with hook and hang just on the surface of deep running water by strong bamboo whip to trap Chital, Boal) especially for carnivorous fishes and techniques like use of "Sand build trap" (small parts of running stretch bounded by small wall sand bundh so that fish can jump to fall on sand bundh, opening by small mouth downwards and after certain time mouth closed and fish are trap) making in the river system. Generally multistage samplings were adopted for fish collection at different stage and place, along with 87 numbers of markets were also surveyed.

Collected fish samples were preserved in 4% formalin for detailed examination and identification was done by following the methodologies after Talwar and Jhingran, 1991 and Jayaram, 1999. Classification has been done on the basis of FishBase (2009). As colour loss is rapid, accurate descriptions of colour patterns were recorded by photography. Fishes were identified to species level except for juveniles.

RESULTS

(a) Fish species richness

From the study area 100 species of fish were recorded (Table-1). Study shows that high species richness blocks were found at Bankura. Middle stretch of river Kangsaboti, Darkeswar and Kangsaboti reservoir were showing great diversity of fish richness. Water area >5ha was showed high richness of fish species and an area

Table-1 : Recorded fish fauna from the study area (After Fishbase, 2009)

Family	Species	Local Name
Ambassidae	*Chanda nama* (Hamilton, 1822) *Parambassis ranga* (Hamilton, 1822) *Parambassis lala* (Hamilton, 1822)	Chandkora Chandkora Lal chandkora
Anabantidae	*Anabas testudineus* Bloch, 1792)	Koi
Anguillidae	*Anguilla bengalensis bengalensis* (Gray, 1831)	Moula
Badidae	*Badis badis* (Hamilton, 1822) *Dario Dario* (Hamilton, 1822)	Kaloputi Lalputi
Bagridae	*Rita rita* (Hamilton, 1822) *Hemibagrus menoda* (Hamilton, 1822) *Sperata aor* (Hamilton, 1822) *Sperata seenghala* (Sykes, 1839) *Mystus cavasius* (Hamilton, 1822) *Mystus bleekeri* (Day, 1877) *Gagata cenia* (Hamilton, 1822)	Ritha Aor Aor Pat Tangra Tangra
Belonidae	*Xenentodon cancila* (Hamilton, 1822)	Gangdara
Channidae	*Channa punctata* (Bloch, 1793) *Channa orientalis* (Bloch and Schneider, 1801) *Channa striata* (Bloch, 1793) *Channa gachua* (Hamilton, 1822) *Channa marulius* (Hamilton, 1822)	Letha Chang Sol Sisir Cheng Sal
Cichlidae	*Oreochromis mossambica* (Peters, 1852) *Oreochromis niloticus niloticus* (Linnaeus, 1758)	Tilapia Nilontega
Clariidae	*Clarias batrachus* (Linnaeus, 1758) *Clarias gariepinus* (Burchell, 1822)	Magur Hybrid magur
Clupeidae	*Gudusia chapra* (Hamilton, 1822) *Tenualosa ilisha* (Hamilton, 1822)	Khoira Ilish

Family	Species	Local Name
Cobitidae	*Somileptus gongota* (Hamilton, 1822)	fossils geto
	Acanthocobitis botia (Hamilton, 1822)	Geto
	Botia lohachata (Chaudhuri, 1912)	Bagaya Geto
	Lepidocephalichthys guntea (Hamilton, 1822)	Geto
Balitoridae	*Schistura beavani* (Günther, 1868)	Chalkura
	Schistura corica (Hamilton, 1822)	Salgeta
Cyprinidae	*Labeo pangusia* (Hamilton, 1822)	Kalbasu
	Osteobrama cotio cotio (Hamilton, 1822)	Dhela/Nadna
	Piaractus brachypomus (Cuvier, 1818)	Piranha
	Danio rario (Hamilton, 1822)	Uli
	Puntius sarana (Hamilton, 1822)	Sar puti
	Labeo gonius (Hamilton, 1822)	Bata
	Rasbora rasbora (Hamilton, 1822)	Darke
	Megarasbora elanga (Hamilton, 1822)	Darka
	Labeo fimbriatus (Bloch, 1795)	Rui
	Labeo dyocheilus (McClelland, 1839)	
	Labeo calbasu (Hamilton, 1822)	Kalbos
	Salmostoma bacaila (Hamilton, 1822)	Chua
	Securicula gora (Hamilton, 1822)	Chua
	Barilius barna (Day, 1865)	Pera
	Barilius barila (Hamilton, 1822)	Pera
	Barilius bendelisis (Hamilton, 1807)	Halde pera
	Puntius ticto (Hamilton, 1822)	Tit puti
	Barbus terio (Hamilton, 1822)	Puti
	Puntius sophore (Hamilton, 1822)	Bara Puti
	Aplocheilus panchax (Hamilton, 1822)	Techokha
	Barilus vagra (Hamilton, 1822)	Pera
	Puntius conchonius (Hamilton, 1822)	Puti
	Esomus danricus (Hamilton, 1822)	Darke
	Aspidoparia morar (Hamilton, 1822)	Chira
	Aspidoparia jaya (Hamilton, 1822)	Chua
	Crossocheilus latius latius (Hamilton, 1822)	Simsuti
	Eutropiichthys murius (Hamilton, 1822)	Bacha
	Labeo boga (Hamilton, 1822)	Bata
	Labeo rohita (Hamilton, 1822)	Rui
	Catla catla (Hamilton, 1822)	Katla
	Cirrhinus cirrhosus (Bloch, 1795)	Mirik
	Ctenopharyngodon idella (Valenciennes, 1844)	Grasscap
	Cyprinus carpio carpio (Linnaeus, 1758)	Sypon
	Hypophthalmichthys molitrix (Valenciennes, 1844)	Silvercap
	Aristichthys nobilis (Richardson, 1845)	Bricate
	Amblyopharyngodon mola (Hamilton, 1822)	Mourala
	Chagunius chagunio (Hamilton, 1807)	Dekar
	Garra lamta (Hamilton, 1822)	Pathar chata
	Labeo dero (Hamilton, 1822)	Nadin rui
	Osteochilus nashii (Day, 1869)	
	Puntius amphibious (Valenciennes, 1842)	Bara Puti
Engraulidae	*Setipinna phasa* (Hamilton, 1822)	Phasa
Gobiidae	*Glossogobius giuris* (Hamilton, 1822)	Bele, Bhelso
	Brachygobius nunus (Hamilton, 1822)	Bhelso
Heteropneustidae	*Heteropneustes fossilis* (Bloch, 1794)	Singi
Mastacembelidae	*Mastacembelus armatus* (Lacepède, 1800)	Ban
	Macrognathus pancalus (Hamilton, 1822)	Penkal
	Macrognathus guentheri (Day, 1865)	Penkal

Family	Species	Local Name
	Macrognathus aral (Bloch, 1786)	Penkal
Amblycipitidae	*Amblyceps mangois* (Hamilton, 1822)	Jia
Mugilidae	*Rhinomugil corsula* (Hamilton, 1822)	Keklas mach
Nandidae	*Nandus nandus* (Hamilton, 1822)	Nados
Notopteridae	*Chitala chitala* (Hamilton, 1822) *Notopterus notopterus* (Pallas, 1769)	Chitol Folui
Osphronemidae	*Colisa fasciata* (Bloch and Schneider, 1801) *Colisa lalia* (Hamilton, 1822)	Kholse Kholse
Pangasiidae	*Pangasius pangasius* (Hamilton, 1822)	Pangus
Schilbeidae	*Silonia silondia* (Hamilton, 1822) *Eutropiichthys vacha* (Hamilton, 1822) *Ailia coila* (Hamilton, 1822) *Clupiosoma garua* (Hamilton, 1822)	Vacha Bacha Banspata Bacha
Siluridae	*Ompok bimaculatus* (Bloch, 1794) *Ompok pabo* (Ham.-Buch.) *Ompok pabda* (Ham. -Buch. 1822) *Wallago attu* (Bloch and Schneider, 1801)	Pabda Pabda Pabda Boal
Sisoridae	*Bagarius bagarius* Hamilton, 1822) *Glyptothorax dorsalis* (Vinciguerra, 1890)	Ritha Telsuti
Synbranchidae	*Monopterus cuchia* (Hamilton, 1822)	Cuche

of 0.40-5.0ha notably showed low richness of fish species and were usually used for culture based fisheries in this region. Since river and rivulets of this region are seasonal in nature fish species richness were maximum shown in patches of 'daha' area (deep pool in river path). Near about 48 species were recorded from different stretch survey during survey period (Table-2).

Fishes were distributed under 9 orders and 26 families (Table-3) in this region of which Cyprinidae family was the most common (42) of all and single species belonged to family Anabantidae, Anguillidae, Belonidae, Clupeidae, Mugilidae, Heteropneustidae, Nandidae, Pangasiidae, Synbranchidae and Engraulidae. As per IUCN categories in species level, out of 26 families 21 families were under threat (in Indian context) of which Cyprinidae was the most leading family followed by Siluridae and Bagaridae. Block wise family distribution of fish showed maximum diversity in the blocks Onda (25), Hirbundh (24), Raipur (24), Ranibundh (26), Barabazar (24) and Manbazar-II (24) (Table-4).

Qualitative study of fin fish showed that categorically out of 100 species, 47 species were identified as commercially important, 21 cat fish, 10 ornamental fish, 41 exclusively riverine and 69 threatened fishes (Table-5). From this region 69 species (Table-6) had been identified as threatened on IUCN criteria of which 51 were identified as locally threatened species. Study reveals that fish richness in Purulia was lower in comparison to Bankura. (Table-4).

Study showed that in Bankura district Onda, Raipur, Bishnupur, Kotolpur, Barjora and Bankura-I were the most cultural Block where as Purulia-I, Purulia-II, Kashipur, Raghunathpur-I and II of Purulia district was the most cultural block in this region. From this region 3 Indian major carp along with 3 exotic carps (*H. molitrix, C. carpio* and *C. idella*) were scientifically cultured. Among riverine fishes *Barilius barna, Wallago attu, Sperata aor, Labeo boga, Barilius bendelisis, Brachygobius nunus, Amblyceps mangois* and *Acanthocobitis botia* were found in maximum sites whereas *Chitala chitala, Pangasius pangasius, Nandus nandus, Ailia coila, Silonia silondia, Osteobrama cotio cotio* were found in least sited areas (Table-2).

Table-2: River based fish information at different stretch(b)Family wise fish distribution

Speciec	Palla ghat	Joykrishnapur bdg	Prakash ghat	Rajgram bdg	Gamidya	Raipur bdg	Guniadah	Parkul	Bhalukkhunadaha	Ahanda bdg	Sanjuri ghat	Dochama	Vhalukgorya ghat	Mahesdi, Keranipur	Molbana Pulkirdah	Bagjuri	Gotora	Girna setu	Amakonda	Khatnagar	Silaboti bdg Simlapal	Bikrampur dah	Lakhyasol bdg	Satsinga	Gamarkuri	WSS Ambagan, Kapista	Kalapathar	Khetropal Bridge	Bansbera	Pairachali	Budhpur bdg to Manbazar	Kochahath Bdg	Manipur Majhi kuli	Hati pahar	Arkasa pole	Dwarsini bdg	Kumardih khal	Total
Rita rita	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	28
Sperata aor	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	33
Sperata seenghala	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	23
Gagata cenia	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	17
Xenentodon cancila	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	25
Gudusia chapra	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	16
Somileptus gongota	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	26
Botia lohachata	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	28
Schistura beavani	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	18
Acanthocobitis botia	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	29
Schistura corica	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	20
Labeo pangusia	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	20
Osteobrama cotio cotio	-	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	9
Hilsa ilisha	-	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	17
Labeo gonius	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	28
Labeo dyocheilus	+	+	+	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	28
Barilius barna	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	37
Barilius barila	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	26
Barilius bendelisis	+	+	+	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	32
Barilius vagra	+	-	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	18
Aspidoparia morar	+	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	19
Aspidoparia jaya	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	31
Crossocheilus latius latius	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	30

Labeo boga	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	-	+	+	+	+	-	+	+	+	+	+	+	+	-	+	-	-	+	32
Brachygobius nunus	+	+	+	+	+	+	+	+	+	-	+	+	+	+	+	+	-	+	+	+	+	+	-	-	+	+	+	+	+	+	+	+	+	-	+	+	+	32
Chagunius chagunio	+	-	+	+	-	+	+	+	+	-	+	+	+	+	+	+	+	+	+	-	+	+	+	-	-	-	+	-	+	+	-	-	-	-	-	+	+	24
Gara lamta	+	-	-	+	-	+	+	+	+	+	+	+	+	+	+	-	+	+	+	-	+	+	+	+	-	+	+	-	-	+	+	-	-	-	+	-	+	25
Labeo dero	-	-	-	+	-	+	+	+	+	+	+	+	+	+	+	+	+	+	-	-	+	+	-	+	+	+	-	+	+	+	-	+	-	-	-	+	+	25
Osteochilus nashii	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	-	+	+	+	-	-	-	-	-	+	+	+	-	+	-	+	+	+	29
Puntius amphibius	-	-	-	+	-	+	-	-	+	+	+	-	-	+	+	+	+	-	-	-	+	+	-	-	-	-	+	+	+	+	-	-	-	+	+	+	+	19
Setipinna phasa	-	+	+	+	-	+	+	-	+	-	-	-	-	+	+	-	-	-	-	+	+	+	+	-	-	-	-	-	-	+	-	-	-	-	-	-	-	13
Rhinomugil corsula	-	+	+	+	+	+	+	-	+	-	-	-	-	+	+	-	-	-	+	+	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	13
Chitala chitala	-	-	+	-	-	+	+	-	+	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	+	-	-	-	-	-	+	7
Silonia silondia	+	+	+	+	-	+	+	+	+	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9
Eutropiichthys vacha	+	+	+	+	+	+	+	+	+	-	+	+	+	+	+	+	-	-	-	+	+	+	-	-	-	-	-	-	-	+	-	-	-	-	-	-	+	21
Ailia coila	-	+	+	+	-	+	+	-	+	-	-	-	-	-	-	-	-	-	-	+	+	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	9
Clupiosoma garua	+	+	+	+	+	+	+	+	+	-	+	-	-	+	+	+	-	-	-	+	+	+	+	-	+	-	-	-	+	+	-	-	-	-	-	-	+	21
Ompok bimaculatus	+	-	+	+	-	+	+	+	+	-	-	-	+	+	+	-	-	-	-	+	+	+	-	-	-	-	-	-	+	+	-	-	-	-	-	-	-	15
Wallago attu	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	37
Amblyceps mangois	+	-	+	+	+	-	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	-	-	+	32
Bagarius bagarius	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	-	+	+	+	+	+	+	-	-	-	-	-	+	+	-	-	-	-	+	-	+	26
Glyptothorax dorsalis	+	-	-	+	-	+	+	+	-	+	+	+	+	+	+	-	+	-	-	-	-	+	-	+	-	-	-	-	-	-	-	-	-	-	-	-	15
Labeo fimbriatus	+	+	+	+	-	+	+	+	+	+	+	+	-	+	+	+	-	-	+	-	+	+	+	-	-	-	+	-	-	+	+	-	+	+	+	-	+	25
Nandus nandus	-	-	+	-	-	+	+	-	+	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5
Pangasius pangasius	-	-	-	-	-	+	+	-	+	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4
Monopterus cuchia	+	-	+	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	-	+	+	+	+	-	+	+	-	-	+	+	-	-	-	+	+	+	28
Anguilla bengalensis	+	-	+	-	-	+	+	+	+	+	+	-	+	+	+	+	-	+	+	+	+	+	+	-	-	-	+	-	-	+	-	-	-	-	+	+	+	23
Badis badis	+	-	+	+	+	+	+	+	+	+	+	-	-	+	+	+	-	-	+	-	+	+	+	-	-	-	-	+	-	+	+	-	+	-	+	-	-	22
Total	**33**	**24**	**36**	**42**	**27**	**47**	**46**	**33**	**45**	**26**	**37**	**28**	**32**	**41**	**41**	**32**	**24**	**25**	**23**	**20**	**40**	**45**	**23**	**18**	**15**	**18**	**22**	**16**	**26**	**39**	**23**	**26**	**12**	**17**	**20**	**17**	**36**	

Table-3: Family wise fish species in the study area

Family	Nos.	Family	Nos.
Ambassidae	3	Cyprinidae	42
Amblycipitidae	1	Gobiidae	2
Anabantidae	1	Heteropneustidae	1
Anguillidae	1	Mastacembelidae	4
Bagridae	7	Nandidae	1
Balitoridae	2	Notopteridae	2
Belonidae	1	Osphronemidae	2
Channidae	5	Pangasiidae	1
Cichlidae	2	Schilbeidae	4
Clariidae	2	Siluridae	4
Clupeidae	2	Sisoridae	2
Cobitidae	4	Synbranchidae	1
Mugilidae	1	Engraulidae	1
Badidae	2		

Table-4: Family wise fish distribution at block levels (Bankura and Purulia) Distribution of fish species

Bankura		**Purulia**	
Block	Family nos.	Block	Family nos.
Bankura-I	22	Arsha	21
Bankura-II	18	Bagmundi	15
Barjora	19	Balarampur	16
Bishnupur	22	Barabazar	24
Chattna	20	Bundwan	16
Gangajal Ghati	21	Hura	15
Hirbundh	24	Jaypur	16
Inddus	16	Jhalda-I	18
Indpur	22	Jhalda-II	20
Joypur	20	Kashipur	22
Khatra	23	Manbazar-I	20
Kotalpur	20	Manbazar-II	24
Mejia	20	Neturia	20
Onda	25	Para	16
Patrasayer	18	Puncha	18
Raipur	24	Purulia-I	22
Ranibundh	26	Purulia-II	22
Saltora	22	Raghunath Pur-I	15
Sarenga	22	Raghunath Pur -II	23
Simlapal	20	Santuri	18
Sonamukhi	18		
Taldangra	20		

Table-5 : Different categories of fish in the study area

Sl. No.	Species	IUCN
1	*Xenentodon cancila* (Ham.-Buch.)	-- LRnt
2	*Wallago attu* (Schneider)	-- LRnt
3	*Silonia silondia* (Ham.-Buch.)	-- LRnt
4	*Semiplotus semiplotus* (McClelland)	-- VU -- (A1c; B1, 2ab)
5	*Salmostoma bacaila* (Ham.-Buch.)	-- LRlc
6	*Rita rita* (Ham.-Buch.)	-- LRnt
7	*Rhinomugil corsula* (Ham.-Buch.)	-- VU -- (A1acd)
8	*Puntius ticto* (Ham.-Buch.)	-- LRnt
9	*Puntius terio* (Ham.-Buch.)	-- LRnt
10	*Puntius sophore* (Ham.-Buch.)	-- LRnt
11	*Puntius sarana sarana* (Ham.-Buch.)	-- VU -- (A1acd)
12	*Pangasius pangasius* (Ham.-Buch.)	-- CR -- (A1abcd)
13	*Osteobrama cotio cotio* (Ham.-Buch.)	-- LRnt
14	*Channa gachua* (Bloch and Schneider)	-- VU -- (B1,2c)
15	*Ompok pabda* (Ham.-Buch.)	-- EN -- (A1acd, 2cd)
16	*Ompok bimaculatus* (Bloch)	-- EN -- (A1acd, 2cd)
17	*Notopterus notopterus* (Pallas)	-- LRnt
18	*Notopterus chilata* (Ham.-Buch.)	-- EN -- (A1abcd, 2cd)
19	*Nemacheilus guentheri* (Day)	-- LRlc
20	*Nemacheilus corica* (Ham.-Buch.)	-- LRnt
21	*Nemacheilus botia* (Ham.-Buch.)	-- LRnt
22	*Mystus vittatus* (Bloch)	-- VU -- (A1acd)
23	*Nandus nandus* (Ham.-Buch.)	-- LRnt
24	*Mystus cavasius* (Ham.-Buch.)	-- LRnt
25	*Mystus bleekeri* (Day)	-- VU -- (A1acd)
26	*Monopterus cuchia* (Ham.-Buch.)	-- LRnt
27	*Macrognathus pancalus* (Ham.-Buch.)	-- LRnt
28	*Labeo rohita* (Ham.-Buch.)	-- LRnt -- -
29	*Labeo pangusia* (Ham.-Buch.)	-- LRnt -- -
30	*Labeo kontius* (Jerdon)	-- EN -- (B1, 2c)
31	*Labeo gonius* (Ham.-Buch.)	-- LRnt
32	*Labeo fimbriatus* (Bloch)	-- LRnt
33	*Labeo dyocheilus* (McClelland)	-- VU -- (A1acd)
34	*Labeo dero* (Ham.-Buch.)	-- VU -- (A1acd)
35	*Labeo calbasu* (Ham.-Buch.)	-- LRnt
36	*Labeo boga* (Ham.-Buch.)	-- LRnt
37	*Labeo bata* (Ham.-Buch.)	-- LRnt
38	*Hilsa ilisha* (Ham.-Buch.)	-- VU -- (A1acd)
39	*Heteropneustes fossilis* (Bloch)	-- VU -- (A1acd)
40	*Gudusia chapra* (Ham.-Buch.)	-- LRlc
41	*Glossgobius giuris* (Ham.-Buch.)	-- LRnt
42	*Eutropiichthys vacha* (Ham.-Buch.)	-- EN -- (A1abcd, 2bcd)

Table-6 Threatened fishes in the study area (after CAMP, 1998)

Sl. No.	Species	IUCN
43	*Eutropiichthys murius* (Ham.-Buch.)	-- LRnt
44	*Esomus danricus* (Ham.-Buch.)	-- LRlc
45	*Crossocheilus latius latius* (Ham.-Buch.)	-- DD
46	*Colisa fasciatus* (Bloch and Schneider)	-- LRnt
47	*Clupisoma garua* (Ham.-Buch.)	-- VU -- (A1acd, 2cd)
48	*Clarias batrachus* (Linnaeus)	-- VU -- (A1acd)
49	*Cirrhinus reba* (Ham.-Buch.)	-- VU -- (A1abcd, 2cd)
50	*Cirrhinus mrigala* (Ham.-Buch)	-- LRnt
51	*Cirrhinus cirrhosus* (Bloch)	-- VU -- (B1, 2c)
52	*Channa striatus* (Bloch)	-- LRlc
53	*Channa punctatus* (Bloch)	-- LRnt
54	*Channa orientalis* (Bloch and Schneider)	-- VU -- (A1acd)
55	*Channa marulius* (Ham.-Buch.)	-- LRnt
56	*Catla catla* (Ham.-Buch.)	-- VU -- (A1acde)
57	*Botia lohachata* (Chandhuri)	-- EN -- (B1, 2c)
58	*Barilius vagra* (Ham.-Buch.)	-- VU -- (A1a, 1c)
59	*Barilius bendelisis* (Ham.-Buch.)	-- LRnt
60	*Barilius bakeri* (Day)	-- VU -- (A1acd)
61	*Bagarius bagarius* (Ham.-Buch.)	-- VU -- (A1acd)
62	*Aspidoparia morar* (Ham.-Buch.)	-- LRnt
63	*Aspidoparia jaya* (Ham.-Buch.)	-- VU -- (A1acd)
64	*Aplocheilus panchax* (Ham.-Buch.)	-- DD
65	*Anguilla bengalensis* (Gray)	-- EN (A1acd; B1, 2c)
66	*Anabas testudineus* (Bloch)	-- VU -- (A1acd)
67	*Amblypharyngodon mola* (Ham.-Buch.)	-- LRlc
68	*Amblyceps mangois* (Ham.-Buch.)	-- LRnt
69	*Ailia colia* (Ham.-Buch.)	-- VU -- (A1abcd, 2bcd)

VU = Vulnerable; LRnt = Lower Risk near threatened; LRlc = Lower Risk least concern; EN = Endangered; CR = Critically endangered; NE = Not Evaluated

The distribution of the most common species - Barilius sp., *Puntius* sp., *Danio* sp. and few *loaches were* recorded in river system where as some selected species with few weed fishes found in every water body. These situations were associated with the onset of the dry season in March when the flow declined end and to the middle stretch of the river or going to dry the closed water system. The fish species examined were distributed throughout the study area and were found in all the larger tributaries and closed water body. The rarest species *M.cuchia* and *A. anguila,* which were not usually found in the main river and only occasionally in some of the creek where muddy substance remain with rocky substance. *N. chitala* was caught only once in the Kangsaboti river during post monsoon season by the typical fishing bait called "Changi" using small murrel fish at the tip of fishing line with fishing hooks in the night. *N. Chitala* never found in the Darkeswar river since last 10 years (personal communication with fisherman at different stretches).

However river Darkeswar has no obstacle (dam/bundh) in the running course. A number of diadromus fishes e.g. *Tenualosa* sp., *Eutropichthys*

sp., *Sperata* sp., *Bagarius* sp. and other cat fishes were located at the tip of this river during monsoon. But in Kangsaboti such kind of fishes are not frequently located on the upper riches of the reservoir. It might be that some of these fishes were present here previously or might have migrated.

DISCUSSION

The study reveals that 100 species have been recorded from this region compared to 171 fresh water species in the state (ENVIS report, 2007). It demonstrates that a great diversity of fishes has been revealed from this region, some of them like *Glyptothorax dorsalis, Schistura corica* and *Schistura bevani have* not been recorded previously.

The first step in conservation of biodiversity is to assess the diversity of natural resources present and identify those, which are important and most irreplaceable (Groombridge & Jenkins 1998). Areas that are rich in diversity for these species are assumed to be rich in general.

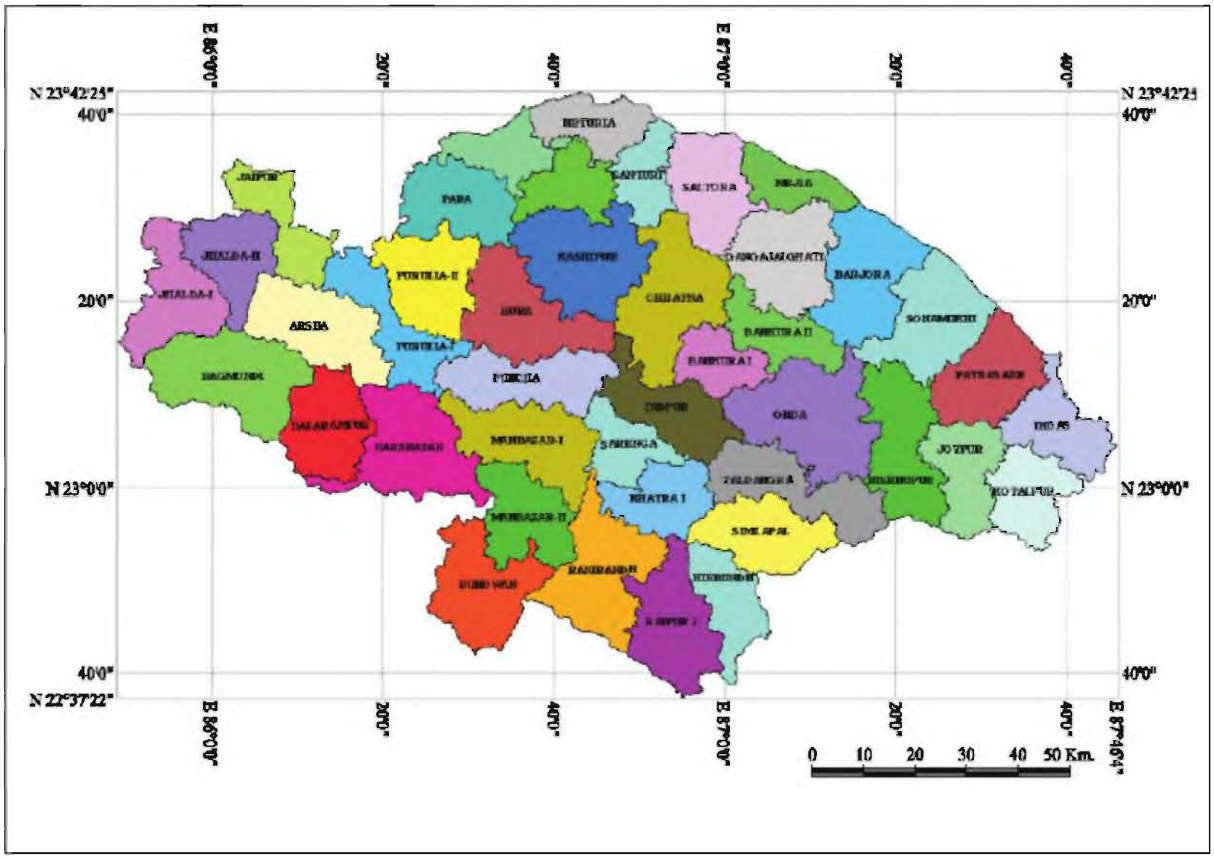
The absence of some important fishes (*B. bagarius S. senghala, C. chitala* and *S. aor*) from these river systems and nearby reservoirs shows great variability in species composition eg. presence of carnivorous fishes declines of the population small fish groups as it frequently seen in Kangsaboti river where as it is reverse in Darkeswar river. This may be due to a shift in hydrological regime through river regulation, obstruction to free movement of fish, pollution, or change in landscape use.

Reservoir, river and in stream naturalness is more concise to natural breeding fishes where as artificial stocking of selected species in ponds and tanks not happen frequently. For running water system middle stretch of the river, reservoir and 'daha' (deep pool in the path of river, colloquial term used in Bankura and Purulia) has been selected where maximum number of fish species has been assembled after monsoon. These water bodies are the prime source of water as well as survival for wild varieties of fishes in this region.

Qualitatively Cyprinidae are the most common and Anguillidae are most rare family found in this region. Few anandromus and diadromus fishes through migration come across the river during monsoon that capture affects the economic profit to bank dwelling fisher.

Familial distribution of fresh water fishes is remarkably good enough in comparison to state (Kar *et al.*, 2000; Prasad *et al.*, 2002). 100 species under 26 families under 9 orders have been recorded from this region of which the Cyprinidae family is the most predominant (CAMP, 1998, Reyjol *et al.*, 2007). Finally 8 families were representing each only one species (Synbranchidae, Pangasiidae, Heteropneustidae, Mugilidae, Clupeidae, Belonidae, Anguillidae and Anabantidae). Maximum threat found in Cyprinidae (family 14 nos.) and catfish group. Similar findings have also been reported by other workers (Hossain *et al.*, 2008; chakrabarti *et al.*, 2009). In the present study, maximum family was recorded in Bankura district (26). According to Heda (2009) the varieties are commonly found in natural system like river Channels and reservoir rather than in ponds and tanks. This may be due to naturalness of the ecosystem.

Analysis shows that the blocks with high fish richness are found at Bankura due to suitable condition for their diversity e.g. middle stretch of river Kangsaboti and Darkeswar. Similar observations were also made by (Mishra *et al.*, 2009, Mukherjee *et al.*, 2005). Further Kangsaboti reservoir shows great diversity of fish richness and this district acts as a buffer zone in this region. Large water body shows high richness of fish species in comparison to small water bodies. Small water bodies are usually used for culture based fisheries in this region. Some fishes like *C. chitala, O. pabda, G. dorsalis* decline steadily and are likely to disappear. Similar observations were also made by other workers (Menon, 1989; Yadava and Chandra, 1994; Prasad, 1994; Das, 1998; Mishra *et al.*, 2001a,b,c; Mukherjee *et al.*; 2002; Mishra *et al.*, 2009) from this region. Sixty nine (69) of 227 species as classified in IUCN criteria, 2003 (CAMP, 1998) except *Cirrhinus mrigala* and *Cirrhinus cirrhosus* is the same species as described in Fishbase and 39 of 83 at state level



Location of the Study Area

(Mukherjee *et. al.*, 2002; West Bengal Doc on NBSAP, 2003; Ghosh, 2007; State report, 2005) species have been identified as threatened. This demonstrates that this region is definitely an area to be preserved. Currently 51 of 69 species have been detected as locally threatened species. As more and more surveys will be conducted in this region much more information on these threatened fishes will be revealed.

Certain species are not recognized as hill stream fishes but their adaptive nature (developing adaptive organs) has enabled them to be referred to as hilly variety. Possibly the junction between hilly steps of Purulia merged into alluvial plain of Bankura make an edge effects in the western parts of Bankura where a number of algae feeder and sucker fishes living year after year, such fishes are rare in other rivers and streams in this region.

CONCLUSION

Identifying fish diversity is a vital source of fish information. A large number of species which are earlier not reported has been revealed from this region. Out of 171 species known from West Bengal 100 species have been found which might be more than 58.4% of the total fresh water fish diversity in the state. In this region 47 species are being commercially important, 10 are categorized under ornamental fishes, 21 under catfish, 41 are exclusively riverine fishes and 51 species have been identified locally threatened species. Some of which are already nationally established; compare to FishBase in context to India it is only 17%. A considerable number of 26 fish families have been identified. Maximum fish diversity found in Bankura district because of edge effects and suitable climatic conditions.

The fish fauna in the region considered presently is highly diverse with an estimated cumulative total of 100 species. The diversity of freshwater fish species in the region was significantly related to the adjoining land and channel of the different parts of this region. This is to be explained better if rivers and reservoirs are surveyed systematically.

SUMMARY

The Bankura and Purulia districts lying in the south western part of West Bengal, is considered as a heaven of sweet water resources, nourishing a variety of fresh water fishes. Due to adverse condition of this region intensive survey to reveal information on fish diversity was not done earlier. During 2005-2008 a sample survey was conducted to inventorise fin fishes and nearly 100 species under 26 families were recorded from 625 nos. of closed water bodies and 37 nos. of stretch under 2 main river systems. Many of these fishes are under threat and are not recorded earlier. Some fishes exhibit special adaptive features to survive in this region. Maximum fish diversity was found in the adjoining parts of both districts where undulating terrain merge into fluvial plains which might be an edge effect of this area. District Bankura shows highest number of 100 fish species where as in Purulia 88 species. 69 species were identified as threatened on the basis of CAMP report (1998) of which 51 were detected as locally threatened.

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SPECIES OF THE ORDER TRICHOPTERA REPRESENTED IN THE NATIONAL ZOOLOGICAL COLLECTION OF THE ZOOLOGICAL SURVEY OF INDIA, KOLKATA

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The Order Trichoptera includes a total of 13,574 species, 308 subspecies in 609 genera under 47 families known over the world (Morse, 2011). Sharma and Chandra (2010) listed 1046 species / subspecies belonging to 94 genera and 27 families occurring in India. Of the Indian trichopterans, 166 species/subspecies under 33 genera and 15 families represented in the National Zoological Collection of the Zoological Survey of India have been catalogued. This collection also includes type specimens referring to Type (2 spp.), Type series (2 spp.), Holotypes (9 spp.), Allotypes (2 spp.) and Paratypes (77 spp.) of 86 species/ subspecies. The classification and nomenclature have been followed after Morse (2012).

Order TRICHOPTERA Kirby, 1813
Superfamily PSCHOMYIOIDEA Ivanov, 2002
A. Family DIPSEUDOPSIDAE Ulmer, 1904
Subfamily DIPSEUDOPSINAE Ulmer, 1904

I Genus ***Dipseudopsis*** Walker, 1852

1. ***Dipseudopsis doehleri*** Ulmer, 1929

India: Meghalaya: West Garo Hills, Kherapara, P.W.D.I.B. (2 exs).

2. ***Dipseudopsis indica*** McLachlan, 1875

India: Meghalaya: East Garo Hills, Tasek, F.R.H., Sangsok (3exs); West Garo Hills, Kherapara, P.W.D.I.B. (3 exs).

3. ***Dipseudopsis triclavata*** Martynov, 1935

India: Meghalaya: West Garo Hills, Shibbari, (2 exs).

Subfamily HYALOPSYCHINAE Lestage, 1925

II Genus ***Hyalopsyche*** Ulmer, 1904

4. ***Hyalopsyche sachalinica*** Martynov, 1910
(Syn. **Hyalopsyche parsula** Martynov, 1935)

India: Meghalaya: East Garo Hills, Tasek, F.R.H.I.B., Sangsok (2 exs); West Garo Hills, Shibbari, F.R.H.I.B. (1ex).

B. Family POLYCENTROPODIDAE
Ulmer, 1903
Subfamily POLYCENTROPODINAE
Ulmer, 1903

III Genus ***Plectrocnemia*** Stephens, 1836
5. ***Plectrocnemia obliquofasciata***
Martynov, 1935

India: Uttarakhand, Garhwal, Pandukeswar, 5,500 ft (1 ex); Almora, Dhakwani,11,000ft (1 ex); Garhwal, Vacham, 6,500 ft (1 ex). West Bengal: Darjiling (2 exs).

Superfamily HYDROPSYCHOIDEA
Curtis, 1835
C. Family HYDROPSYCHIDAE
Curtis, 1835
Subfamily ARCTOPSYCHINAE
Martynov, 1924

IV Genus ***Arctopsyche*** McLachlan, 1868
6. ***Arctopsyche lobata*** Martynov, 1930

India: West Bengal: Darjiling, 2000 ft. (3 exs).

Subfamily DIPLECTRONINAE Ulmer, 1951

V Genus ***Diplectrona*** Westwood, 1840

Scientist -C (Retired)

7. ***Diplectrona marginata*** (Betten, 1909)

India: Uttarakhand: Garhwal, Khumyara, 4,000 ft (10 exs). West Bengal: Darjiling (1ex), Kurseong, (1ex).

8. ***Diplectrona orientalis*** (Betten, 1909)
(Syn. *Hydromanicus orientalis* Betten, 1909)
(Type)

India:West Bengal: Darjiling, Kurseong (1 ex).

Subfamily HYDROPSYCHINAE Curtis, 1935
VI Genus ***Cheumatopsyche*** Wallengren, 1891
9. ***Cheumatopsyche columnata*** Martynov, 1935

India: Meghalaya: East Garo Hills, Tasek, F.R.H.I.B., Sangsok (1 ex).

10. ***Cheumatopsyche truncata*** Martynov, 1935

India: Meghalaya: East Garo Hills, Tasek, F.R.H.I.B. (1ex); West Garo Hills, Tura, 1200-1500 ft (2 exs).

VII Genus ***Hydromanicus*** Brauer, 1865
11. ***Hydromanicus spatulatus*** Martynov, 1935
(Syn. *Hydatopsyche spatulata* Martynov, 1935)

India: Meghalaya: West Garo Hills, Shibbari P.W.D.I.B. (2 exs).

12. ***Hydromanicus luctuosus*** Ulmer, 1905
(Syn. *Hydromanicus truncatus* Betten, 1909)

India: Uttarakhand: Mandoli, 8,000 ft. (1 ex.). West Bengal, Darjiling (5 exs), Ghumti (1 ex), Sureil, 5000 ft. (1 ex), Kurseong, 1700 ft (1 ex),

VIII Genus *Hydropsyche* Pictet, 1834
13. ***Hydropsyche indica*** Betten, 1909

India: West Bengal: Darjiling, Reyang, F. R. H. Compound (11 exs), Kurseong (2 exs).

14. ***Hydropsyche kaznakovi*** Martynov, 1915

India: Uttarakhand: Knert Pass, 12,000 ft (1 ex); Kholara, 11,000 ft (1 ex); Garhwal Jelam, 9,000 ft (2 exs). West Bengal: Darjiling, Rangpo, F.R.H., 5,000 ft. (6 exs), 500m (5 exs), Kalimpong Agricultural Seed Farm (2 exs).

Subfamily MACRONEMATINAE Ulmer, 1905
TRIBE MACRONEMATINI Ulmer, 1905
IX Genus ***Amphipsyche*** McLachlan, 1872

15. ***Amphipsyche bengalensis*** Martynov, 1935

India: West Bengal: Kolkata (2 exs).

16. ***Amphipsyche extrema*** (Martynov, 1935)
(Syn. *Amphipsychella extrema* Martynov, 1935)

India: Meghalaya: East Garo Hills, Tasek, F.R.H.I.B., Sangsok (3 exs).

17. ***Amphipsyche meridiana*** Ulmer, 1909
(Syns. ***Amphipsyche indica*** Martynov, 1935; ***Amphipsyche tricalcarata*** Martynov, 1935)

India: Meghalaya: East Garo Hills, Tasek, F.R.H.I.B. (11 exs); West Garo Hills, Tura, 290m (5 exs). Uttar Pradesh: Almora, Dawli, 10,500 ft. (1 ex.); Mandoli, 8,000 ft. (1 ex.). Uttarakhand: Khumyara, 4,000 ft (1 ex); Malari, 10,000 ft (1 ex). West Bengal: Bankura, Mukutmanipur (39 exs).

X Genus : ***Macrostemum*** Kolenati, 1859
18. ***Macrostemum fastosum bifasciatum***
(Martynov, 1935)
(Syn. ***Macronema fastosum bifasciatum***
Martynov, 1935)

India: West Bengal: Darjiling: Poshok, 2000 ft (1ex).

19. ***Macrostemum fastosum fastosum*** (Walker, 1852)
(Syn. ***Macronema fastosum fastosum*** Walker, 1852)

India: West Bengal: Darjiling, Kurseong (2 exs).

20. ***Macrostemum pseudoneura*** (Brauer, 1865)
(Syn. ***Macronema pseudoneura*** Brauer, 1865)

India: Karnataka: Mysore, Shimoga District, Bhadravati (1ex). West Bengal: Jalpaiguri, Chelapata (1ex).

XI Genus ***Pseudoleptonema*** Mosely, 1933,
21. ***Pseudoleptonema quinquefasciatum***
(Martynov, 1935)

(Syn. ***Macronema quinquefasciatum*** Martynov, 1935)

India: Uttarakhand: Rishikesh, 1200 ft (1 ex); Manghat, 3,800 ft (5 exs).

TRIBE POLYMORPHINISINI Lestage, 1936

XII Genus ***Aethaloptera*** Brauer, 1875
22. ***Aethaloptera gracilis*** (Martynov, 1935)

(Syn. ***Paraethaloptera gracilis*** Martynov, 1935)

India: Meghalaya: East Garo Hills, Tasek, F.R.H.I.B., Sangsok (1ex). West Bengal: Birbhum, Mallarpur, (1 ex).

23. ***Aethaloptera sexpunctata*** (Kolenati, 1859)

India: Meghalaya: West Garo Hills, Shibbari, P.W.D.I.B. (6 exs). West Bengal: Darjiling, 2123 m (1 ex); Murshidabad, Azimganj (1 ex), Jangipur (1 ex); Bardhaman, Bolgana (1 ex); West Dinajpur, Raiganj, Kod Gram (1 ex); Malda, Sahapur (1 ex).

Superfamily : GLOSSOMATOIDEA Wallengren, 1891
D. Family : GLOSSOMATIDAE Wallengren, 1891
Subfamily : AGAPETINAE Martynov, 1913
XIII. Genus : ***Agapetus*** Curtis, 1834
24. ***Agapetus triangularis*** Martynov, 1935

India: Uttarakhand: Dehradun, Rishikesh, 1200 ft (1 ex).

Subfamily : GLOSSOSOMATINAE Wallengren, 1891
TRIBE GLOSSOSOMATINI Wallengren, 1891
XIV. Genus : ***Glossosoma*** Curtis, 1834
25. ***Glossosoma atchintitam*** Schmid, 1971 (Paratype)

India: Uttarakhand: Tehri, Juladi, 3500 ft. (1 ex).

26. ***Glossosoma fissum*** Martynov, 1935

India: Meghalaya: Shillong, Risa Colony (1 ex). West Bengal: Darjiling, Ghoombhanjan, 7000 ft., Youth Hostel (2 exs).

Superfamily : LEPTOCEROIDEA Leach, 1815
E. Family : CALAMOCERATIDAE Ulmer, 1905
Subfamily : ANISOCENTROPODINAE Lestage, 1936
XV Genus : ***Anisocentropus*** McLachlan, 1863
27. ***Anisocentropus salsus*** (Betten, 1909)
(Syn. ***Ganonema salsum*** Betten, 1909)

India: Assam: Bhairakund (1 ex). Uttarakhand: Kumaon Hills (4 exs), Ukhul (1 ex).

Subfamily : CALAMOCERATINAE Ulmer, 1905
XVI Genus : ***Ganonema*** McLachlan, 1866
28. ***Ganonema fuscipenne*** (Albarda,1881)
(Syns. ***Asotocerus fuscipenne*** Albarda, 1881; ***Ganonema brunneum*** Ulmer, 1905)

India: Assam: Sibsagar (1ex). Himachal Pradesh: Kulu (2exs).Uttarakhand: Kumaon Hills (1 ex).

29. ***Ganonema sinuatum*** (Martynov, 1936)
(Syn. ***Asotocerus sinuatus*** Martynov, 1936)

India: Tamil Nadu: Nilgiri Hills (1 ex).

F. Family : LEPTOCERIDAE Leach, 1815
Subfamily : LEPTOCERINAE Leach, 1815
TRIBE LEPTOCERINI Leach, 1815
XVII Genus : ***Leptocerus*** Leach, 1815
30. ***Leptocerus distinguendus*** Kirschbaum, 1868

India: Uttarakhand: Garhwal, Trijuginarayan, 7500 ft (1 ex).

TRIBE NECTOPSYCHINI Morse,1981
XVIII Genus : ***Parasetodes*** McLachlan, 1880
31. ***Parasetodes respersellus*** (Rambur, 1842)
[Syn. ***Parasetodes respersella*** (Rambur, 1842)]

India: Meghalaya: East Garo Hills, Rongrengiri F.R.H. (10 exs); West Garo Hills, Shibbari P.W.D.I.B. (8 exs).

TRIBE OECITINI Silfvenius, 1905
XIX Genus : ***Oecetis*** McLachlan, 1877
32. ***Oecetis indivisa*** (Martynov, 1936)
(Syn. ***Setodellina indivisa*** Martynov, 1936)

India: Meghalaya: East Garo Hills, I Km west of I. B. (2 exs).

33. ***Oecetis mahadeva*** (Banks, 1913)
(Syn. ***Oecetina mahadeva*** Banks, 1913)

India: Meghalaya: East Garo Hills, I Km west of I. B. (1 ex).

TRIBE TRIAENODINI Morse, 1981
XX Genus : *Adicella* McLachlan, 1877
34. *Adicella biramosa* Martynov, 1936

India: Meghalaya: East Khasi Hills, Shillong Peak, 8400 ft (1ex); West Garo Hills: Kherapara (1ex).

Subfamily : TRIPLECTIDINAE Ulmer, 1906
TRIBE TRIPLECTIDINI Ulmer, 1906
XXI Genus : ***Triplectides*** Kolenati, 1859
35. ***Triplectides magnus*** (Walker, 1852)

India: Bihar: Purnea District, Katihar (1ex). Meghalaya: East Garo Hills, Tasek, F. R. H., Sangsok (2 exs). West Bengal: Birbhum: Eaglegram Forest, Gopalpur (1 ex); Calcutta (now Kolkata) (2).

G. Family : LIMNOCENTROPIDIDAE Tsuda, 1942

XXII Genus ***Limnocentropus*** Ulmer, 1907

36. ***Limnocentropus himalayanus*** Martynov,1930

[Syn. ***Limnocentropus insolitus himalayanus*** (Martynov, 1930)]

India: Uttarakhand: Mandoli, 8,000 ft (3 exs); Panwali, Trifugenpass, 11,500 ft (2 exs); Trijuginarayan, 7,500 ft (3 exs).

H. Family ODONTOCERIDAE Wallengren, 1891

Subfamily ODONTOCERINAE Wallengren, 1891

XXIII Genus ***Marilia*** Mueller, 1880

37. ***Marilia mixta*** (Hagen,1858)

(Syn. ***Molanna mixta*** Hagen, 1858; ***Marilia ceylanica*** Martynov, 1936)

India: Uttarakhand: Palwara, 4,300 ft (2 exs). West Bengal: Darjiling, Singla, F.R.H. (1 ex).

Superfamily LIMNEPHILOIDEA Kolenati, 1848

I. Family GOERIDAE Ulmer, 1903

Subfamily LARCASINAE Navas, 1917

XXIV Genus ***Larcasia*** Navas, 1917

38. ***Larcasia assamica*** Schmid, 1965 (All Paratypes)

India: Manipur:Pushing (1 ex); Sirohikashong (15 exs); Tangkhul (1 ex).

J. Family LIMNEPHILIDAE Kolenati, 1848

Subfamily LIMNEPHILINAE Kolenati, 1848

TRIBE PSEUDOSTENOPHYLACINI Schmid, 1955

XXV Genus : ***Pseudostenophylax*** Martynov, 1909

39. ***Pseudostenophylax micraulax*** (McLachlan, 1878)

(Syn. ***Stenophylax micraulax*** McLachlan, 1878)

India: Uttarakhand: Chamroo, 14,000 ft. (7 exs.); Dhatkwani , 11,000 ft. (4 exs.); Gangria, 10,000 ft (7 exs), Ghastoli, 12,000 ft (2 exs); Kedarnath, 11,500 ft. (1 ex); Khartooloma, Kharyongra (1 ex); Magoochatti, 10,000 ft (1 ex); Malari, 9,000 ft.(2 exs), 10,000 ft. (1 ex); Mana, 10,500 ft (4 exs); Tehri, Telhari, 3,500 ft (1 ex), Ukhal, 9,000 ft (2 exs).

40. ***Pseudostenophylax mitchelli*** (Mosely,1936) (Syn. ***Stenophylina mitchelli*** Mosely,1936)

India: Uttarakhand: Kedarnath, 11,500 ft (4 exs); Khartooloma, Kharyyonma, 17,800 ft (1 ex); Mana, 10,500 ft (5 exs); Paudor, 8,000 ft (1 ex); Shapuk, 13,000 ft. (4 exs).

Superfamily PHILOPOTAMOIDEA Stephens, 1829

K. Family PHILOPOTAMIDAE Stephens, 1829

Subfamily PHILOPOTAMINAE Stephens, 1829

XXVI Genus ***Dolophilodes*** Ulmer, 1909

41. ***Dolophilodes indica*** Martynov, 1935

India: Uttarakhand: Kumaon Hills (1ex); Pouri Garhwal, Mandoli, 8,000 ft (1 ex). West Bengal: Darjiling (1ex).

Subfamily CHIMARRINAE Rambur, 1842

XXVII Genus ***Chimarra*** Leach, 1829

42. ***Chimarra aberrans*** Martynov, 1935 (Syn. ***Chimarrha aberrans*** Martynov, 1935)

India: West Bengal: Darjiling, Singla, Goke, F.R.H. Compound (1 ex). Darjiling, (1 ex).

43. ***Chimarra diaphana*** Ghosh & Chaudhury, 1998

India: West Bengal: Darjiling, Goomti near Kurseong, 1250m, at light 1 ex (Holotype), 1 ex (Allotype), 3 exs (Paratypes).

44. ***Chimarra kumaonensis*** Martynov, 1935

(Syn ***Chimarrha kumaonensis*** Martynov, 1935)

India: West Bengal: Darjiling, Hima Falls, 4 Km west of Ghoom, Hill Forest, 2150m (1 ex).

45. ***Chimarra nepalensis*** Kimmins, 1964

India: Uttarakhand: Badrinath, 10,000 ft (1 ex), Chandrapuri, 2,200 ft (1 ex), Dhaktala, 8,000 ft (1 ex), Gangria, 10,000 ft (1 ex), Jelam, 9,000 ft (3 exs), Malari, 10,000 ft (2 exs).

46. ***Chimarra reyangensis*** Ghosh & Chaudhury, 1998

India: West Bengal: Darjiling, Reyang, F.R.H., 275m, 1 ex (Holotype), 1 ex (Allotype), 3 exs (Paratypes).

L. Family STENOPSYCHIDAE Martynov, 1924
Subfamily STENOPSYCHINAE
Martynov, 1924
XXVIII Genus ***Stenopsyche*** McLachlan, 1866
47. ***Stenopsyche benaventi*** Navas, 1934

(Syn. ***Stenopsyche composita*** Martynov, 1936)

India: Uttarakhand: Almora, Vacham, 6,500 ft. (1 ex).

48. ***Stenopsyche griseipennis*** McLachlan, 1866

(Syn. ***Stenopsyche quadrilobata*** Martynov, 1935)

India: Himachal Pradesh: Kulu (1 ex). Sikkim: Sikkim (4 exs). Tamil Nadu: Nilgiri Hills (22 exs). Uttarakhand: Dangchawra, 2,000 ft. (1 ex); Mana, 10,500 ft (2 exs). West Bengal: Darjiling (47 exs); Kalimpong (1 ex); Kurseong (2 exs); Reyang F.R.H.Compound (1 ex), 275m (1 ex); Singla, Goke F.R.H. Compound (1 ex), Goke F.R.H. Compound, Singla (1 ex); Tukdah F.R.H. Compound (2 ex), 7500 ft. (1 ex).

49. ***Stenopsyche himalayana*** Martynov, 1926

India: Uttarakhand: Ghastoli, 12,000 ft (2 exs), Jagroo, 17,000 ft (2 exs), Korai Pass, 12,000 ft (1 ex). Malari, 10,000 ft. (6 exs), Paudor, 8,000 ft (3 exs), Suraithota, 8,000 ft (5 exs), Saraswati, 15,000 ft (2 exs).

50. ***Stenopsyche similis*** Ulmer, 1927

[Syns. ***Parastenopsyche montana*** (Navas, 1932); ***Parastenopsyche similis*** (Ulmer, 1927)]

India: Uttarakhand: Rampur, 2,000 ft (4 exs). West Bengal: Darjiling, Singla, Goke, F.R.H. Compound (12 exs), Kurseong, 4700 ft. (1ex.). Punjab: Dalhousie, Kalatope Hills (1 ex).

51. ***Stenopsyche splendida*** Martynov, 1935

India: Meghalaya: East Khasi Hills, Cherrapunji (1 ex.). Sikkim: Gaysing (1 ex), Tarku (2 exs), Thanggou, 3750m (1 ex), Tumin, 1800m (1 ex). West Bengal: Darjiling, Reyang F. R. H. (2 exs); Singla, Goke, F.R.H. Compound (9 exs); Tukdah, F.R.H (2 exs). Uttarakhand: Garhwal, Gangria, 10,000 ft (2 exs); Manu, 10500 ft (1 ex); Rampur, 2,000 ft (4 exs).

Superfamily PHRYGANEOIDEA Leach, 1815
M. Family LEPIDOSTOMATIDAE Ulmer, 1903
Subfamily LEPIDOSTOMATINAE Ulmer, 1903
XXIX Genus ***Lepidostoma*** Rambur, 1842
52. ***Lepidostoma heterolepidium***
(Martynov, 1936)

(Syn. ***Indocrunoceia heterolepidia***
Martynov, 1936) (Type)

India: West Bengal: Darjiling (1 ex).

53. ***Lepidostoma latum*** (Martynov, 1936)

(Syn. ***Dinarthrum latum*** Martynov, 1936)

India: West Bengal: Darjiling (1 ex).

54. ***Lepidostoma punjabicum*** (Martynov, 1936)
(Syn. ***Dinarthrum punjabicum*** Martynov, 1936)

India: Uttarakhand: Dehradun (1ex).

XXX Genus ***Paraphlegopteryx*** Ulmer, 1907
55. ***Paraphlegopteryx composita*** Martynov, 1936

(Syn. ***Paraphlegopteryx compositus***
Martynov, 1936)

India: Uttarakhand: Almora, Vacham, 6500 feet (1ex).

N. Family PHRYGANEIDAE Leach, 1815
Subfamily PHRYGANEINAE Leach, 1815
XXXI Genus ***Eubasilissa*** Martynov, 1930
56. ***Eubasilissa maclachlani*** (White, 1862)

India: West Bengal: Darjiling, 7000 ft (1 ex).

57. ***Eubasilissa tibetana*** Martynov, 1930

India: Uttarakhand: Almora, Ompata 2,500 ft. (1 ex); Chandrapuri 2,200 ft. (3 exs); Gardera, 9,500 ft. (1 ex). Panwali, Trifugenpass, 11,500 ft. (3 exs); Trijuginarayan 7,500 ft. (5 exs).

58. ***Eubasilissa wigginsi*** Ghosh & Chaudhury, 1987 (Holotype)

India: Uttarakhand: District Garhwal, Gangria, 10,000 ft. (1 ex).

Superfamily RHYACOPHILOIDEA
Stephens, 1836
O. Family RHYACOPHILIDAE Stephens, 1836
XXXII Genus ***Himalopsyche*** Banks, 1940
59. ***Himalopsyche angnorbui*** Schmid, 1963

India: Sikkim: Lachung (7 exs); Chachu (7 exs), Singha (5 exs). Uttarakhand: Pouri Garhwal, Kosa (1 ex.), Binaikchatti (4 exs), Nagtal (8 exs).

60. ***Himalopsyche bhagirathi*** Schmid, 1963

India: Uttaranchal: Pouri Garhwal, Badrinath (7 exs), Gangria (4 exs), Hanumanchatti (4 exs), Moussapani (1 ex), Nagtal (8 exs), Ukhral (1 ex).

61. ***Himalopsyche digitata*** (Martynov, 1935)

(Syn. ***Rhyacophila digitata*** Martynov, 1935)

India: Meghalaya: Khasi Hills, Dunpep (1ex). Sikkim: Chamlong (2 exs.), Chungjam (2 exs), Karpanong (1 ex). Uttarakhand: Pouri Garhwal, Dwali (1 ex.), Hanumanchatti (1 ex). West Bengal: Darjiling 6 exs (Type series).

62. ***Himalopsyche dolmasampa*** Schmid, 1963

India: Sikkim: Banshal (1 ex), Changang (2 exs), Dolmasampa (50 exs), Rongsha (3 exs), Sasa (6 exs), Taling (1 ex), Thanggou, 3750 m (2 exs), Theulache (1 ex), Tongsing (5 exs), Yadang (3 exs), Zemp (4 exs).

63. ***Himalopsyche gyamo*** Schmid, 1963

India: Sikkim: Onglaktang (4 exs), Tikiachu (7 exs), Tongsing (8 exs).

64. ***Himalopsyche hierophylax*** Schmid, 1966

India: Uttarakhand: Pouri Garhwal, Badrinath (5exs), Kedarnath (9 exs).

65. ***Himalopsyche horai*** (Martynov, 1936)

(Syn. ***Rhycophila horai*** Martynov, 1936)

India: Aunachal Pradesh: Amatulla, Kameng (4 exs), Gigaon (1 ex), Shergaon (2 exs). Punjab: Dalhousie, Punjpul Nallah, 1 ex (Holotype).

66. ***Himalopsyche lanceolata*** (Morton, 1900)

(Syn. ***Rhycophila lanceolata*** Morton, 1900)

India: Manipur: Loni (1ex), Mapum (1ex), Margu (1ex), Marogi (2 exs), Mattibhang 1ex), Pal (1ex), Sirohikashong (1ex), Tangkhul, Hangdung (1ex). Sikkim: Lingtham (1ex).

67. ***Himalopsyche lepcha*** Schmid, 1963
(All Paratypes)

India: Sikkim: Yoksam (4 exs), Zamphuk 1 ex.

68. ***Himalopsyche lungma*** Schmid, 1963
(All Paratypes)

India: Uttarakhand: Pouri Garhwal, Saraswati (8 exs).

69. ***Himalopsyche malenanda*** Schmid, 1963

India: Sikkim: Bansbol (4 exs), Chamiteng (2 exs), Karpanong (1 ex), Lachen, 3500m (1 ex), Lachung (2 exs), Ramitagg (1 ex), Tongsing (1 ex).

70. ***Himalopsyche tibetana*** (Martynov,1930)

(Syn. ***Rhycophila tibetana*** Martynov, 1930)

India: Sikkim: Chachu (2 exs), Chamlong (4 exs), Kaieg (1 ex), Namnasa (2 exs), Singha (3 exs), Tangau (2 exs), Yaktang (1 ex), Yamtang (2 exs).

71. ***Himalopsyche todma*** Schmid, 1963

India: Uttarakhand: Pauri Garhwal, Phulkia (3 exs).

72. ***Himalopsyche yongma*** Schmid, 1963

India: Sikkim: Tongsing (3 exs), Tikiachu (2 exs).

XXXIII Genus : ***Rhyacophila*** Pictet, 1834

73. ***Rhyacophila anatina*** Morton, 1900

India: Meghalaya: Cherrapunji (2 exs), Mowpran (1 ex), U.J.K.H, Mowpran (1 ex). Serrarim (1 ex). Sikkim: Singbong (1 ex),

74. ***Rhyacophila ancestralis*** Martynov, 1935

India: Meghalaya: Dunpep, 3 exs (Types), Laitynghat (4 exs), Rumthang (3 exs).

75. ***Rhyacophila aureomaculata*** Schmid, 1970
(All Paratypes)

India: Arunachal Pradesh: Kameng, Shergaon (6 exs); Bilola (3 exs), Domkho (4 exs), Kalaktang (1 ex), Moshing (2 exs), Nyukmadong (5 exs), Rupa (1 ex).

76. ***Rhyacophila aureostigma*** Schmid, 1970
(All Paratypes)

India: Sikkim Chachu (2 exs), Lathong (1 ex), Manu (2 exs), Nanga (1 ex), Rapham (1 ex), Teng (3 exs).

77. ***Rhyacophila bhotia*** Schmid, 1970
(All Paratypes)

India: Uttarakhand: Garhwal, Ampata (1 ex), Dangchawra (1 ex); Dobalgaon (8 exs), Duldhar (4 exs), Gery (1ex.); Gourikund (4 exs.); Jaspur (2 exs.), Katkor (1 ex); Khumyara (6 exs.); Paukhal (1ex.); Nogani (1 ex); Pouri Garhwal, Simra (1ex),

Rampur (1 ex.); Tehri, Gawana (1ex.); Tapaban (1ex.); Kumaon, Loharket (2 exs). Uttar Pradesh: Agra (2 exs).

78. ***Rhyacophila bidens*** Kimmins, 1953

India: Arunachal Pradesh: Dirang Dzong (7 exs), Kameng: Rahung (1 ex), Phutang (1 ex). Manipur: Hkyumboum (1 ex), Sirohikashong (2 exs). Sikkim: Bakhim (1 ex), Chunggam (1 ex), Lachung (3 exs), Namnasa (4 exs), Ramtang (5 exs), Singha (3 exs), Tang (2 exs), Uttare (3 exs), Yoksam (4 exs), Zamphuk (2 exs).

79. ***Rhyacophila chandzo*** Schmid, 1970
(All Paratypes)

India: Arunachal Pradesh: Kameng, Jhumla (1 ex); Talung Dzong (1 ex).

80. ***Rhyacophila changpa*** Schmid, 1970
(All Paratypes)

India: Sikkim: Bakhim (2 exs).

81. ***Rhyacophila chayulpa*** Schmid, 1970
(All Paratypes)

India: Sikkim: Changpong (2 exs); Kambur (2 exs); Lingdok (1 ex); Lingtham (3 exs) Singhik (2 exs); Teng (2 exs); Yoksam (1 ex); Manu (1 ex).

82. ***Rhyacophila chayulpa ringmo*** Schmid, 1970
(All Paratypes)

India: Arunachal Pradesh: Kameng, Dirang Dzong (2 exs).

83. ***Rhyacophila chayulpa tsetangpa*** Schmid, 1970
(All Paratypes)

India: Uttarakhand: Pouri Garhwal, Dogalbeta (4 exs); Tungnath (1 ex).

84. ***Rhyacophila chembo*** Schmid, 1970
(All Paratypes)

India: Sikkim: Arunachal Pradesh: Kameng, Amatulla (1 ex); Bomdila, (1 ex), Chug (2 exs); Jhumla (1 ex); Nyukmadong (2 exs); Rahung (3 exs); Shergapa (1 ex). Uttarakhand: Pouri, Dhar (1 ex).

85. ***Rhyacophila chomoyuma*** Schmid, 1970
(All Paratypes)

India: Arunachal Pradesh: Kameng, Chug (1 ex). Manipur: Hkyumboum (4 exs).

86. ***Rhyacophila choprai*** Martynov, 1935
(Holotype)

India: Uttarakhand: Mussoorie (1 ex).

87. ***Rhyacophila chumikpa*** Schmid, 1970
(All Paratypes)

India: Arunachal Pradesh: Kameng, Domkho (2 exs); Shergaon (1 ex).

88. ***Rhyacophila chungse***
Schmid, 1970 (Paratype)

India: Arunachal Pradesh: Kameng, Amatulla (1 ex).

89. *Rhyacophila curvata* Morton, 1900

India: Meghalya: U.J.K.H., Borghat (1 ex), Mowshin (1 ex), Muktapur (1 ex), Pynter (1 ex). Uttarakhand: Garhwal, Gangria, 10,000 ft (1 ex), Shapuk (1 ex).

90. ***Rhyacophila dgaldanpa*** Schmid, 1970
(All Paratypes)

India: Arunachal Pradesh: Kameng, Chug (2 exs).

91. ***Rhyacophila dilatata*** Martynov, 1935

India: Himachal Pradesh: Shimla Hills, I ex (Holotype). Uttarakhand: Gangria, 10,000 ft (7 exs); Khartooloma, Kharyongra (1 ex), Magoochatti, 110,00 ft (1 ex); Pandor, 8,000 ft (1 ex); Ukhal, 9,000 ft (1 ex).

92. ***Rhyacophila dolingpa*** Schmid, 1970
(All Paratypes)

India: Meghalya: U.J.K.H. Mowpran, (1 ex.); Shnongodong (2 exs), Syndai (1 ex), Taranblang (3 exs.); Tharauyang (1 ex), Umpuh (3 exs).

93. ***Rhyacophila dongkyapa*** Schmid, 1970
(All Paratypes)

India: Arunachal Pradesh: Kameng, Amatulla (5 exs), Ankaling (1 ex); Bokhar (5 exs); Brukpatanchem (1 ex); Chug (1 ex.); Dirang Dzong (5 exs.); Kujlalong (2 exs); Langduar (3 exs); Nyukmadong, (2 exs), Rohung (4 exs); Rupa, (1 ex). Sikkim: Chongung (1 ex); Dethang (2 exs); Hi (24 exs); Lingdok (8 exs); Lingsaka (2), Lingtham (8 exs); Mangung (2 exs); Manu (3 exs); Nanga (3 exs); Nampung (2 exs); Ramtang (1 ex); Samdong (5 exs); Singbong (14 exs); Tang (3 exs); Yoksam (9

exs), Zamphuk (2 exs). West Bengal: Banglabazar (2 exs); Barahata (9 exs); Digha (1 ex).

94. ***Rhyacophila drokpa drokpa*** Schmid, 1970
(All Paratypes)

India: Arunachal Pradesh: Kameng, Amatulla (1 ex). Manipur: Mapum (1 ex). Meghalaya: Shnongodong, (1 ex).

95. ***Rhyacophila drokpa gurla*** Schmid, 1970
(Paratype)

India: Uttarakhand: Garhwal, Tehri, Gawana (1 ex).

96. ***Rhyacophila drosampa*** Schmid, 1970
(All Paratypes)

India: Meghalya: U.J.K.H. Mowpran (1 ex); Shnongodong (1 ex).

97. ***Rhyacophila fletcheri*** (Kimmins, 1952)

(Syn. ***Trichophila fletcheri*** Kimmins, 1952)

India: Sikkim: Lingdok (1 ex); Lingtham (3 exs), Mangung (1 ex), Tang (1 ex).

98. ***Rhyacophila gelukpa*** Schmid, 1970
(All Paratypes)

India: Arunachal Pradesh: Kameng, Chug (1 ex), Dirang Dzong (2 exs), Jhumla (6 exs), Moshing (2 exs), Phutang (1 ex), Shergaon (1 ex), Taluk Dzong (2 exs). Sikkim: Chamiteng (1 ex.) (5 exs), Gay (1 ex), Lachung (7 exs), Rongne (1 ex), Tang (1 ex).

99. ***Rhyacophila gyaldzen*** Schmid, 1970
(All Paratypes)

India: Manipur: Hanggo (1 ex); Parbang (1 ex).

100. ***Rhyacophila gyamo*** Schmid, 1970
(Paratype)

India: Manipur: Sirohikashong (1 ex).

101. ***Rhyacophila gyaspa*** Schmid, 1970
(All Paratypes)

India: West Bengal: Barahata (2 exs), Dilpa (2 exs).

102. ***Rhyacophila gyelbu*** Schmid, 1970
(All Paratypes)

India: Manipur: Sirohikashong (5 exs).

103. ***Rhyacophila hingstoni*** Martynov, 1930

India: Sikkim: Chachu (1 ex), Rangpa (4 exs), Thomnachen (2 exs), Thomphyak (3 exs), Yadang (4 exs), Yahul (1 ex), Zeema (1 ex). Uttarakhand: Badrinath, 10,000 ft (1 ex); Bampa, 10,500 ft (2 exs); Gangria, 10,000 ft (6 exs); Khartooloma, 17,800 ft (1 ex); Magoochatti, 10,000 ft. (1 ex.); Shapuk, 13000 Ft (1 ex); Trijuginarayan, 7500 ft (1 ex).

104. ***Rhyacophila hobsoni*** Martynov, 1930

India: Sikkim: Chamiteng (4 exs), Karpanong (7exs), Singha, (12 exs), Yamtang (2 exs).

105. ***Rhyacophila hydaspica*** Schmid, 1959

Arunachal Pradesh: Kameng, Chug (1 ex), Dirang Dzong (1 ex), Lih (6 exs), Rupa (1 ex); Salari, (2 exs). Uttarakhand: Pouri Garhwal, Koti (1 ex).

106. ***Rhyacophila inconspicua*** Morton, 1900

India: Meghalaya: U.J.K.U. Nongrim (1 ex).

107. ***Rhyacophila jayadurga*** Schmid, 1970
(Paratype)

India: Tamil Nadu: Madras (now Chennai), Makurti (1 ex).

108. ***Rhyacophila kadaphes*** Schmid 1959

India: Uttarakhand: Garhwal, Bampa (1 ex.), Hanumanchatti (1 ex.), Kosa (1 ex.); Pouri, Timarsan (2 exs).

109. ***Rhyacophila kando*** (Schmid, 1970)
(All Paratypes)

India: Arunachal Pradesh: Kameng, Phutang (3 exs). Uttarakhand: Garhwal, Dhar (2 exs); Gery (1 ex); Gwaldam (2 exs); Khali (2 exs); Pana (1 ex); Wan (3 exs).

110. ***Rhyacophila kangjongpa*** Schmid, 1970
(Paratype)

India: Arunachal Pradesh: Kameng, Bokhar (1 ex).

111. ***Rhyacophila kanichka*** Schmid, 1959

India: Uttarakhand: Bampa, 10,000 ft. (1 ex); Gangria, 10,000 ft. (15 exs); Malari 10,000 ft.(1 ex); Shapuk, 13,000 ft. (2 exs); Siunti (2 exs); Ukhal (4 exs).

112. ***Rhyacophila kashongpa*** Schmid, 1970 (Paratype)

India: Manipur: Sirohikashong (1 ex).

113. ***Rhyacophila kawachenpa*** Schmid, 1970 (All Paratypes)

India: Arunachal Pradesh: Bokhar (2 exs), Domkho (3 exs), Kameng (2 exs), Lifakpo (5 exs), Nakhu (1 ex), Nyukmadong (1 ex), Salari (1 ex), Shergaon (5 exs). Sikkim: Gigaon (2 exs).

114. ***Rhyacophila kedara*** Schmid, 1970 (All Paratypes)

India: Uttarakhand: Gery (1 ex); Kanol (3 exs); Kulara (1 ex), Malari, 10000 ft (1 ex), Pana (2 exs), Ramni (1 ex), Timarsan (4 exs).

115 ***Rhyacophila khamakhya*** Schmid, 1970 (Paratype)

India: Tamil Nadu: Madras (now Chennai), Senbanganur (1 ex).

116. ***Rhyacophila khasiorum*** Schmid, 1970 (All Paratypes)

India: Arunachal Pradesh: Kameng, Kuljalong (1 ex); Lifakpo (1 ex); Langduar (1ex); Rupa (1 ex). Sikkim: Chongung (1 ex.); Hi (3 exs); Mangalbarey (1 ex.); Manu (1 ex.); Nyukmadong (1 ex); Singbeng (5 exs); Yugang (1 ex). Uttarakhand: Garhwal, Dhar (6 exs). West Bengal: Barahata (1 ex).

117. ***Rhyacophila khimbarpa*** Schmid, 1970 (All Paratypes)

India: Arunachal Pradesh: Kameng, Jhumla (2 exs).

118. ***Rhyacophila khiympa*** Schmid, 1970 (Paratype)

India: Sikkim: Tongsing (1 ex).

119. ***Rhyacophila laptsapa*** Schmid, 1970 (Paratype)

India: Sikkim: Teng (1 ex).

120. ***Rhyacophila lepcha*** Schmid, 1970 (All Paratypes)

India: Sikkim: Bop (2 exs); Chetang (1 ex); Lachung (4 exs); Manu (1 ex); Nanga (2 exs); Serabtang (1 ex); Yoksam (3 exs); Zamphuk (1 ex).

121. ***Rhyacophila lhadzongpa*** Schmid, 1970 (All Paratypes)

India: Arunachal Pradesh: Kameng, Nyukmadong (1 ex); Rupa (5 exs); Shergaon (1 ex).

122. ***Rhyacophila lhakpa*** Schmid, 1970 (All Paratypes)

India: Uttaranchal: Dhar (1 ex); Hanumanchatti, (1 ex); Dawli (1 ex.); Suraithola (1 ex).

123. ***Rhyacophila lhopa*** (Schmid, 1970) (Paratype)

India: Tamil Nadu: Madras (now Chennai), Senbanganur, 1 ex.

124. ***Rhyacophila maitripa*** Schmid, 1970 (All Paratypes)

India: Arunachal Pradesh: Kameng, Jhumla (4 exs.), Moshing (1 ex), Nyukmadong (1 ex.); Rahung (1 ex).

125. ***Rhyacophila manipuri*** Schmid, 1970 (All Paratypes)

India: Manipur: Tangkhul, Hungdung (2 exs); Pamlal (1 ex).

126. ***Rhyacophila manlungpa*** Schmid, 1970 (All Paratypes)

India: Arunachal Pradesh: Kameng, Nyukmadong (2 exs); Talung Dzong (5 exs).

127. *Rhyacophila mishmica* Kimmins, 1953

India : Arunachal Pradesh: Kameng, Phutang (1 ex).

128. ***Rhyacophila mortoni*** Kimmins, 1953 (All Paratypes)

India: Arunachal Pradesh: Kameng, Bomdila (1 ex). Meghalaya: U.J.K.H., Serrarim (1 ex).

129. ***Rhyacophila muktepa*** Schmid, 1970 (All Paratypes)

India: Meghalaya: Laitynghat (1 ex); U.J.K.H. Larenshiap (1 ex).

130. ***Rhyacophila nabochepa*** Schmid, 1970 (All Paratypes)

India: Sikkim: Lachung (1 ex.), Yoksam (1 ex).

131. ***Rhyacophila naga*** Schmid, 1970 (All Paratypes)

India: Manipur: Hkyumboum (3 exs).

132. ***Rhyacophila nagongpa*** Schmid, 1970
(All Paratypes)

India: Meghalaya: Syndai (2 exs); Umpuh (1 ex); U.J.K.H.Larenshiap (1 ex).

133. ***Rhyacophila nakpo*** Schmid, 1970
(All Paratypes)

India : Manipur: Hkyumboum (2 exs).

134. ***Rhyacophila namgyal*** Schmid, 1970
(Al Paratyp)

India: Meghalaya: U.J.K.H Shillong, Myntang (1 Paratype).

135. ***Rhyacophila ngorpa*** Schmid, 1970
(All Paratypes)

India: Sikkim: Bop (1 ex); Manu (4 exs); Nanga (3 exs); Singbong (1 ex); Teng (4 exs); Yoksam (5 exs), Zamphuk (2 exs).

136 ***Rhyacophila ngulpa*** Schmid,1970
(All Paratypes)

India:Uttarakhand: Pauri Garhwal: Gangria (1 ex); Rata (1 ex).

137. ***Rhyacophila obscura*** Martynov , 1927

India: Uttarakhand: Pouri Garhwal, Gery (1 ex); Ghona (1 ex); Gwaldam (1ex.); Harmal (20 exs); Loharket (1 ex); Malari,(1 ex); Sirkot (1 ex).

138. *Rhyacophila parva* Kimmins, 1953

India: Meghalaya: U.J.K.H., Serrarim (1 ex).

139. ***Rhyacophila paurava*** Schmid, 1959

India: Uttarakhand: Pouri Garhwal, Akhroikoli (1 ex); Dhut (1 ex); Gourikund (1 ex); Kanol (4 exs); Trijuginarayan (2 exs); Tungnath (2 exs); Ukhral (1 ex).

140. ***Rhyacophila pemba*** Schmid, 1970
(All Paratypes)

India: Meghalaya: U.J.K.H. Borghat (1 ex); Taranblang (3 exs)

141. ***Rhyacophila poba*** Schmid, 1970
(All Paratypes)

India: Sikkim: Gey (1 ex); Tangaling (6 exs).

142. ***Rhyacophila polha*** Schmid, 1970
(Paratype)

India: Arunachal Pradesh: Kameng, Domkho (1ex).

143. ***Rhyacophila procliva*** Kimmins, 1953

India: Arunacha. 25l Pradesh: Kameng, Dirang Dzong (2 exs); Jhumla (1 ex); Nyukmadong (1 ex); Rehang (1ex); Talung Dzong (3 exs). Manipur: Hkyumboum (2 exs).

144. ***Rhyacophila rhombica*** Martynov, 1935
(Holotype)

India: West Bengal: Darjiling, 7000 ft. (1 ex).

145. ***Rhyacophila rongpa*** Schmid, 1970
(All Paratypes)

India: Arunachal Pradeh: Kameng, Jhumla (1 ex). Manipur: Chingsao (1 ex). Sikkim: Chumtang (1 ex); Lingtham (2 exs); Nanga (3 exs); Singbong (1 ex); Singhik (2 exs); Teng (1 ex). West Bengal: Gitdabing (1 ex); Labha (2 exs).

146. ***Rhyacophila sakyapa*** Schmid, 1970
(All Paratypes)

India: Uttarakhand: Pouri Garhwal, Binaikchatti (4 exs.); Dhar (1 ex); Khali (2 exs); Saran (1 ex); Trijuginarayan (1 ex); Tungnath (1 ex).

147. *Rhyacophila scissa* Morton, 1900

India : Arunachal Pradesh: Kameng, Amatulla (5 exs); Bokhar (2 exs); Dirang Dzong (2 exs); Moshing (2 exs); Nizang (1 ex); Rohung (4 exs); Sherong (2 exs); Talung Dzong (1 ex). Meghalaya: U. J. K. H. Rumthang (1 ex); U. J. K. H. Umpuh (1 ex). Manipur: Chingsao (6 exs); Hkyumboum (1 ex); Leni (1 ex); Sirohikashong (17 exs). Sikkim: Chumtang (4 exs); Chongjam (1 ex); Dikchu (1 ex); Hi (1 ex); Lathong (8 exs); Lingdok (2 exs); Lingtham (8 exs); Manu (17 exs); Nanga (6 exs); Namgung (2 exs); Singhik (20 exs); Teng (13 exs); Tangsing (1 ex). West Bengal: Lohika (1 ex).

148. ***Rhyacophila scissa niyampa*** Schmid, 1970
(All Paratypes)

India: Manipur: Chingsao (2 exs); Sirohikashong (1 ex).

149. ***Rhyacophila scissoides*** Kimmins, 1953

India: Sikkim: Chumtang (4 exs); Chongpong (1 ex); Dikchu (1 ex); Lingtham (1 ex); Nanga (6 exs); Poshek (1 ex); Samshong (1 ex); Teng (2 exs).

150. *Rhyacophila shakangpa* Schmid, 1970 (Paratype).

India: Uttarakhand: Almora, Chhana (1 ex).

151. ***Rhyacophila sherchokpa*** Schmid, 1970 (All Paratypes)

India: Arunachal Pradesh: Kameng: Chug (1 ex); Kujlalong (1 ex); Salam (3 exs); Shergaon (2 exs).

152. ***Rhyacophila similis*** Martynov, 1935 (Type series)

India: Uttarakhand: Garhwal, Ampata (1 ex); Paukal (1 ex); Rishikesh (1 ex), Rudra Prayag (1ex); Tehri (1ex). Uttar Pradesh: Agra (1 ex).

153. ***Rhyacophila stenostyla*** Martynov, 1930

India: Sikkim: Chachu (1 ex.), Dolmasampa (1 ex.), Kaieg (2 exs.), Rongha (5 exs), Singha (1 ex.), Tailing (1 ex.), Thomphyak (7 exs.), Tangau (1 ex.), Yadang (4 exs.), Yamthang (4 exs.), Zama (1 ex.). Uttarakhand: Gangria, 10,000 ft (7 exs). Mandoli, 8000 ft (1 ex).

154. ***Rhyacophila tecta*** Morton, 1900

India:Arunachal Pradesh: Kameng: Domkha (2 exs); Gigaon (12 exs); Shergaon (3 exs).

155. ***Rhyacophila tengyelingpa*** Schmid, 1970 (Paratype)

India: Sikkim: Lachen (1 ex).

156. ***Rhyacophila tolungpa*** Schmid, 1970 (All Paratypes)

India :Arunachal Pradesh: Kameng: Amatulla (1 ex.); Dirang Dzong (1 ex.). Sikkim: Dikchu (5 exs); Lingtham (8 exs); Mangalbarey (1 ex).

157. ***Rhyacophila trulungpa*** Schmid, 1970 (Paratype)

India:Uttarakhand: Pouri Garhwal, Hilang (1 ex).

158. ***Rhyacophila tshiringpa*** Schmid, 1970 (All Paratypes)

India: Arunachal Pradesh: Kameng, Jhumla (1 ex); Nyukmadong (1 ex), Talung Dzong (1 ex). Sikkim: Chamiteng (4 exs.), Karpanong (2 exs.), Lachung (38 exs.); Namnasa (1ex).

159. ***Rhyacophila tshogpa*** Schmid, 1970 (All Paratypes)

India: Sikkim: Chumtang (3 exs); Nanga (2 exs); Singhik (2 exs); Teng (4 exs).

160. ***Rhyacophila tsona*** Schmid, 1970 (All Paratypes)

India: Manipur: Hkyumboum (2 exs); Pushing (2 exs); Sirohikashong (4 exs).

161. ***Rhyacophila tsongkhapa*** Schmid, 1970 (All Paratypes)

India: Sikkim: Tongsing (24 exs).

162. ***Rhyacophila tungpa*** Schmid, 1970 (All Paratypes)

India: Uttarakhand: Pouri Garhwal, Junglechatti (2 exs).

163. ***Rhyacophila yarlungpa*** Schmid, 1970 (Paratype)

India: Sikkim: Dikchu (1 ex).

164. ***Rhyacophila yigrongpa*** Schmid, 1970 (Paratype)

India: Sikkim: Tashlong (1 ex).

165. ***Rhyacophila yipung*** Schmid, 1970 (Paratype)

India: Manipur: Longkpe (1 ex).

166. ***Rhyacophila zhungpa*** Schmid, 1970 (All Paratypes)

India: Sikkim: Chumtang (1 ex), Chungjam (1 ex), Lingdok (4 exs), Lingsaka (1 ex); Mangung (1 ex), Yoksam (1 ex).

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SINGING AND SWINGING APE : THE HOOLCK GIBBON OF INDIA

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INTRODUCTION

The Hoolock gibbon, *Hylobates hoolock*, is familiar by its song and special way of locomotion, known as brachiation. It uses its extremely long arms for swinging from one branch to the other or from tree to tree with incredible speed. The gibbon hardly leaves the forest and is seldom destructive to ground crops. The gibbons, smallest among the apes, are represented by 16 species. The Hoolock gibbon or the white browed gibbon, is the only ape found in India. The rest of the species are found out side this country. It occurs in all the seven states of Northeastern India. Gibbons are also known as Lesser or smaller apes. The distribution of Western hoolock, *H. hoolock*, is restricted to the evergreen rain forests of Northeastern India, extending from south of Brahmaputra river system to Mizoram and Manipur and also in Bangladesh, southern Yunnan in China to west of Chindwin river in Myanmar. Earlier records show that this ape was widely distributed in this region and was fairly common (Fig. 1) but now it is fragmented in distribution (Fig.2) and is much reduced in numbers.

The Eastern hoolock, *H. leuconedys*, is distributed from east of Chindwin to Salween rivers in Myanmar and western Yunnan Province in China at an altitude of 1066-1219 m. It has recently been reported from Lohit district of Arunachal Pradesh (Das *et al.*, 2006).

A total of 28 species of gibbons, under four genera have been identified. These genera are *Bunopithecus* (with 2 species), *Hylobates* (with 15 species), *Nomascus* (with 9 species) and *Syamphalangus* (with 2 species) (Brandan-Jones et. al., 2004). However, the taxonomy of the Hoolock gibbon has recently been revised and gibbons have been placed into the genus *Hoolock* and split into two discrete species, the Western Hoolock Gibbon, *H. hoolock* (Fig.3), and the Eastern Hoolock Gibbon, *H. leuconedys* (Fig.4) (Mootnick and Groves, 2005). Many workers considered these two species as distinct sub-species.

The field studies on gibbons were started in late 1930's with the pioneering study on Lar gibbon, in Thailnd. The studies were resumed in 1960's on the Lar gibbon and Siamang in Malaya Peninsula. This was followed by extensive studies of different species in Malaysia and Indonesia. By 1980's comprehensive studies were undertaken on most of the species like Lar, Agile, Maloch, Muller's, Kloss, Siamang and Crested gibbons in the erstwhile Indo-China. During this period, the field studies of Hoolock gibbon in Northeastern India and Bangladesh were also intensified.

TAXONOMY

Earlier the Hoolock gibbon was placed to the genus *Hylobates* under the family Hylobatidae. The genus *Hylobates* consisted of four subgenera viz. *Bunoptithecus, Hylobates, Nomascus* and *Symphalangus*. Recent molecular studies have shown that the phylogenetic distance amongst these subgenera was as large as or larger than the distance between chimpanzees and humans (Roos and Geissmann, 2001). As a consequence,

all the subgenera were elevated as full-genera (Gupta *et.al.* 2005) and, thus, the name *Hylobates hoolock* was changed to *Bunopithecus hoolock* (Brandan Jones *et.al.*, 2004). But again its generic name was resuscitated as *Hoolock* by Mootnick and Groves (2005).

Characteristics

Head and body length:

Male : 45.7-63.0cm

Female : Almost the size of male

Body Weight:

Male : 6.1-7.9 kg

Female : 6.0-6.6 kg

Head : Small and round.

Face : Black with silver white band above eye-brows; snout is not protruding; nostrils are widely spaced.

Hands and Feet : Long hands and feet; arms are more than double the length of legs.

Coat : Fur shaggy, long and dense.

Sexual dimorphism : Adult females are a little smaller than adult males, golden buff or brownish grey in colour (Fig.5), with clitoris; adult males are black. According to some observers both the sexes of Hoolock gibbon are black in Arakan in Myanmar, and they believe that Arakan population is different from that inhabiting the forests of Northeastern India.

Juvenile : At birth, the infant is pale grayish white with yellowish tinge and face, palms, and soles black; the body colour gradually darkens with age, becoming black in adult males; but in adult females, the black colour fades at puberty and becomes golden or yellowish brown.

Distribution : Fragmented distribution in Northeastern India- south and east of Brahmaputra river extending up to south-eastern part of Dibong river in Arunachal Pradesh-the southern limit in India is Mizoram. Also found in eastern Bangladesh, southern China and northern Myanmar.

Population : The exact status is not known. However, most of the population is threatened.

Intraspecific variation : Two sub-species, *H.h. hoolock* and *H.h. leuconedyes*, are recognized but some workers consider them as distinct species.

Similar species : *Hylobates lar* of south-east Asia and Indonesia and *Hylobates concolor* of China.

Legal status : This species is protected under schedule I of Indian Wild Life (Protection) Act 1972 and Appendix-I of CITES. It is treated as endangered under the Red Data Book of Indian Animals,1994. Mukherjee *et.al.*, (2008) reported the fragmented distribution of this species in Northeastern India and considered it as rare and threatened.

ECOLOGY

Hoolock gibbons are exclusively forest-dwelling ape and inhabit forest with contiguous canopy. They are usually found in (i) broad-leaf, moist deciduous forests, (ii) mixed evergreen and semi-evergreen forests with tall trees and (iii) thick under-story in mountains, valleys, slopes and low land. They are found in all the three kinds of forest - primary, secondary and regenerating (Mukherjee, 1986, Mukherjee *et.al.*, 1991-1992: Chowdhury, 1996, 2000, 2006: Das *et.al.*, 2003). In general, Hoolock gibbon's habitats are tropical forests having wet, hot summer, monsoon rains and dry cool winter. The annual rainfall ranges from 130 to 140 cm.

Hoolock gibbon of northeastern India inhabits all the seven states viz. Assam, Arunachal Pradesh, Meghalaya, Manipur, Tripura, Mizoram and Nagaland (21°57'-29°30' N to 89°46'-97°30' E). The whole area is rich in flora and fauna and has been recognized as one of the two biodiversity hot spots in India, the other being the Western Ghats in southern India. Among all the other animal communities, the non-human primates form an important group of animals in this region. The Hoolock gibbon that shares this habitat is sympatric with other non-human primates of the region and they subsist together.

Table-1: Geographical area, % of forest cover, % of dense forest and forest types in seven states of Northeastern India.

States	Geographical area (km^2)	% of forest cover	% of dense forest	Forest types
Assam	78,438	30.2	18.5	LSW, STBH, STP, TMD, TSE, TWE.
Arunachal Pradesh	83,743	82.2	68.9	MWT, SAF, STP, TWE
Meghalaya	22,429	69.7	26.4	STP, TMD, TSE, TWE
Mizoram	21,081	86.9	17.9	STP, TMD, TWE
Tripura	10,492	54.8	21.2	STBH, TMD
Nagaland	16,579	85.4	30.9	MWT, STP, TMD, TWE
Manipur	22,327	77.9	26.6	MWT, STP, TSE

Abbreviation : LSW-Littoral and Swamp. MWT- Montane wet temperate. SAF-Sub-alpine forest. STBH- Sub- tropical broad leaved hill. STP- Sub-tropical pine. TMD-tropical moist deciduous. TSE- Tropical semi-evergreen. TWE- Tropical wet evergreen.

Lowland rain forests, the ideal habitat of Hoolock gibbon(Fig.6), in all the seven states of Northern India is one of the richest terrestrial ecosystems. However, this ideal habitat is greatly damaged by biotic disturbances. The types of forests found in this region are ranging from tropical moist deciduous, tropical wet evergreen and semi-green, and sub-tropical broad leaved, pine and alpine forests to montane wet temperate, swamp and secondary forests. The Hoolock gibbons mostly inhabit wet evergreen forests and less in deciduous and scrub forests (Gupta *et.al.*, 2005). The trees found in these forests are mostly Sal, moist deciduous, savannah, riverine, etc. The climbers are common and the forest floor is covered with scrub and ferns. In the National Parks, Reserve Forests and Wildlife Sanctuaries, the trees are generally tall with close canopy. Geographical area, percentage of forest cover, percentage of dense forest and forest types of each state are given in Table-1.

Assam is the second largest in geographical area after Arunachal Pradesh. In this state, the forest area of 28, 185km^2 is divided into 36 forest divisions. Nearly half of this area at present can be considered as dense and the remaining as open (Gupta *et.al.*, 2005).

These forests can further be classified as reserved forests (14,958km^2), protected forests (3,436km^2), district council reserved forests (1,081km^2), proposed reserve forests (2,815km^2) and unclassified forests (5,894km^2). There are 23 protected areas of which 5 are National Parks(1,969km^2), which constitute about 2.5% of the total geographical area, and 18 Wildlife Sanctuaries (1,440km^2), which are about 1.9% of the total geographical area (Gupta *et.al.*, 2005). The state of Assam is composed of mountainous areas and flood plains. It is surrounded by hill states like Meghalaya, Arunachal Pradesh, Mizoram, Manipur, Nagaland, Tripura and the kingdom of Bhutan. Till 1980's, out of 78,438km^2 area of Assam, *i.e.*, more than 33% was covered with forests. However, in recent years, it has reduced to about 30%, due to various factors.

The state of Mizoram consists of hill ranges which run in north-south direction. The state is situated between 20°20' to 24°21' N latitude and 92°20' to 93°29' E longitude. The average height of the hills are about 1000m. The forests are of three types - tropical wet evergreen, tropical moist deciduous and montane sub-tropical. Deciduous forests, grassland and evergreen forests are found at higher altitude. The total forest cover is about 15,935km^2 (about 75.59% of the total geographical area). The forest is a mixed one, with various species of bamboo confined to the lower areas of the forests. Various species of orchids are found in this state. The protected areas are about 1200km^2 which constitute roughly 6% of total geographical area. The protected areas in Mizoram are the best in Northeastern India. The monsoon rain is very heavy, 2000-4000mm. There are 2 National Parks, one Tiger Reserve and 9 Wildlife Sanctuaries in

Mizoram. There is a proposal for setting up more sanctuaries in the state.

Arunachal Pradesh is the biggest state in Northeastern India (26°28'-29°31' N and 91°30'-97°30' E). The state is rich in forest cover. It is about 68, 620km^2 which accounts to about 81.9% of the total geographical area. This is the highest forest cover among the seven north-eastern states of India. The closed and the open canopy cover consist of about 79.4% and 20.6% respectively. The reserve and the district community forests cover an area of 37.3% and 62.2% respectively. The forests are tropical, sub-tropical, temperate, Pine, Alpine and Secondary.

The state is mostly hilly and sparsely populated and is divided into three sections viz, high hills, foot hills and flood plains. The altitude varies from 50m in the foot hills to about 7,000m in the northern parts of the state. The soil in the majority of the area is rocky. There are 2 National Parks and 11 Wildlife Sanctuaries.

The whole of Meghalaya is a plateau (25°5'-26°10' N and 89°47'-92°47' E). The western, central and eastern parts commonly known as Garo, Khasi and Jaintia hills respectively. The topography is irregular. The type of forests are tropical, sub-tropical and temperate. The tropical forests are confined to 1,200m elevation and temperate forests between 1,200 to 1,800m elevations. Bamboo forests also grow within these forest types. The state is rich in a variety of orchids. The total area of forest is about 9,496 km^2 which is about 42.3% of total geographical area. The dense and open forest areas are about 25.8% and 74.2% respectively. About 89.5% of forest is under the control of autonomous district council. The forest department controls only 10.5% of the forests as reserved and protected areas. There are 5 protected areas out of which 2 are National Parks and 3 are Wildlife Sanctuaries.

The Nagaland is also rich in forest resources the forest cover of the state is 14,221km^2 i.e. about 86% of the land area. About 0.9% of the forest area is reserved forest. Protected and the unclassified private forests are about 5.9% and 93.1% of the total forest land respectively. About 30.9% of the geographical area is dense forest. The forest cover has considerably reduced due to practice of shifting cultivation. The forests are tropical wet evergreen, tropical moist deciduous, mountane wet temperate and sub-tropical pine. The state has one National Park and 3 Wildlife Sanctuaries.

The Manipur is also very rich in forest resources and is covered by plains and hills. The forest area constitutes about 17,418km^2 which is about 78% of the total geographical area of the state. The reserved and protected forests cover are about 9.7% and 27.5% respectively and the unclassified and private forests cover about 62.8%. The presence of autonomous areas in 6 districts are further cause of this faulty land use. The unclassed forested areas are controlled and managed by the councils. This multilevel control of forest lands is the reason for the loss of forest cover to the tune of 267 km^2 within a span of 6 years i.e. between 1991 and 1997. The state though lose the area of dense forest but it gains the open forest area. The practice of shifting cultivation leads to huge reduction in forest cover. The state has one National Park of about 40km^2 and 5 Wildlife Sanctuaries covering an area of 185km^2.

The Tripura is located between 22°56' and 24°32' N latitude and 91°09' and 92°20' E longitude. The total forest cover is 7,065km^2 of which 3,463km^2 is dense forest and 3,602km^2 open forest. Out of this, about 3,588 km^2 are reserved forest and 2,195km^2 as unclassified.

The type of forest vary from east Himalayan lower bhabar Sal, tropical evergreen, moist mixed deciduous, low alluvial savannah woodland, dry bamboo breaks and secondary moist bamboo breaks. Hill ranges of Tripura are in close continuity with the Chittagong hill tracts of Bangladesh and the hills of southern Assam. About 30% of the total area of the state is under autonomous district council. There are 4 Sanctuaries in the state.

In the Northeastern India, the lay of the land is flat with gentle slopes and high hills. Plains and hills form the whole area and the elevation varies from place to place. It is as low as 33m in Assam to

1,260-1,400m in Arunachal Pradesh. The climate is characterized as sub-tropical, with hot and wet summer and cold dry winter. The rivers originate from the high hills of Himalaya's. The longest among them is the Brahmaputra, which criss-cross the plains and runs north-south. Its tributaries drain the plains and forests. During monsoon, when the rain is heavy, these rivers over-flow and inundate many areas including the reserve forests and National Parks. These rivers though very turbulent during the monsoon are practically dry during the winter and the summer months. The tract at places are formed by boulders and gravelly sand. The top soil consists of humus, varying from almost nil to over 30cm in thickness. The rainy season lasts from June to October, the summer from March to May or June and the winter from November to February. The coldest months are December and January. The snow falls at the high altitude during the winter months. The winter and the summer rains are also common. Rivers and streams are the main source of water supply. Almost the entire rain occurs during the monsoon period. At times, mild frost also occurs in low-lying areas during the winter months.

DISTRIBUTION

The vibrant economy of the over-populated developing countries of Asia and Africa is largely dependant on exploitation of natural resources including the forest. The non-human primates inhabit these forests. The loss and fragmentation of the forests have an adverse effect on their population in general and Hoolock gibbon in particular. Forest survey of India recently made an estimation of forest cover in India and came to the conclusion that the country had lost almost 5,500km^2 of forest in two year's period. Hoolock gibbon, the only ape found in India, inhabits the dense, contiguous, broad leaved, wet evergreen forests of Northeastern India from 100m to about 1,400m altitude, upto 2,500m estimated by Choudhury, 2006, is affected by these loss and fragmentation of the forests.

The species, once well distributed and abundant in all the seven states of Northeastern India (Fig.1), is now not continuous in distribution but is found in fragmented areas (Fig.2). Its population is drastically reduced, as is evident by some recent reports. Some population, in certain areas, have lost so many members that only a few individuals are left in isolated habitats and cut of from the main population. These tiny populations as a result of inbreeding have no future and are unlikely to survive for long. Alfred and Sati (1990) surveyed 200 localities in Garo hills, Meghalaya, for the presence of Hoolock gibbons but recorded them only in 32 localities. As-far-as the information goes the remaining 168 localities had gibbons in the past but now they have disappeared. These forest patches are now separated from each other.

This species is now treated as one of the world's 25 most endangered primates and is likely to become extinct faster than expected, because they are arboreal, frugivorous, highly territorial, brachiater, monogamous, and of low reproductive out put. In recent years, the population of hoolock gibbon were wiped out in 18 localities in India and Bangladesh in just 3 to 5 years. Mukherjee *et.al.*, (1986, 2008) reported that six groups of this ape were wiped out in Tripura within a period of six years.

The hoolock gibbon is distributed in Northeastern India, south of Brahmaputra river (Dibong-Brahmaputra river system), from Arunchal Pradesh to Mizoram and Manipur. Outside India it is found in Bangladesh, southern Yunnan in China to west of Chindwin river in Myanmar.

According to Groves (1967) the distribution of *H. h. hoolock* and *H.h. leuconedys* are demarcated by two rivers, Chindwin and Irrawaddy, in Myanmar. *H. h. hoolock* occurring west and *H.h.leuconedys* to the east of Chindwin river. The distribution of *H.h. leuconedys* continues east as far as the Salween river in Myanmar. However, Das *et. al.*, (2006) has reported the occurrence of *H. h. leuconedys* in Lohit district of Arunachal Pradesh. Detailed present distribution is given in Table 2.

In Arunachal Pradesh, the gibbons were reported from Subansiri district till 1975 (Borang

Table-2: Distribution of Hoolock gibbon in Protected areas of Northeastern India (Chetry et.al. 2007)

States	Protected Areas	Total area(km^2)
Arunachal Pradesh.	Kamlang Wildlife Sanctuary.	680.00
	Mehao Wildlife Sanctuary.	281.50
	Namdapha National Park.	1985.00
Assam	Amchang Wildlife Sanctuary.	79.00
	Barail Wildlife Sanctuary.	326.00
	Bherjan- Borajan- Podumani Wildlife Sanctuary.	7.21
	Dibru-Saikhow National Park.	340.00
	Dihing Patkai Wildlife Sanctuary.	111.00
	East Karbi Anglong Wildlife Sanctuary.	221.81
	Garampani Wildlife Sanctuary.	6.05
	Hollongapar Gibbon Sanctuary.	20.98
	Kaziranga National Park	860.00
	Marat Longri Wildlife Sanctuary.	451.00
	Nambor- Doigrung Wildlife Sanctuary.	97.15
	Nambor wildlife Sanctuary.	37.00
	North Karbi Anglong Wildlife Sanctuary (Proposed).	96.00
Manipur	Bunning Wildlife Sanctuary.	115.80
	Jiri-Makru Wildlife Sanctuary.	198.00
	Kailam Wildlife Sanctuary.	157.80
	Yangoupokpi Lokchao Wildlife Sanctuary	184.00
	Zeilad Wildlife Sanctuary	21.00
Meghalaya	Bghmara Pitcher Plant Wildlife Sanctuary	00.02
	Balpakhram National Park	220.00
	Nokrek National Park	47.48
	Nongkhyllem Wildlife Sanctuary	29.00
	Siju Wildlife Sanctuary	5.18
Mizoram	Dampa National Park	500.00
	Khaurnglung Wildlife Sanctuary	41.00
	Lengteng Wildlife Sanctuary	80.00
	Murlen National Park	150.00
	Ngenpui National Park	110.00
	Phawngpui National Park	50.00
	Tawi Wildlife Sanctuary	37.75
Nagaland	Fakim Wildlife Sanctuary	6.42
	Intaki	202.00
Tripura	Gumti Wildlife Sanctuary	389.50
	Trishna Wildlife Sanctuary	194.70

and Thapliyal, 1993) and also from the forests of Banderdeva, a place close to Itanagar, even in 1978 (Mukherjee *et.al.*, 2008).

In the past, no document was available about the distribution and status of hoolock gibbon in Bangladesh and Myanmar. In recent years some field studies on gibbons have been initiatd in Bangladesh but practically nothing is known from Myanmar.

Inspite of the studies conducted on Hoolock gibbon in Northeastern India, its status is not conclusively known, except some information on the groups inhabiting the protected areas. Recent studies show that the populations are equally good in outside the protected areas as well as in village forests. Gupta (1994) recorded 18 and 9 groups of Hoolock gibbon from primary and secondary forests respectively in Tripura. Groups of gibbon have been reported from the forests inside the villages, particularly in Meghalaya and Arunachal Pradesh and occasionally in the village orchards. The villagers are tolerant to these village groups. Out of 7 Northeastern states, Assam is probably the only state where extensive field studies have been carried out and some documents are available. The Annual Report – II (1995 – 1996) of Indo-US Primate Project reported the presence of Hoolock Gibbon from about 19 areas and Gupta et. al., (2005) reported from 13 protected areas, 2 National Parks and 11 Wildlife Sanctuaries, in Assam.

As regards the remaining states practically nothing is known about the gibbon populations.

Table-3 : Location of gibbon groups in different habitats of Meghalaya (Gupta et.al.2005 with certain additions and amendments).

Sl. No	Location	No. of groups in protected areas			No. of groups outside protected areas			
		RF	NP	WLS	VF	ADP	PF	Total
1.	Narpuh-I	3	-	-	-	-	2	05
2.	Narpuh-II	3	-	-	-	-	2	05
3.	Corridor	-	-	-	6	-	1	07
4.	Siju WLS	-	-	2	1	1	-	04
5.	Balphakram NP	-	1	-	1	1	-	03
6.	Baghmara	5	-	-	-	-	-	05
7.	Nongkhyllum WLS	4	-	10	-	-	1	15
8.	West Garo Hills	-	1	-	38*	-	-	39
	Total	15	2	12	46	2	6	83
	% of population in protected areas		34.94					
	% of population in outside protected areas					65.06		

Abbreviation : ADP-Adjacent to protected Areas. NP- National Park. PF-Private Forests. RF-Reserved Forests. VF-Village Forests. WLS- Wildlife Sanctuary.* Songacham is treated as Village Forests.

However, gibbons are known to occur in Kamlangnagar and Mehao Wildlife Sanctuaries, Dibang Wildlife Sanctuary and Namdapha National Park in Arunachal Pradesh and 5 Wildlife Sanctuaries, namely, Jiri- makru, Kellam hill, Yangoupokpi- Lockchao, Zeilad and Bunning in Manipur. They are supposed to occur in Intaki, Fakim and Pulie-Badge Wildlife Sanctuaries in Nagaland but no confirm reports are available.

Gupta *et al.*, (2005) studies in protected areas of Meghalaya, Mizoram and Tripura and revealed that a large population of gibbons still live outside the protected areas and village forests. These populations are under constant pressure of their survival. The information

Table-4 : Location of gibbon groups in different habitats of Mizoram (Gupta *et.al.*, 2005 with certain additions and amendments).

Sl. No	Location	No. of groups in protected areas			No. of groups outside protected areas		
		RF	NP	WLS	VF	ADP	Total
1	Dampa Tiger Reserve	10	---	---	---	---	10
2	Ngenpui WLS	---	---	4	5	1	10
3	LengtengWLS	---	---	6	6	---	12
4	Murlen NP	---	2	---	---	2	04
5	Khawnglung WLS	---	---	9	10	---	19
6	Tawi WLS	---	---	1	13	---	14
7	Phawngpui NP	---	3	---	---	---	03
	Total	10	5	20	34	3	72
	% of population in protected areas		48.61				
	% of population in outside protected areas.					51.39	

Abbreviation : ADP-Adjacent to Protected Areas. NP-National Park. RF- Reserve Forests. VF- Village Forests. WLS- Wildlife Sanctuary.

Table 5 : Location of gibbon groups in different habitats of Tripura (Gupta et.al.2005 with certain additions and amendments).

Sl. No	Location	No. of groups in protected areas			No. of groups outside protected areas			
		RF	NP	WLS	PF	VF	PF+RF	Total
1.	Phuldansai	3	-	-	-	-	-	03
2.	Bethingship	-	-	-	-	-	5	05
3.	Sabul	-	-	-	3	-	-	03
4.	Conzai	-	-	-	1	-	-	01
5.	Vangmung	11	-	-	4	-	-	15
6.	Manu (N. Tila)	-	-	-	-	-	1	01
7.	Kanchanchera	1	-	-	-	-	-	01
8.	Laxmanpara	-	-	-	-	-	1	01
9.	Chamanu	1	-	-	-	-	-	01
10.	Dewachera	-	-	-	-	-	1	01
11.	Thalchera	-	-	-	-	-	1	01
12.	Ambasa	1	-	-	-	-	-	01
13.	Harinchera	1	-	-	-	-	-	01
14.	Ganganagar	1	-	-	-	-	-	01
15.	Khowaichera	1	-	-	-	-	-	01
16.	Noonchera	1	-	-	-	-	-	01
17.	Gandachera	1	-	-	-	-	-	01
18.	Jiyalchera	1	-	-	-	-	-	01
19.	Trishna	-	-	1	-	-	-	01
	Total	23	-	1	8	-	9	41
	% of population in Protected areas. % of population outside Protected areas.	58.54			41.46			

Abbreviation: NP- National Park, RF- Reserve Forests. VF- Village Forests. PF- Private Forests. WLS- Wildlife Sanctuary.

regarding the distribution of gibbons collected by them from the three states are given in Tables 3-5.

POPULATION ESTIMATION

It is believed that the population of Hoolock gibbon was over 1,00,000 individuals in 1970's but their number has reduced drastically in recent years (Gron, 2008). It was estimated to be between 1,70,000 and 5,32,000 individuals by Chivers (1977) and Mackinnon and Mackinnon (1987) respectively. Tilson (1979), however, gave an estimate of 78,800 gibbons in Assam and adjoining areas of Meghalaya and Mizoram. He estimated about 16,700 individuals only in Cachar, Hailakandi and Karimganj area of Assam. Gittins (1984) estimated a population of 3000 gibbons in Bangladesh.

After a lapse of two decades, Chowdhury (1995,1996) estimated a total population of 6200-6700 gibbons in Assam, with a population of 600-700 in North Cachar Hills, and 1100-1300 in Cachar, Hailakandi and Karimganj districts, and 30 gibbons in Borajan Reserve Forest, Assam.

In recent years, the population of gibbons in Northeastern India was estimated to be around 2500 by Menon (2003), between 1700 and 2200 by Chowdhury (2006), and around 200 in Bangladesh by Biswas *et.al.*, (2003), Molur *et.al.*, (2005), and Walker *et.al.*, (2007). Gron (2008) quoted the findings of Chowdhury, Biswas, Molur and Walker in the Primate Factsheets : Hoolock Gibbon (Hoolock).

No serious attempts has been made to assess the population of gibbons in Myanmar. A population estimate of 1,70,000-5,32,000 gibbons estimated by Chivers (1977) and Mackinnon and Mackinnon (1987) mentioned above appear to

include the population of both India and Myanmar. Gron (2008), however, estimated about 30000 gibbons only in Myanmar.

In China, the number of Eastern Hoolock Gibbons was estimated to be less than 150 individuals by Zhang (1998) and between 300 and 600 by Zhang Yongzu *et.al.*, (2002).

The population of Hoolock gibbon, in India, can not be estimated accurately, as their status in all the seven states of Northeastern India are not authentically known. This ape was studied from time to time by various workers particularly in the Protected areas like Sanctuaries and National Parks. Mukherjee *et.al.*, (1982,1992) estimated it in Assam and Arunachal Pradesh, Alfred *et.al.*, (1990, 1994) in Meghalaya, and Gupta *et.al.*, (2005) in Meghalaya, Mizoram and Tripura. No published account is available on its population in Nagaland and Manipur. Das *et.al.*, (2004) counted 62 groups containing 219 individuals in 20 forest divisions of Assam. However, they have estimated a total population of 4404 individuals in about 1246 groups in the undisturbed forest habitat, and 4980 individuals in 1429 groups in fragmented forest habitats.

The report of the Population and Habitat Viability Assessment (PHVA) workshop(2005) mentioned that from 600 to 700 gibbons are present in the wild in 126 localities with population ranging from 1-40 individuals in India and Bangladesh. The report further mentioned that the present population of Hoolock gibbon in India and Bangladesh will be extinct within a period of 20 to 40 years.

The variation in estimation mentioned above is actually due to observation based in a limited area. So it is necessary to study its population extensively in all the ecological habitat in seven Northeastern state of India to get an accurate idea about its status.

SOCIAL COMPOSITION

Monogamous gibbon groups comprise of an adult male and adult female, along with immature juveniles and infants. They maintain small group size of 2-6 individuals with an average of around 3. Majority of groups consist of monogamous mated pairs of adult male and adult female with one or two immature individuals. Rarely, groups with more than one adult male or more than one adult female occur. Mukherjee *et.al.*, (1991-92) recorded 16 gibbon groups in Lohit district of Arunachal Pradesh out of which 15 were bisexual groups whereas one was all male group of 7 members.

Table 6 : Population estimate and social composition of Hoolock gibbon in different locations at Meghalaya (Gupta *et.al.*, 2005 with certain additions and amendments).

Sl. No.	Location	Mode / No. of groups			Total No. of groups	Social Composition.				Total	Area(km²)
		PC	SO	ST		AD Male	AD Female	JJ	II		
1.	Narpuh-I	5	-	-	5	-	-	-	-	-	9.2
2.	Narpuh-II	2	3	-	5	-	-	-	-	-	9.1
3.	Corridor	-	7	-	7	-	-	-	-	-	18.2
4.	Siju WLS	-	3	1	4	-	1	-	-	1	4.1
5.	Balphakram NP	1	1	1	3	1	1	1	-	3	6.0
6.	Baghmara	1	3	1	5	1	1	2	1	5	5.0
7.	Nongkhyllum WLS	-	12	3	15	3	3	3	3	12	28.1
8.	West Garo Hills	20	3	16	39	23	18	17	9	67	179.5
	Total	29	32	22	83	28	24	23	13	88	259.2
	Percentage	34.94	38.55	26.51							
	Distribution of a group										3.12

Abbreviation: PC-Personal Communication. SO- Song. ST- Sighting. AD- Adult. JJ- Juvenile, II- Infant. WLS- Wildlife Sanctuary. NP- National Park.

Table 7: Population estimate and social composition of Hoolock gibbon in different location at Mizoram (Gupta *et.al.* of 2005 with certain additions and amendments).

SL No.	Location	Mode / No. of groups			Total No. of groups	Social Composition.				Total	Area(km²)
		PC	SO	ST		AD Male	AD Female	JJ	II		
1.	Dampa TR	2	6	2	10	2	2	1	1	6	29.4
2.	Ngenpui WLS	8	2	-	10	-	-	-	-	-	33.7
3.	Lengteng WLS	8	4	-	12	-	-	-	-	-	73.5
4.	Murlen NP	4	-	-	04	-	-	-	-	-	46.0
5.	Khawangung WLS	8	11	-	19	-	-	-	-	-	48.0
6.	Tawi WLS	7	6	1	14	1	1	-	1	3	46.6
7.	Phawngphui NP	2	1	-	03	-	-	-	-	-	23.5
	Total	39	30	3	72	3	3	1	2	9	300.7
	Percentage	54.16	41.67	4.17	-	-	-	-	-	-	
	Distribution of a group										4.18

Abbreviation: PC- Personal Communication. SO- Song. ST- Sighting. Ad- Adult. JJ- Juvenile. II- Infant. WLS- Wildlife Sanctuary. NP- National Park. TR- Tiger Reserve.

Table-8: Population estimate and social composition of Hoolock gibbon in different locations at Tripura (Gupta *et.al.* 2005 with certain additions and amendments).

SL No.	Location	Mode / No. of groups			Total No. of groups	Social Composition.				Total	Area(km²)
		PC	SO	ST		AD Male	AD Female	JJ	II		
1.	Phuldansai	2	1	-	3	2	2	-	-	4	4
2.	Bethingship	5	-	-	5	-	-	-	-	-	3
3.	Sabul	-	2	1	3	1	1	-	-	2	5
4.	Conzai	-	-	1	1	1	1	-	1	3	3
5.	Vangmung	5	9	1	15	1	-	-	-	1	14
6.	Manu (N.Tilla)	1	-	-	1	-	-	-	-	-	4
7.	Kanchan-chera	-	-	1	1	2	1	-	-	3	9
8.	Laxmanpara	-	1	-	1	-	-	-	-	-	-
9.	Chamanu	-	-	-	-	-	-	-	-	-	-
10.	Dewachera	1	-	-	1	1	2	-	-	3	-
11.	Thalchera	1	-	-	1	-	-	-	-	-	-
12.	Ambasa	-	-	-	-	-	-	-	-	-	-
13.	Harinchera	-	-	1	1	2	-	-	-	2	All male Group
14.	Ganganagar	-	1	-	1	-	-	-	-	-	-
15.	Khowaichera	-	1	-	1	-	-	-	-	-	-
16.	Noonchera	-	-	-	-	-	-	-	-	-	4
17.	Gandachera	1	-	-	1	-	-	-	-	-	-
18.	Jiyalchera	-	-	1	1	2	-	-	-	2	All male Group
19.	Trishna	-	-	2	2	2	2	-	1	5	7
	Total	16	15	08	39	14	09	-	02	25	53
	Percentage	41.03	38.46	20.51							
	Distribution of a group										1.36

Abbreviation: PC- Personal communication. SO- Song. ST- Sighting. Ad- Adult. JJ- Juvenile. II- Infant.

Blanford (1888-91) had observed groups of 5 to 100 individuals and more and also recorded solitary males occasionally. Groups with more than one adult male or more than one breeding adult female have also been reported by him. The occurrence of all male groups have also been reported by some field workers. Gupta *et.al.*, (2005) gave the social composition of Hoolock gibbon of three states, Meghalaya, Mizoram and Tripura (Tables 6-8), based on the personal communication by local people and forest staff, call of the gibbons and sightings. The sighting of the groups, which is more authentic than any other method, was limited in comparison to the other two methods in all the three states.

Hoolock gibbons of both sexes emigrate from their natal groups on maturity (Gupta *et.al.*, 2005). Maturity is reached from four to six years. On reaching the maturity the members are driven away from the group by the parents. The new groups can be formed by pairing of father and daughter, pairing of brother and sister, emigration and subsequent re-mating or dispersed sub-adult pair formation (Ahsan, 2001). The adult males might resort to polygamy, though rare, in sexually imbalanced groups in deteriorated habitat.

DAILY ACTIVITY

The agile Hoolock gibbons spend most of their time on upper and middle canopy of the tall trees at a height of 6 to 20m. Their routine activities are sleeping, feeding, singing, resting, grooming and moving by brachiation from branch to branch or from tree to tree in search of food.

They sleep on tall trees and are diurnal in habit. Hence their activities are confined to light hours of the day between sunrise and sunset. Invariably the gibbons woke up at down, before the sun comes up on the horizon. They change their positions on their perches, which signal the arrival of the new day. On waking up, the groups do not start to move immediately but they remain on the trees where they had slept the previous night for varying period of time, depending upon the morning weather conditions. The morning activity starts earlier in the summer than winter. In the winter months, the gibbons on waking up, bask in the sun for some time on high branches by exposing their back towards the sun light. Then they start their morning feeding activity by reaching to the ends of the twigs to nibble at the buds, fruits or young leaves.

Hoolock gibbons usually remain active for 8-10 hours every day, starting at dawn or in the early morning till late afternoon, except during the rainy day. Usually they defecate and urinate just before or after leaving their sleeping trees. Then they start feeding which gradually peaks up as the day proceeds. However, their feeding activity is not a continuous process and is usually interrupted with frequent spells of rest. During the feeding period they feed, rest and move by brachiation from tree to tree in search of food. With the rise in the day temperature their activity generally slows down and mid-day is invariably spent in resting. This period of rest is short during the winter and long in the summer months. Hoolock gibbons can feed in sitting and suspending positions. They feed on leaves, buds, flowers, fruits, insects, bird's eggs etc. Though they feed over 100 species of plants but their availability and density vary from habitat to habitat. Fruits and leaves form the main food items of the gibbons. Among the fruits, the fig is the dominant food item. However, they also feed on shoots, petioles, plant exudates, nector and lichens.

The typical diet of gibbons consist of 51-65% fruit, 5-23% leaves, 13% buds, 12% flowers and 0.1% animal prey (Tilson, 1979, Gittins and Tilson,1984).In a degraded habitat, the gibbons have been found feeding on bamboo shoots. It has been reported that they spend about 40% of time in feeding on fruits,40% on young leaves, 14% on leaf buds and about 6% on mature leaves (Gupta *et.al.*, 2005).

Their feeding activity again picks up in the afternoon, much earlier than they go to their sleeping trees. During this period they feed most intensively. The end of activity period for the day is usually several hours before the sun set and

much earlier than the other non-human primates. This is possibly to avoid feeding overlap with other sympatric non-human primates (Gupta *et.al.*, 2005). Alfred and Sati (1994) stated that Hoolock gibbons spend nearly 35% of their total awakening time in feeding, and the adult female spends more time in feeding than the adult male.

Locomotion in Hoolock gibbon is primarily through brachiation by using their long arms. They also move by leaping, climbing and jumping. About 70-80% movement is by brachistion, 16-25% by leaping, climbing, and jumping and the rest 4-5% are bipedal walking. At times, they walk bipedally on the thick branches of the trees or on ground by holding the long arms over their head, or holding horizontally to support the body movements. But by this way they can hardly move to a small distance. Terrestrial bipedal movement usually occurs when the trees are too far apart to leap between the trees. One of us (VCA) observed a group of Hoolock gibbon crossing the forest gap on ground by holding the long arms over their head at Ambasa, Tripura. The daily travel distance is between 300 and 1000m depending upon the season and the dispersal of the food.

Home-range-size of Hoolock gibbon varies from habitat to habitat and can range between 0.15km^2 to 4.00km^2. However, the home ranges of neighboring groups overlap. They maintain their home range by morning song bouts. Their call can be heard even from a distance of one km. They defend their home range from intruders by their call and chase. This type of inter-troop encounters are frequent particularly during the feeding time, when the two groups meet they indulge in whooping contests and then the weaker group retreats.

The territory usually varies between 15 and 30 ha irrespective of group-size or composition (Alfred and Sati, 1986, 1990).

Gibbon groups sing, the stereotyped song bouts usually in the early morning, but they do not sing every morning. Generally the groups respond to the calls of other groups. They usually select tall trees for singing. The songs serve to defend their territory, food resources, maintenance of pair-bounds, to attract potential mates, maintaining communication and distance between the groups to avoid inter-group encounters. Thus, vocalization acts as an inter -group communication system. Mated pairs produce duet songs, where at times, young ones also participate. Usually the mated pairs sing in the morning between 7 and 10am but the timing may change depending upon the weather condition. The average duration of duet song is from 15 to 20 minutes. Unmated Hoolocks produce solo song. The song repertoires of male and female are markedly different, but they co-ordinate their singing to produce a double solo. The recital begins with a low measured cooing, generally by a male, when the female also joins and the sound grows into a family unison.

Hoolock gibbon spends less time in grooming which is a part of social activity. Gupta et.al.(2005) reported that grooming, play and social interaction take less than 10% of the total time. Grooming serves to maintain social bonds, reducing the aggression and helps in maintaining hygiene. Grooming is more common in the summer, when they spend more time in resting than in the winter months.

Play is common among juveniles and infants but the adults at times join the play group. The gibbons take up their sleeping position much before dusk and the female sleeps with her infant in ventro- ventral position. The adult male usually sleeps close to his partner. Older off springs sleep separately. They sleep high up on the canopy to avoid predators.

Monogamous gibbons usually mate between March and May. The extra pair mating are rare. They give birth to a single off spring between November and February. However, births have also been recorded in the monsoon months of July and August. The birth interval in Hoolock gibbons is about 2 to 3 years. Thus, their reproductive output is low, which means that even if the habitat is improved the population size can not exceed beyond a limit. Infants are born without much hair on their body and depend on

their mothers for warmth. Preweaned period lasts for about two years. The gibbons reach maturity in 6 to 8 years. The off spring leaves or chased off by parents from the natal group on maturity. For the first six months the infant depends entirely on mother's milk but after this period, it starts to eat other food items. Alfred and Sati (1986) stated that mother breast-feeds the infant for about 8 to 10 months and after one year the infant starts to feed on fruits and tender leaves. They also stated that infant before going to sleep feeds on breast milk. Chasing, wrestling or play with inanimate objects are the common forms of play in immature gibbons.

The infant starts to explore the surrounding at the age of three months and it becomes independent of its mother after attending the age of two and half years. The life span of wild gibbon is not known. Fall from high trees is supposed to be a major factor for the cause of the death in the wild. Infanticide by adult male has been reported by Alfred and Sati (1991).

CONSERVATION

The Hoolock gibbon is placed in Appendix-I of CITES, which lists species that are threatened with extinction. It is ranked endangered under IUCN (ENA1CD) Red Data List. The Indian Wildlife (Protection) Act, 1972 placed the species in schedule-I. It is treated as endangered under Red Data Book of Indian Animals,1994. These classifications mean that the species is facing a very high risk of extinction in days to come.

The species is threatend due to habitat loss, poor quality of habitat, fragmented distribution, hunting for food and slow reproductive rate.

In the past gibbons were even common in the foot hill forests of Sibsagar, Assam, but their population now decreased considerably. The last Hoolock vanished from Diroi or Rangoli reserve forest sometime in 1970's. Though no reasons are known but their number decline to as low as 10-15 (Chowdhury, 1988).

Chowdhury (2000) stated that population of Hoolock gibbon in Dibru-Saikhowa National Park was fragmented into four sub-populations due to habitat loss. He estimated that the total population in the park was about 160-170 individuals and at certain places they were living in the village woodlands. The strict arboreal habit and their way of movement restricted them within the forest.

In general, gibbons, both Western and Eastern, are threatened with extinction. The Western Hoolock Gibbon is listed as one of the world's 25 most endangered non-human primates. Their numbers, which was over 1,00,000 individuals in the 1970's, have decreased considerably and most of them are found in fragmented groups. Most of these isolated populations are very small in group-size and their long term viability is doubtful. Although the detail document on the population of Hoolock gibbon in Myanmar is not available. It seems that the gibbon population is better secured in Myanmar than in any other habitats.

Habitat-loss is also one of the main factors for the decline of gibbon population. Jhum(shifting cultivation), conversion of forest lands into agricultural lands, encroachment of forest for settlement purposes, extracting timber (legally or illegally), collection of fuel wood, mining, expansion of communication network, construction of dams, irrigation and hydel projects, exploration of oil and gas fields are some of the factors for the loss of viable habitat of Hoolock gibbon. Alfred and Sati(1990) while surveying the West Garo Hills of Meghalaya recorded 75% of gibbon population near the village forest. They have also noted that adult males and adult females comprised of nearly 67% while the non-breeding population comprised only 33% of the whole population. The occurrence of a large population in non-protected areas and low percentage of non-breeding population are the cause of great concern for their conservation.

The small isolated populations in fragmented habitats, cut of from the rest of the populations, lead to inbreeding, thus, become genetically weak.

The Annual Report of Indo-US Primate Project (August 1998-July, 1999) revealed that Hoolock gibbons in Borajan Reserve Forest were reduced from 11 groups, consisting of 34 individuals, in 1995 to 5 groups and 11 individuals in 1999, a decline of 68%, and were living in an isolated area with a few trees. Thus, they had to move on the ground for access to other food trees. This population was represented by only 20% immature gibbons.

Hunting of gibbons in certain parts of Northeastern India is also the cause of concern to its population. They are hunted for food and for their various body organs which are used for medicinal purpose by certain tribes.

Although Hoolock gibbons are legally protected but the laws are not strictly implemented which is cause of great concern for its conservation.

The simulation Modeling Working Groups of Population and Habitat Viability Assessment (PHVA) Workshop Report (2005) stated that there is a very high probability of extinction of populations of less than 15 individuals within 20 years. It applies to more than 80% of existing population of Western Hoolock Gibbon (WHG) in India and Bangladesh. For populations more than 15 individuals, the probability of extinction is increased with higher levels of adult mortalities, negative trend in carrying capacity and hunting, which are common factors affecting most of the wild Western Hoolock Gibbon populations. The largest population of 156 individuals in India is relatively safe, if habitat destruction and hunting are reduced (Molur, et.al.2005).

DISCUSSION

Primates play an important role in maintaining the integrity of habitats in which they live by way of seed dispersers and pollinators. They also serve as food for many predatory birds and carnivore-mammals. Thus, the loss of a single primate species may lead to the extinction of a number of plant species.

Recent studies in Mexico, Brazil and India have documented drastic reduction in primate populations due to loss and fragmentation of their habitats. Forest report of India suggested that during a two year period from 1995 to 1997 there is a loss of 5,500 km^2 of forest land and it reflects on the dwindling populations of forest living primates, including the Hoolock gibbon of Northeastern India.

The conservation problem of Hoolock gibbon in all the seven states of Northeastern India is almost the same. The major factor is the loss and fragmentation of habitats and in some states it reached to an alarming stage.

Recent studies indicate that substantive population of Hoolock gibbon live outside the protected areas in Meghalaya (65.06%), Mizoram(51.39%) and Tripura(41.46%). This creates the management problem and make the conservation efforts more difficult. This also suggests that the unprotected areas are also potential sites for the survival of gibbons and need greater attention.

Hoolock gibbons are arboreal frugivorous and monogamous. They live in small family groups and their activity is restricted mostly to upper and middle canopy. Thus, they are very sensitive to any change in their habitats. Gibbons live long and their reproductive output are low, which means that even they are provided with an ideal environment the populations can not go beyond a certain limit.

Since the Hoolock gibbons are frugivorous they need large areas to explore for their food resources, as the fruiting trees are patchy in distribution. Thus, the fragmentation of habitats limit their food resources and isolate the populations, making them genetically weak.

To make the habitat more viable, the degraded areas and the corridors should be afforested and linked with each other to prevent the populations getting isolated. Small and isolated populations should be translocated to viable habitats, thus, prevent them from extinction. Local communities should be involved in the conservation programme. Field surveys should be intensified to collect more and more

information about this ape and regular monitoring of the population and habitats should be done to prevent their further loss. There is also a need of proper co-ordination among the implementing agencies at state and central level for management and conservation of the species.

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Fig. 1. : Earlier distribution of Hoolock gibbon in Northeastern India.

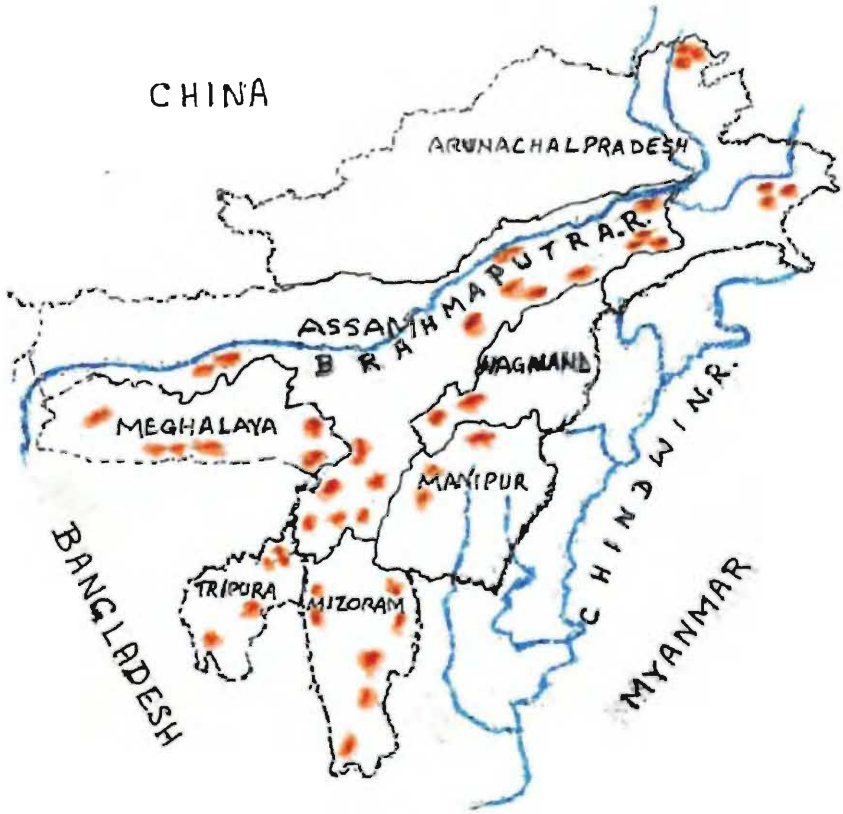

Fig. 2. : Present fragmented distribution of Hoolock gibbon in Northeastern India.

Fig. 3. : Male : Western Hoolock gibbon (Photo : NEWS).

Fig. 4. : Male : Eastern Hoolock gibbon (Photo : NEWS).

Fig. 5. : Female : Hoolock gibbon (Photo : NEWS).

Fig. 6. : Habitat of Hoolock gibbon (Photo : Kaushik Deuti).

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REPORT ON THE SOIL FAUNA OF BHADRAK AND BALASORE DISTRICT, ORISSA

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INTRODUCTION

Soil is one of the basic natural resources that supports life on Earth. It is a huge ecosystem, which is the habitat to several living organisms. Historically, most of the efforts on biodiversity studies focused, especially on aboveground plant and animal species (Wardle, 2006). However, it is well recognized that in most terrestrial ecosystems, the belowground biota supports much greater diversity of organisms than does the aboveground biota, because soils are the central organising entities in terrestrial ecosystems (Coleman, and Whitman, 2005). Soil fauna is a highly diverse group of organisms living within the soil and make soil alive by their activity. They represent most classes and orders and are extremely abundant and species rich (Anderson, 1977). They are determining factor in soil formation and influence all the properties of soil, including fertility and quality. They play important role in supporting plant communities on the earth surface. One of the major activity of soil fauna is decomposition and cycling of organic matter in soil. Soil fauna communities, including soil inhabiting invertebrates, are known to improve soil structure by decreasing bulk density, increasing soil pore space, soil horizon mixing, increased aeration and drainage, increased water holding capacity, litter decomposition and improving soil aggregate structure (Abbott, 1989). They act as bioindicators of soil health. Identifying, counting of soil fauna and associated abiotic factors can help to assess the functioning of the soil ecosystem indicating soil fauna diversity.

In this study, the assessment of soil fauna in the study areas aimed at obtaining a general overview of soil fauna in the ecosystems of the region. Perusal of published literature shows no such systematic study was conducted in these areas of our study zone previously.

Soil Fauna and their Function in Soil

There are many animal groups inhabiting soil system. It has been reported that of the total number of described species on Earth (~1,500,000), as many as 23 per cent are soil animals (Decaens *et. al.*, 2006). Estimated numbers of soil species include 30,000 bacteria; 1,500,000 fungi; 60,000 algae; 10,000 protozoa; 500,000 nematodes; and 3,000 earthworms (Pankhurst, 1997). The interdependence of soil biological fertility with physical and chemical characteristics of soil is established. Among invertebrate soil animals, nematodes, annelids (mainly earthworms) and arthropods represent the most numerous and diversified groups. Among all the groups of soil fauna, arthropods constitute the greatest number and diversity of soil inhabiting species. Most soil animals occur in the top 30 cm of soil, although some also occur at depth. In most environments, the most abundant soil dwellers are collembolan (springtails) and mites, (Andre *et al.* 1994, Coleman, and Crossley 1996) though ants and termites predominate in certain situations, especially in desert and tropical soils. Significant effects of soil fauna on soil structure are achieved mainly by three most important groups which are earthworms, termites and ants (Lee and Foster, 1991).

Soil organisms perform vital functions in the soil to a varying degree depending on the system.

Soil organisms make up the diversity of life in the soil. They play an important role in the decomposition and cycling of organic matter (OM) in soil systems. Insects, earthworms, and other arthropods churn the soil and promote formation of soil structure. Earthworm burrowing in the soil creates channels for aeration, root penetration, reduction in bulk density, enhancement of water infiltration and nutrient cycling. Some soil fauna ingest organic matter by taking in soil, applying digestive enzymes, and excreting the soil/OM complex, thus providing a more readily available food source for other soil fauna and soil micro-organisms.Earthworms, termites, millipedes, centipedes and woodlice ingest soil particles with their food and contribute to aggregate formation by mixing organic and mineral matter in their gut. Some soil fauna contribute to the carbon cycle by fixation (photosynthesis). One group of soil fauna is particularly important in nitrogen cycling.

Topographical description of the Study Areas

The present study was conducted in the two districts namely, Bhadrak and Balasore of the state of Orissa in West Bengal, India. The topographical description of the study areas gives an idea of different ecosystems that prevail in these areas.

1. Bhadrak – Bhadrak is one of the important coastal districts of Orissa. The area is in the east of Bay of Bengal and is located between longitude 86° 30' 0 E and latitude 21° 4' 0 N. The area of this district is 1721 Km^2.There are 5 types of forests in the Bhadrak district. The total forest area is 97 Km^2.

It is a level trac of alluvial soil with a gradual slope eastwards to the Bay of Bengal. A number of deltaic rivers viz., Salandi, Baitarani, Kansabansa, Gamol, Mantei, Genguti, Kochila, Reba and Kapali pass through and around the district.

This district is divided in to three zones according to its soil condition. 1. Saline Soil, 2. Alluvial Soil, and 3. Sandy Soil. This district is naturally divided into two well-designed tracks. 1. The salt tracks along the coasts which is not arable and 2. The arable track, which is called the granary of the state.

The climate of this district is generally hot and high humid. Max. & min. temperatures are 42°C&11.4°Crespectively.Average annual rainfall of the district is 1427.9 mm (15 years average).

2. Balasore - Balasore is another important coastal district of Orissa, lies on the northern most part of the state having 21° 03' to 21° 59' North Latitude & 86° 20' to 87° 29' East Longitude. Geographical area of the district is 3634 Km^2. Bay of Bengal is on the east.

Broadly this district can be divided into three geographical regions, namely,

1. the Coastal belt
2. the inner alluvial plain and
3. the North-Western hills.

The coastal belt – It is about 26 Kms. wide and shapes like a strip. In this region, sand dunes are noticed along the coast with some ridges. The soil of this small strip is saline in nature. This region is mostly flooded with brackish water of estuarine rivers which is unsuitable for cultivation.

The deltaic alluvial plain - It is a wide stretch of highly fertile and irrigated land. The soil of this region is mostly alluvial laterite. The soil of Central region is mostly clay, clay loam and sandy loam which is very fertile for paddy and other farm produces.

The north- western hilly region - Nilgiri Sub-division is mostly gravelly and lateritic soil, which is less fertile. It is mostly hilly terrain and vegetated with tropical semi-ever green forest.

Balasore is crisscrossed with perennial and estuarine rivers because of its proximity to sea. Two important rivers of Orissa, Budhabalanga and Subarnarekha, pass through this district from west to east before surging into the Bay of Bengal.

The climate of Balasore district is mostly hot and humid. The average temperature of the

district varies between 22°C to 32°C and the average rain fall is 1583 mm.

MATERIALS AND METHODS

The present study was undertaken in August, 2009 to March, 2012 in different types of soil in different areas of Bhadrak & Balasore district of Orissa. Soil samples were collected during monsoon and winter seasons. 500 gms. of soil samples taken from each plot. The physico-chemical parameter namely temperature, pH & moisture were taken during collection of soil samples.

Collection and preparation of slides of protozoa

In laboratory soil samples were cultured. 50-100 gms. of soil were taken into Petridish and distilled water was added to it. Petridish were then kept in sunlight. After 1-2 days' a small drop of water was placed on micro slide and examined through microscope. Testacid of Rhizopod started growing if present in the sample. Soon as the Rhizopodes are seen, the water in the slide is dried by using blotting paper. Thus the specimen is fixed. After fixation 1-2 drops of D.P.X. poured upon the speceimen. A cover slip first placed at 45 degree angle upon the specimen and slowly lowered down with the help of a needle, so that D.P.X. will evenly spread devoid of bubbles. We kept this slide for 1-2 days for drying of D.P.X. This permanent slide was then ready for identification.

Collection and preservation of Arthropod

For extraction of the soil micro arthropods fauna, 500 gms. of soil sample was put in a modified Tulgren funnel apparatus using 40 watt electric bulb as heat source. The samples were then kept in the funnel for 72 hours. Permanent slides prepared with the extracted fauna for identification.

Apart from extraction we collected exopedonic arthropods by sweeping method with a fine net. Later killed with Benzene. Finally separated in different envelope according to order under class insecta.

Collection and preservation of earthworm

The living worms were collected by digging soil with a shovel and hand sorting. The worms then dropped in 70 % ethyl alcohol. When the movement of worms stopped, they were removed from alcohol and placed on a piece of blotting paper in straight position. They were then transferred to a flat bottomed container with 10-15% formalin for fixation for 24 hours. The worms were then washed in fresh water and preserved in 70-90% alcohol in suitable sized vials . A label with locality, date of collection and name of collector affixed in each vial.

SYSTEMATIC ACCOUNT

Phylum I. SARCOMASTIGOPHORA
Subphylum SARCODINA
Class LOBOSEA
Order 1 TESTACEALOBOSEA
Family 1 ARCELLINIDAE

Genus 1 *Arcella* Ehrengerg, 1830

1. *Arcella vulgaris* Ehrenberg.
2. *Arcella discoides* Ehrenberg.
3. *Arcelle catinus* Penard.

Family 2 CENTROPYXIDAE

Genus 2 *Centropyxis* Stein, 1857

4. *Centropyxis minuta* Deflandre.
5. *Centropyxis spinosa* (Cash & Hopkinson) Deflandre.
6. *Centropyxis arcelloides* (Penard) & Deflandre.

Family 3 DIFFLUGIDAE

Genus 3 *Difflugia* Leclerc, 1815

7. *Difflugia lucida* Penard.
8. *Difflugia oblonga* Ehrenberg & var. *musicola* var. *nov.*

Class FILOSEA
Order 2 TESTSCEAFILOSEA
Family 4 EUGLYPHIDAE

Genus 4 *Euglypha* Dujardin, 1841

9. *Euglypha ciliata* (Ehrengerg).
10. *Euglypha laevis* (Ehrengerg).
11. *Euglypha rotunda* Wailes and Penard.

12. *Euglypha tuberculata* Dujardin.

Genus 5 *Trinema* Dujardin, 1841

13. *Trinema enchelys* (Ehrengerg) Leidy.

Phylum II. ANNELIDA
Class OLIGOCHAETA
Order 3 HAPLOTAXIDA
Family 5 MEGASCOLECIDAE

Genus 6. *Lampito* Kinberg, 1867

14. *Lampito mauritii* Kinberg.

Genus 7 *Metaphire* Sims & Easton, 1972

15. Metaphire posthuma (Vaillant).

Genus 8 *Perionyx* Perrier, 1872

16. *Perionyx excavatus* Perrier.

Family 6 OCTOCHAETIDAE

Genus 9 *Dichogaster* Beddard, 1888

17. *Dichogaster saliens* (Beddard).

Genus 10 *Eutyphoeus* Michaelsen, 1900

18. *Eutyphoeus orientalis* (Beddard).

Genus 11 *Lennogaster* Gates, 1939

19. *Lennogaster pusillus* (Stephenson).

Genus 12 *Octochaetona* Gates, 1962

20. *Octochaetona paliensis* (Stephenson).

21. *Octochaetona surensis* (Michaelsen).

Genus 13 *Ramiella* Stephenson, 1921

22. *Ramiella bishambari* (Stephenson).

Genus 14 *Pellogaster* Gates, 1939

23. *Pellogaster bengalensis* Michaelsen.

Order 4 MONILIGASTRIDA
Family 7 MONILIGASTRAIDAE

Genus 15 *Drawida* Michaelsen, 1900

Phylum III ARTHROPODA
Class INSECTA
Order 5 ORIBATIDA
Family 8 ORIBATELLIDAE

Genus 16 *Lamellobates* (Hammer)

24. *Lamellobates palustris* (Hammer).

Order 6 ISOPTERA
Family 9 TERMITIDAE

Genus 17 *Odontotermas* Holmgren

25. *Odontotermas feae* (Washman)

26. *Odontototermas obesus* (Rambur).

Order 7 HYMENOPTERA
Family 10 VESPIDAE

Genus 18 *Antepipona*

Order 8 DIPTERA
Family 11 SARCOPHAGIDAE

Genus 19 *Parasarcophaga* Johnston & Tiegs

27. *Parasarcophaga* (Parasarcophaga) albiceps (Meigen).

Family 12 SYRPHIDAE

Genus 20 *Mesebrius* Rondani

28. *Mesebrius bengalensis* (Wiedomann).

Family 13 MUSCIDAE

Genus 21 *Stemoxys* Geoffro

29. *Stemoxys calcitrans* (Linnaeus).

Order 9 HEMIPTERA
Suborder AUCHENORRHYNCHA
Infraoder CICADOMORPHA
Superfamily CERCOPOIDEA
Family 14 CERCOPIDAE

Genus 22 *Poophilus* Stal, 1866

30. *Poophilus costalis* (Walker).

Superfamily MEMBRACOIDAE
Family 15 CICADELLIDAE

Genus 23 *Neodartus* Melichar, 1903

31. *Neodartus acocethaloides* Melichar.

Genus 24 *Goniagnathus* Fieber

32. *Goniagnathus punctifer* (Walker).

Suboder HETEROPTERA
Infraoder PENTATOMOMORPHA
Superfamily PENTATOMOIDEA
Family 16 PENTATOMIDAE

Genus 25 *Agonoscelis Spin*, 1873

33. *Agonoscelis nubila* (Fabricius).

Family 17 SCUTELLERIDAE

Genus 26 Chrysocoris Hahn, 1834

34. *Chrysocoris stallii* (Wolff.).

Superfamily COREOIDAE
Family 18 ALYDIDAE

Genus 27 *Riptortus* Stal, 1859

35. Riptortus fuscus (Fabricius)

Superfamily LYGOIDEA
Family 19 LYGAEIDAE

Genus 28 *Spilostethus* Stal, 1868

36. *Spilostethus hospes* (Fabricius).

Genus 29 *Metochus* Scot, 1874

37. *Metochus uniguttatus* (Thunberg).

Superfamily PYRRHOCOROIDAE
Family 20 PHRRHOCORIDAE

Genus 30 *Dysdercus* Amy. & Serv., 1843

38. *Dysdercus koenigii* (Fabricius).

Order 10 ORTHOPTERA
Family 21 ACRIDIDAE

Genus 31 *Annulata Thunbegr* 1815

Genus *Oxya Serville* 1813

39. *Oxya hyla hyla* (Servilla).

Genus 32 *Oedaleus Fieber* 1853

40. *Oedaleus abruptus* (Thunberg).

Genus 33 *Trilophidia* Stal 1872

41. *Trilophidia annulata* (Thunberg).

Family 22 TETTIGONIIDAE

Genus 34 *Letana* sp. Walker 1869

Genus 35 *Atractomorpha* Saussure 1862

42. *Atractomorpha crenulata* (Fabricius).

Genus 36 : *Himertula* Uvarov 1940

43. *Himertula kinneari* Uvarov.

Order 11 COLEOPTERA

Family 23 COCCINELLIDAE
24 CHRYSOMELIDAE
25 TENEBRIONIDAE
26 CARCULIONIDAE
27 TENEBRIONIDAE
28 CARABIDAE
29 ELATERIDAE
30 DERNESTIAE
31 SCARABAEIDAE

Order 12 COLLEMBOLA
Family 32 ENTOMOBRYIDAE
33 PARONELLIDAE
34 ISOTOMIDAE
35 SMINTHURIDAE
Phylum IV MOLLUSCA
Class GASTROPODA
Order 13 MESOGASTROPODA
Superfamily VIVIPAROIDEA
Family 36 VIVIPARIDAE

Genus 37 ***Bellamya*** Jousseaume 1886

44. *Bellamya bengalensis* (Kobelt).

45. *Bellamya crassa* (Bernson).

Family 37 AMPULLARIIDAE

Genus 38 *Pila* Boltan

46. *Pila globosa* (Swainson).

SYSTEMATIC ACCOUNT

Phylum I SARCOMASTIGOPHORA

Class LOBOSEA

Order 1 TESTACEALOBOSEA

Family 1 ARCELLINIDAE

Genus 1 ***Arcella*** Ehrengerg, 1830 (1832)

1830 (1832) *Arcella* Ehrenberg, *Abh. K. Akda. Wiss Berlin*, p.40.

1 ***Arcella vulgaris*** Ehrengerg.

1830 (1832) *Arcella vulgaris* Ehrengerg, *Abh. K. Akda. Wiss Berlin*, p.40.

1928. *Arcella vulgaris* Ehrengerg, *Arch. Protistenkd.*, 64, p.219

Material examined : 2exs.: Manisai, Dist. Bhadrak; 30.i.2010; A. Murmu & party coll.; 1ex.: Sasanbad village, Dist. Balasore; 23.vi. 2010; D.Saha & party coll.

Distribution: India: Orissa (Dist. Bhadrak & Balasore), Andhra Pradesh, Meghalaya, Manipur, Nagaland, Sikkim, Uttaranchal.

2 ***Arcella discoides*** Ehrenberg.

1843. *Arcella discoides* Ehrenberg, *Ber. K. Akad. Wiss., Berlin*, p.139.

1928. *Arcella discoides* Ehrenberg : *Deflandre, Arch. protistennkd.*, 64, p.256.

Material examined : 1 ex : Manisai, Dist. Bhadrak; 30. i.2010; A. Pal & party coll., 2ex.: Sasanbad village, Dist. Balasore; 23.vi.2010; A. Murmu & party coll.

Distribution : India : Orissa (Dist. Bhadrak & Balasore), Andhra Pradesh, Mizoram, Nagaland, Sikkim Pradesh, Mizoram, Nagaland, Sikkim, West Bengal.

3 *Arcelle catinus* Penard.

1890. *Arcelle catinus* Penard, *Mem. Soc. Phys. & Hist. Nat. Geneva*, p15.

1928. *Arcelle catinus* Penard : *Deflandre, Arch. Protistenkd.*, 64, p.243.

Material examined : 1ex: Manisai, Dist. Bhadrak; 30.i.2010; D. Saha & party coll.

Distribution : India: Orissa (Dist. Bhadrak & Balasore), Andhra Pradesh, Assam, J & K, Sikkim, Uttaranchal.

Family 2 CENTROPYXIDAE

Genus 2 ***Centropyxis*** Stein, 1857

1857 Centropyxis Stein, Sitz. Bohm. Gesellsch. Wiss.

4. ***Centropyxis minuta*** Deflandre.

1929. *Centropyxis minuta* Deflandre, *Arch. protistennkd.*, 67, p 366.

Material examined : 1ex: Sanget, Dist. Bhadrak; 06.vii.2011; D. Saha & party coll.

Distribution : India: Orissa (Dist.Bhadrak& Balasore), Andhra Pradesh, Assam, Himachal Pradesh, J & K, Manipur, Nagaland, Uttaranchal, West Bengal.

5. ***Centropyxis spinosa*** (Cash & Hopkinson).

1929. *Centropyxis spinosa* (Cash & Hopkinson) *Deflandre, Arch. protistennkd.*, 67, p353.

Material examined : 2exs: Joragaria, Dist. Bhadrak; 29.i.2010; D. Saha & party coll. 2exs: Amreya village, Dist.Balasore; 12.ii.2012; D. Saha & party coll. 2exs: Chandipore Jhapar Vilage, Dist. Balasore; 25.vi.2010; D. Saha & party coll.

Distribution: India : Orissa (Dist. Bhadrak & Balasore), Andhra Pradesh, Himachal Prdesh, Mizoram, Sikkim, West Bengal.

6. ***Centropyxis arcelloides*** (Penard).

1902. *Centropyxis arcelloides* Penard, *Fauna Rhizopodique du basin du Leman, Geneva*, p.309.

1929. *Centropyxis* (Cyclopyxis) *arcelloides Deflandre, Arch. protistennkd.*, 67, p367.

Material examined : 1ex: Gelpur village, Dist. Bhadrak; 05.ii. 2012; D. Saha & party coll.

Distribution : India : Orissa (Dist. Bhadrak & Balasore).

Family 3 DIFFLUGIDAE

Genus 3 ***Difflugia*** Leclerc, 1815

1815. *Difflugia* (partim) *Leclerc, Mem. du Mus.*, 2, p.474.

1958. *Difflugia* Gauthier-Lievre and *Thomas, Arch. Protistenkd.*, 103, p.240.

7 ***Difflugia lucida*** Penard.

1890. *Difflugia lucida*, Penard Mem. *Soc. Phys. et. Hist. Nat. Geneve*, 31, p.145.

1958. *Difflugia lucida* : Gauthier-Lievre and *Thomas, Arch. Protistenkd.*, 103, p.294.

Material examined : 1ex: Bali Patna Dist. Bhadrak; 05.vii.2011; D. Saha & party coll.

Distribution : India : Orissa (Dist. Bhadrak & Balasore), Nagaland, Sikkim, Uttaranchal.

8. ***Difflugia oblonga*** Ehrenberg, var. ***musicola*** var. nov

Material examined : 2exs: Sanget, Dist. Bhadrak; 06.vii.2011; D. Saha & party coll.

Distribution : India : Orissa (Dist. Bhadrak & Balasore), Andhra Pradesh, West Bengal.

Class FILOSEA
Order 2 TESTSCEAFILOSEA
Family 4 EUGLYPHIDAE

Genus 4 ***Euglypha*** Dujardin, 1841

1841. *Euglypha* Dujardin, *Zooph. Infus.*, p.131.

1915. *Euglypha* : Cash, Wailes and Hopkinson, *The British Freswater Rhizopoda* and *Heliozoa*, 3, p.131.

1962. Euglypha : Decloitre, *Arch. Protistenkd.*, p.131.

9. ***Euglypha ciliata*** (Ehrengerg).

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

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

1915. *Euglypha ciliate* : Cash, Wailes and Hopkinson, *The British Freswater Rhizopoda and Heliozoa*, 3, p.34.

Material examined : 2exs: Sanget, Dist. Bhadrak; 06.vii.2011; D. Saha & party coll.

Distribution: India: Orissa (Dist. Bhadrak & Balasore), Assam, J & K, Mizoram, Sikkim, West Bengal.

10. ***Euglypha laevis*** (Ehrenberg).

1845. *Difflugia laevis* Ehrenberg, *Ber. Akad., Berlin*, p.307.

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

1915. *Euglypha laevis* : Cash, Wailes and Hopkinson, *The British Freswater Rhizopoda and Heliozoa*, 3, p.32.

Material examined : 1ex : Sreekona, Dist Balasore; 12.ii.2012; D. Saha & party coll.

Distribution : India: Orissa (Dist. Bhadrak & Balasore), Megalaya, Sikkim, Tripura, West Bengal.

11. ***Euglypha rotunda*** Wailes and Penard.

1911. *Euglypha rotunda* Wailes and Penard, *Proc. R. Irish Acad*,. 31, pp.17,41,60-62.

1915. *Euglypha rotunda* : Cash, Wailes and Hopkinson, *The British Freswater Rhizopoda and Heliozoa*, 3, p.32.

Material examined : 1ex : Sreekona, Dist Balasore; 12.ii.2012; D. Saha & party coll.

Distribution : India : Orissa (Dist. Bhadrak & Balasore), Andhra Pradesh, Assam, Himachal Pradesh, Manipur, Tripura, West Bengal.

12. ***Euglypha tuberculata*** Dujardin.

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

1915. *Euglypha tuberculata* : Cash, Wailes and Hopkinson, *The British Freswater Rhizopoda and Heliozoa*, 3, p.13

Material examined : 2exs: Gelpur Village, Dist. Bhadrak ; 05.ii.2012; A. Murmu & party coll.

Distribution : India : Orissa (Dist. Bhadrak & Balasore), Andhra Pradesh, Assam, Himachal Pradesh, Manipur, Tripura, West Bengal.

Genus 5 ***Trinema*** Dujardin, 1841

1841. *Trinema* Dujardin, *Zooph. Infus.*, p.249.

1915. *Trinema;* Cash, Wailes and Hopkinson, *The British Freswater Rhizopoda and Heliozoa*, 3, p.85.

13. *Trinema enchelys* (Ehrengerg, 1838) Leidy, 1878.

1838. *Difflugia enchelys* Ehrenberg (Pratim), *Infusionsth.*, p.132,

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

1915. *Trinema enchelys* : Cash, Wailes and Hopkinson, *The British Freswater Rhizopoda and Heliozoa*, 3, p.86.

Material examined : 2exs: Gelpur Village, Dist. Bhadrak; 05.ii.2012; A. Pal & party coll.

Distribution : India: Orissa (Dist. Bhadrak & Balasore), Andhra Pradesh, Manipur, Mizoram, Nagaland, West Bengal.

PHYLUM II ANNELIDA
Class OLIGOCHAETA
Order 3 HAPLOTAXIDA
Family 5 MEGASCOLECIDAE

Genus 6 ***Lampito*** Kinberg, 1867

1867. *Lampito* Kinberg, *Ofvers. K. Vetens. Akad. Forhandl. Stockholm*, 23; 103.

1987. *Lampito* : Julka & Senapati, *Rec. Zool. Surv. India, Occ. Paper* No.92:8

14. ***Lampito*** mauritii Kinberg.

1867. *Lampito mauritii* Kinberg, *Ofvers.K. Vetens. Akad. Forhandl. Stockholm*, 23 ; 103.

1938. *Lampito mauritii* : Gates, *ibid.*, 40: 413

1987. *Lampito mauritii* : Julka & Senapati, *Rec. Zool. Surv. India, Occ. Paper* No.92 : 9

Material examined : 10 exs.: Dist. Jharnahati vill., Balasore; 26.i.2010; A. Murmu coll.; 11exs.: Uttarbahini, Bhadrak Dist.; 05.vii.2011; R.Goswami coll. 6exs.: Langudi vill., Bhadrak Dist.; 07.ii.2012; A.Pal coll.

Distribution : India: Orissa. (Dist.-Bhadrak & Balasore), Andaman and Nicobar Island, Andhra Pradesh, Bihar, Gujrat, Karnataka, Kerala, Laccadive & Minicoy Islands, Madhya Pradesh, Maharastra, Rajasthan, Tamilnadu, Uttarpradesh, West Bengal.

Remarks : It is widely distributed throughout India, though originally assumed to be Peninsular India.

Genus 7 ***Metaphire*** Sims & Easton,1972

1972. *Metaphire* Sims & Easton, *Biol. J. Linn. Soc.*, 4(3) : 215

1987. *Metaphire* : Julka & Senapati, *Rec. Zool. Surv. India, Occ. Paper* No. 92:10

15. ***Metaphire posthuma*** (Vaillant).

1868. *Perichaeta posthuma* Vaillant, *Annl Sci. Nat.*, (ser.5), 10: 228.

1972. *Metaphire Posthuma* : Sims & Easton, *Biol. J. Linn. Soc.*, 4(3): 239.

1980. *Metaphire Posthuma* : Soota & Halder, *Rec. Zool. Surv. India*, 76:200.

Material examined : 9 exs. : Sasanbad vill., Dist. Balasore; 25.vi.2011; R. Goswamicoll.

Distribution : India: Orissa (Balasore Dist.), Andaman Island, Bihar, Gujrat, Haryana, Himachal Pradesh, Jammu & Kashmir, Madhya Pradesh, Maharastra, Punjab, Rajasthan, Uttar Pradesh, West Bengal.

Remarks : Species originated in south east Asia, widely distributed.

Genus 8 ***Perionyx*** Perrier, 1872

1872. *Perionyx* Perrier, *Nouv. Arch. Mus. Hist. nat. parts.* 8:126.

1987. *Perionyx:* Julka & Senapati, *Rec. Zool. Surv. India, Occ. Paper* No.92:13.

16. ***Perionyx excavatus*** Perrier.

1872. *Perionyx excavatus* Perrier. *Nouv. Arch. Mus. Hist. nat. parts.* 8:126.

1987. *Perionyx excavatus* : Julka & Senapati, *Rec. Zool. Surv. India, Occ. Paper* No.92:13.

Materian examined : 5exs.: Dist. Bhadrak; 07.vii.2011; R. Goswami coll.; 5 exs.; Bhuipada Dist. Balasore; 11.ii.2012; A. Pal coll.

Distribution : India : Orissa (Dist. Bhadrak & Balasore), Andaman Island, Arunachal Pradesh Assam, Himachal Pradesh, Maharastra, Manipur, Sikkim, Tamil Nadu, Uttar Pradesh, West Bengal.

Remarks : This species originated from the Himalayas.

Family 6 OCTOCHAETIDAE

Genus 9 ***Dichogaster*** Beddard, 1888

1888. *Dichogaster* Beddard, *Quast. I. miscrsc. Sci.* (n.s.) 29:251

1987. *Dichogaster* : Julka & Senapati, *Rec. Zool. Surv. India, Occ. Paper* No. 92 : 21.

17. ***Dicogaster saliens*** (Beddard).

1893. *Micridilus saliens* Beddard, *Proc. Zool. Soc. Land,* 1892 : 683.

1900. *Dichogaster saliens* : Stephenson, *Ibid,* : 478.

1972. *Dichogaster saliens* : Gates, *Trans. Am. Phil. Soc.,* 62(7) : 281

Material examined : 13exs. : Balipatna, Dist. Bhadrak; 05.vii, 2011.; R. Goswami coll.

Distribution : India : Orissa (Dist -Bhadrak), Arunachal Pradesh, Karnataka, Meghalaya, Sikkim, West Bengal.

Remarks : Probably originated from West Africa and rare in India.

Genus 10 : ***Eutyphoeus*** Michaelsen 1900

1900. *Eutyphoeus* Michaelsen, *Das Tierreich,* 10: 322.

1987. *Eutyphoeus:* Julka & Senapati, *Rec. Zool. Surv. India, Occ. Paper No.* 92:25.

18. ***Eutyphoeus orientalis*** (Beddard).

1833. *Eyphoeus orientalis* Beddard, *Ann. Mag. nat. Hist.,* (ser.5). 12 :219.

1938. *Eutyphoeus orientalis* : Gates, *Rec. Indian Mus.,* 40: 98.

1966. *Eutyphoeus orientalis:* Soota, *Rec. Zool. Surv. India,* 64:179.

Material examined : 9 exs.: Singla vill, Dist. Balasore; 28.i.2010; A. Murmu coll.

Distribution : India: Orissa (Dist. Balasore), Bihar, Uttar Pradesh, West Bengal.

Remarks : This is endemic species.

Genus 11 ***Lennogaster*** Gates 1939

1939. *Lennogaster* Gates. *Rec. Indian Mus.,* 41:183.

1987. *Lennogaster* : Julka & Senapati, *Rec. Zool. Surv. India, Occ. Paper No.* 92:27.

19. ***Lennogaster pusillus*** (Stephenson).

1920. *Eudichogaster pusillus* Stenphenson, *Mem. Indian. Mus.*

1945. *Lennogaster pusillus* : Gaters, *Proc. Indian Acad. Sci.,* 21 (B) :252.

1987. *Lennogaster pusillus* : Julka & Senapati, *Rec. Zool. Surv. India, Occ. Paper No.* 92: 27.

Material examined : 57exs.: Balipatna, Bamkura, Sanget, Uttarbahini, Dist. Bhadrak; 05.vii.2011 and 06.vii.2011. R. Goswami coll.; 37 exs.: Bhuipada, Sreekona, Dist. Balasore; 11.ii.2012 and 12.ii.2012.; A.Pal coll.

Distribution : India : Orissa (Dist. Bhadrak & Balasore), Himachal Pradesh, Karnataka, Madhya Pradesh, Uttar Pradesh, West Bengal.

Genus 12 ***Octochaetona*** Gates 1962

1962. *Octochaetona* Gates, *Ann. Mag. nat. Hist* (Ser.13), 5: 211.

1987. *Octochaetona* : Julka & Senapati, *Rec. Zool. Surv. India, Occ. Paper No.* 92:28.

20. ***Octochaetona paliensis*** (Stephenson).

1907. *Octochaetus phillotti* Michaelsen, *Jb. Hamb. Wiss. Anst.*, 24:169.

1920. *Octochaetus paliensis* Stephenson, *Mem. Indian Mus.*, 7:228.

1962. *Octochaetona paliensis*, Gates, *Ann. Mag. Nat. Hist.* (ser.13), 5:213.

Material examined : 2exs.: Karali, Dist. Balasore; 09.vii.2011; R. Goswami coll.

Distribution : India: Orissa (Dist. Balasore), Andhra Pradesh, Madhya Pradesh, Maharastra.

21. ***Octochaetona surensis*** (Michaelsen).

1910. *Octochaetona surensis* Michaelsen, *Abh. Geb. Natural., Hamburg.* 19 (5) :8.

1962. *Octochaetona surensis*, Gates, *Ann. Mag. nat. Hist.* (ser.13), 5:213.

1972. *Octochaetona surensis*, Gates, *Trans. Am. phil. Soc.*, 62:309.

Material examined : 8 exs.: Kenduapada vill., Dist. Bhadrak ; 08.ii.2012; A. Pal coll.

Distribution : India : Orissa (Dist-Bhadrak), Assam, Madhya Pradesh, Uttar Pradesh.

Genus 13 ***Ramiella*** Stephenson 1921

1921. *Ramiella* Stephenson, *Proc. zool. soc Land*, 1921 : 109

1987. *Ramiella:* Julka & Senapati, *Rec. Zool. Surv. India, Occ. Paper No.* 92:34.

22. ***Ramiella bishambari*** (Stephenson).

1914. *Octochaetus bishambari* Stephenson, *Rec. Indian Mus.*, 10; 347.

1923. *Ramiella bishambari* : Stephenson, *Fauna. Br. India, Oligochaeta.*: 398.

1987. *Ramiella bishambari:* Julka & Senapati, *Rec. Zool. Surv. India, Occ. Paper No.* 92: 35.

Material examined : 2exs. : Gopinath temple, Dist. Balasore; 09.vii.2011; R. Goswami coll.

Distribution : India : Orissa (Dist-Balasore), Andaman & Nicobar Island, Madhya Pradesh, Uttar Pradesh, West Bengal.

Remarks : Originated from the sub Himalayan region.

Genus 14 : ***Pellogaster*** Gates,1939

1939. *Pellogaster* Gates, *Rec Indian. Mus.*, 41 : 200.

1987. *Pellogaster* : Julka & Senapati, *Rec. Zool. Surv. India, Occ. Paper No.*92:33.

23. *Pellogaster bengalensis* (Michaelsen).

1910. *Eudichogaster bengalensis* Michaelsen, *Abh. Geb. Naturw., Hamburg*, 19 : 96.

1939. *Pellogaster bengalensis* Gates, *Rec. Indian Mus.* 41 : 201.

1987. *Pellogaster bengalensis* : Julka & Senapati, *Rec. Zool. Surv. India, Occ paper No.* 92 : 34.

Material examined : 8exs.: Jaleswar, Dist. Balasore; 25.vi.2010; A.Murmu coll.

Distribution : India : Orissa (Dist-Balasore), Bihar, Madhya Pradesh.

Remarks : This species is endemic to India.

Order 4 MONILIGASTRIDA

Family 7 MONOLIGASTRAIDAE

Genus 15 ***Drawida*** Michaclaelsen 1900

1900 *Drawida* Michaelsen, *Das Tirreich, Berlin*, 10;114.

1987 *Drawida* : Julka & Senapati, *Rec. Zool. Surv. India, Occ. Paper No.* 92 : 37.

Material Examined : 7exs. : Chandbali, Dist. Bhadrak; 27.i.2010; A. Murmu. coll. 2exs.: Arjunpur, Dist. Bhadrak; 06.vii. 2011; R. Goswami coll.

Distribution : India : Orissa (Dist. Bhadrak), West Bengal.

Phylum III ATRHROPODA
Class INSECTA
Order 5 ORIBATIDA
Family 8 ORIBATELLIDAE

Genus 16 ***Lamellobates*** Hammer

24. ***Lamellobates*** palustris Hammer.

1968. *Lamellobates palustris* Hammer, *Arges. Bot. Diol. SKR. DAN. VZE. SEL. SK*, p.10

Material examined : 12 exs.: Gelpur vill., Dist. Bhadrak; 04.ii. 2012; A. Pal coll.

Distribution : India : Orissa (Dist. Bhadrak), W.B.

Order 6 ISOPTERA
Family 9 TERMITIDAE

Genus 17 Odontotermes

25. ***Odontotermes obesus*** (Rambur).

1842. *Termes obesus* Rambur, *Histoire nat. Insectes, Nevropteres:* 304.

2010. *Odontotermes obesus* (Rambur): Saha, Roy and Sar, *Zool. Surv. India, Fauna of Uttarakhand, State Fauna Series.* 18 (Part-2) :83,94,98.

Material examined : 2 exs.: Chandbali, Dist. Bhadrak; 26.i.2010; A.Murmu. coll.

Distribution : India : Orissa (Dist.Bhadrak), Arunachal Pradesh, Assam, Bihar, Himachal pradesh, Jammu & Kashmir, Karnataka, Madhya Pradesh, Manipur, Tripura.

26. ***Odontotermes feae*** (Wasmann).

1896. *Termes feae* Wasmann *Ann. Mus. Star. Nat. Geneva,* (2) 16 (360 ; 625,626. S and W.

2010. *Odontotermes feae* (Washmann): Saha, Roy and Sar, *Zool. Surv. India, Fauna of Uttarakhand. State Fauna Series,* 18 (Part-2) : 82,93.9.

Material examined : Chandbali, Dist. Bhadrak; 26.i.2010; A. Murmu. coll.

Distribution : India : Orissa (Dist. Bhadrak), Assam, Bihar, Himachal Pradesh, Jammu & Kashmir, Karnataka, Madhya Pradesh, Manipur, Tripura.

Order 7 HYMENOPTERA
Family 10 VESPIDAE

Genus 18 ***Antepipona.*** Sp.

Order 8 DIPTERA
Family 11 SARCOPHAGINAE

Genus 19 ***Parasarcophaga*** Johnston and Tiegs

1921. *Parasarcophaga* Johnston and Tiegs, *Proc. R. Soc. Qd.* 33 : 86.

27. ***Parasarcophaga albiceps*** (Meigen).

1826. *Sareophaga albiceps* Meigen, *Syst. Bechr. europ. zeeifl. Insect.* 5:22.

Material examined : 1 ex.; Jitunauga, Dist. Bhadrak; 04.ii.2012; A. Pal & Party coll.

Distribution : India: Orissa (Bhadrak), Bihar, Karnatak, Kerala, Madhya Prradesh, Tamil Nadu, West Bengal.

Family 12 SYRPHIDAE

Genus 20 : ***Mesembrius*** Rondani

1857. *Mesembrius Rondani,* Diptenol. *ital. Prodr.* 2.p. 50.

28. *Mesembrius bengalensis.*(Wiedemann).

1819. *Eristalis bengalensis.* Wiedemann, *Zool. Mag.(wied.)* 1:16.

Material examined : 2 exs.: Soro, Dist. Balasore; 10.ii.2012; A.Pal & Party coll.

Distribution : India : Orissa (Dist. Balasore), Assam, Bihar, Meghalaya, M.P, Oriental Region.

Family 13 MUSCIDAE

Genus 21 ***Stomoxys*** Geoffroy

1762. *Stomoxys* Geoffroy, *Hist. abreg. Ins. Paris.* 2; 449.

29. ***Stomoxys calcitrans*** (Linnaeus).

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

Material examined : 1 ex; Soro, Dist. Balasore; 10.ii.2012; A.Pal & Party coll.

Distribution : India : Orissa (Dist. Balasore), Assam, Bihar, Madhya Pradesh, South India.

Order 9 HEMIPTERA
Infraoder CICADOMORPHA
Family 14 CERCOPIDAE

Genus 22 ***Poophilus*** Stal, 1866

1866. Poophilus Stal, Hem

30. *Poophilus* costalis (Walker)

1851. *Ptyelus costalis* Walker, *List. Hem.,* **3**: 707.

1908. *Poophilus costalis*: Distant, *Fauna Brit. India, Rhynchota,* **4**:86.

Material examined : 1ex., Sara, Dist., Balasore, 10.2.12, coll. A. Pal and party.

Distribution : India : Orissa (Balasore), Andhra Pradesh, Karnataka, Maharashtra, Meghalaya.

Elsewhere: Bangladesh, Singapore, Sri Lanka, South &West Africa.

Superfamily MEMBRACOIDEA
Family 15 CICADELLIDAE

Genus 23 ***Neodartus*** Melichar, 1903

1903. *Neodartus* Melichar, *Hom. Fauna Ceylon:* 162.

31. ***Neodartus acocethaloides*** Melichar

1903. *Neodartus acocethaloides* Melichar, *Hom. Fauna Ceylon:*163.

1200. *Neodartus acocethaloides:* Ghosh and Biswas, *State Fauna Series 7: Fauna of Tripura,* part-2: 326.

Material examined : 2 exs., Basudevpur, Dist. Bhadrak, 22.vi.2010, coll. A. Murmu and party.

Distribution: India: Orissa (Bhadrak), Punjab, Tamil Nadu, Tripura, West Bengal, *Elsewhere*: Philippines.

Genus 24 ***Goniagnathus*** Fieber, 1866

1866. *Goniagnathus* Fieber, *Verh. Z.b.Ges. Wien.*, 16:506.

32. ***Goniagnathus*** punctifer (Walker).

1858. *Bythoscopus punctifer* Walker, *Insecta Saundersim* : 108.

2007. *Goniagnathus punctifer:* Ghosh and Bal, *State Fauna Series 5: Fauna of Andhra Pradesh,* part-3: 293.

Material examined : 4 exs., Basudevpur, Dist. Bhadrak, 22.vi.2010, coll. A. Murmu and party.

Distribution : India : Orissa (Bhadrak), Andhra Pradesh, Assam, Bihar, Maharashtra, Meghalaya, Tamil Nadu, Tripura, Uttar Pradesh, West Bengal.

Elsewhere: Maldives, Myanmar, Sri Lanka.

Suborder HETEROPTERA
Infraorder CICADOMORPHA
Superfamily PENTATOMOIDEA
Family16 PENTATOMIDAE

Genus 25 ***Agonoscelis*** Spin, 1873

1873. *Agonoscelis* Spin.

33. ***Agonoscelis nubila*** (Fabricius).

1775. *Cimex nubile* Fabricius: *Syst. Ent.*, : 712.

1904. *Agonoscelis nubila:* Distant, *Fauna Brit. India, Rhynchota,* 1: 58.

Material examined : 1ex. Bhuipada, Dist. Bhadrak, 11.2.12, coll. A. Pal and party.

Distribution: India: Orissa (Bhadrak), Andhra Pradesh, Bihar, Jammu & Kashmir, Karnataka, Madhya Pradesh, Maharashtra, Meghalaya, Tamil Nadu, West Bengal. Elsewhere: Myanmar, China, Japan, Malayan Peninsula, Sri Lanka.

Family 17 SCUTELLERIDAE

Genus 26 ***Chrysocoris*** Hahn, 1834

1843. *Chrysocoris* Hahn, *Wanz. Ins.*, 2:38.

34. *Chrysocoris* stollii (Wolff.).

1801. *Cimex stollii* : Wolff., *Ic.*, 2 : 48.

1904. *Chrysocoris stollii* Distant, *Fauna Brit. India, Rhynchota,* 1 : 58.

Material examined : 6exs., Chandbali, Dist. Bhadrak, 27.1.10, coll. A. Murmu and party.

Distribution : India : Orissa (Bhadrak), Tripura, West Bengal and throughout the country.

Elsewhere : China, Mayanmar.

Superfamily COREROIDEA
Family 18 ALYDIDAE

Genus 27 ***Riptortus*** Stal, 1859

1859. *Riptortus* Stal, *Ofv. Vet.-Ak. Forh.*, : 400.

35. ***Riptortus fuscus*** (Fabricius).

1798. *Lygaeus fuscus* : Fabricius, *Ent. Syst. Suppl.*, 539.

1904. *Riptortus fuscus* Distant, *Fauna Brit. India, Rhynchota,* 1 : 414.

Material examined: 1ex., Badudevpur, Algoda, Dist. Bhadrak , 23.vi.10, coll. A. Murmu and party.

Distribution : India : Orissa (Bhadrak).

Superfamily LYGOIDEA
Family 19 LYGAEDAE

Genus 28 ***Spilostethus*** Stal, 1868

1868. *Spilostethus* Stal, Kongl. Svensk. Vet. Akad. Handl., 7(11): 72

36. ***Spilostethus hospes*** (Fabricius)

1794. *Lygaeus hospes* : Fabricius, *Ent. Syst.*, 4 : 150.

1988. *Spilostethus hospes* Mukhopadhyay, *Rec. Zool. Surv. India, Occ. Paper No.* 107 : 15.

Material examined : 2exs., Chandbali, Dist. Bhadrak, 27.i.10, coll. A. Murmu and party, 6exs. Chandipur P.W.D. Bunglow, Dist. Balasore, 17.vi.10, coll. A. Murmu and party.

Distribution : India: Orissa (Balasore, Bhadrak), Maharashtra, Tamil Nadu, Uttarakhand, Tamil Nadu.

Genus 29 ***Metochus*** Scott, 1874

1874. *Metochus* Scott, *Ann. Mag. Nat. Hist.*, (4) **14**: 433-434.

37. ***Metochus uniguttatus*** (Thunberg)

1822. *Pendulinus uniguttatus* Thunberg, *Hem. Rost. Cap.*, 4:6.

1904. *Metochus uniguttatus* : Mukhopadhaya, *Rec. Zool. Surv. India, Occ. Paper No.*107 : 56.

Material examined : 1ex.,Chandbali, Dist. Bhadrak, 27.i.10, coll. A. Murmu and party.

Distribution : India : Orissa (Bhadrak), Andaman Islands, Maharashtra, Meghalaya, Uttaranchal, West Bengal. Elsewhere: China, Myanmar, Malay Archipelago, Sri Lanka.

Superfamily PYRRHOCOROIDEA

Family 20 PYRRHOCORIDAE

Genus 30 ***Dysdercus*** Amy. & Serv., 1843

1843. *Dysdercus* Amy. & Serv., *Hem.*, : 272.

38. ***Dysdercus koenigii*** (Fabricius)

1775. *Cimex cingulatus* Fabr., *Syst. Ent.*, : 719.

2007. *Dysdercus koenigii* Saha & Bal, *State Fauna Series 18, Fauna of Uttarakhand:* 248.

Material examined : 3exs.,Chandbali, Dist. Bhadrak, 27.i.10, coll. A. Murmu and party, 1ex. Baripada, Dist. Bhadrak, 11.ii.12, coll. A. Pal and party.

Distribution : India: Orissa (Bhadrak), Andhra Pradesh, Assam, Andaman & Nicobar Islands, West Bengal.

Elsewhere: Sri Lanka.

Order 10 ORTHOPTERA
Family 21 ACRIDIDAE

Genus 31 ***Oxya*** Serville, 1831

39. ***Oxya hyla hyla*** (Serville).

1831. Oxyahyla Serville , *Ann.sci. nat. (Zool.), Paris*, 22: 287.

2006. *Oxya hyla hyla* : Shishodia, *Binotes*, 81: 11.

Material examined : 5 exs.; Remuna & Singla, Dist. Balasore; 04.ii.2010;A.Murmu.

Distribution : India : Orissa (Dist. Balasore), Andaman, Nicobar, A.P., Arunachal Pradesh, Bihar, M.P., Haryna, Gujrat, U.P.,W.B.

Genus 32 : ***Oedaleus*** Fieber 1853

40. ***Oedaleus abruptus*** (Thunberg).

1815. *Gryllus abruptus* Thunberg, *Mem. Acad. Soc. St. Petersb*, 5 :233.

1981. *Oedaleus abruptus* : Ritchie, *Bull. Br. Mus. Nat. Hist.(Ent.)*, 42(3) : 104.

Material examined : 1ex.; Basudebpur, Dist. Bhadrak; 21.vi. 2010 ; A.Murmu.

Distribution : India : Orissa (Dist. Bhadrak), Andhra Pradesh, Bihar, H. P., J & K, M.P. Rajasthan, T.N., Tripura, U.P., W.B.

Genus 33 ***Trilophidia*** Stal,1872

41. ***Trilophidfia annulata*** (Thunberg).

1815. *Gryllus annulatus* Thunberg, *Mem. Acad. Sci. Sipetersb*, 5: 234.

1965. *Trilophidia annulata:* Hollis, *Trans. R. ent. Soc.* 117(8:251).

Material examined : 3exs.; Tihidi, Dist. Bhadrak; 20.vi.2010; A. Murmu coll.

Distribution : India : Orissa (Dist. Bhadrak), A.P., Arunachal Pradesh, Bihar, Kerala, Manipur, Himachal Pradesh, Tamilnadu, Tripua, W.B.

Family 22 TETTTIGONIIDAE

Genus 34 ***Atractomorpha*** Saussure, 1862

42. *Atractomorpha crenulata crenulata* (Fabricius)

1793. *Truxalis crenulatus* Fabricius, *Ent. Syst.*, 2 : 28.

1960. *Atractomorpha crenulata crenulata* : Banerjee & Keven, *Treubia*, 25 : 184.

Material examined : 2exs.; Soro, Dist. Balasore; 10.ii. 2012; A.Pal coll.

Distribution : India : Orissa (Dist. Balasore), Andaman & Nicobar Islands, Andhra Pradesh, Bihar, J & K, Karnataka, Madhya Pradesh, Rajasthan, Tamilnadu, W.B.

Genus 35 : *Himertula* Uvarov, 1940

43. ***Himertula kinneari*** (Uvarov)

1923. *Himertula kinneari* Uvarov, *J.Bom. Nat. Hist. Soc.*, 29(3:661).

2007. *Himertula kinneari* : Chandra *et.al, Zoos. Print. Journl.*, 27 (5 : 2684).

Material examined : 3Exs. Kenduapada, Dist. Bhadrak; 08.ii.2012; A.Pal. coll.

Distribution : India : Orissa (Dist. Bhadrak), Bihar, Chhattrishgarh, M.P., Gujarat, Himachal Pradesh, Maharastra, Uttar Pradesh, W.B.

Phylum IV MOLLUSCA
Class GASTROPODA
Order 13 MESOGASTROPODA
Family 36 VIVIPARAIDAE

Genus 36 ***Bellamya*** Jousseaume, 1886

44. ***Bellamya bengalensis*** (Kobalt).

1908. *Viviparaannandalei* Kobalt, Malak. *Ges.*, 60: 161.

2005. *Bellamya bengalensis:* Mitra, Dey & Ramakrishna, *Fauna of A. P. : State Fauna Series,* Part 5 :190.

Material examined : 17Exs. Sreekona, Dist. Balasore, 12.ii.2012; A.Pal & Party coll : 4Exs, Langudi, Dist. Bhadak; 07.ii.2012; A.Pal & Party.

Distribution : India : Orissa (Dist. Balasore & Bhadrak), Andhra Pradesh, Bihar, Jharkhand, Manipur, Meghalaya, Rajasthan, Tamilnadu, W.B.

45. ***Bellamya crassa*** (Benson).

1836. *Paludina crassa* (Benson), *J. Saiat. Soc. Beng.* 5 : 745.

2005 *Bellamya crassa* : Mitra, Dey & Ramakrishna, *Fauna of A.P., State Fauna Series,* Part 5, p.190.

Material examined : 12exs. Soro, Dist. Balasore, 12.ii.2012; A.Pal & Party coll: 5Exs; Langudi, Dist. Bhadrak : 07.ii.2012; A.Pal & Party.

Distribution : India : Orissa (Dist. Balasore, Bhadrak) Assam, A.P., Karnataka, Meghyalay, Gujrat, West Bengal.

Family 37 AMPULLARIIDAE

Genus 37 ***Pila*** Boltan, 1798

46. ***Pila globosa*** (Swainson).

1822. *Ampullaria globosa* Swainson, *Zool. Illustration,* 2l: pl.xix.

1889. *Pila globosa;* Subbarao, *Hand book of fresh water Molluscs of India,* p.58, Fig. 80-82.

Material examined : 5exs; Sreekona, 3exs., Bhuipada, Dist. Balasore 11. ii.2012; A.Pal & Party coll. 10Exs.; Langudi, Dist. Bhadrak, 07. ii.2012 A. Pal & Party coll.

Distribution : India : Orissa (Dist. Bhadrak, Balasore), Assam, Bihar, H.P., Jharkhand, Maharastra, M.P., Meghalay, U.P., Rajasthan, W.B.

SUMMARY

The paper deals with the studies of soil fauna in different habitats of two districts of Orissa , namely, Bhadrak & Balasore during the period from August 2009 to March 2012. The work consists of taxonomic study of soil fauna. The purpose of study is to identify the diversity of soil fauna that inhabit in different soil types and also different soil insects collected from this soil. The paper deals with introduction, functions of soil fauna in soils, topographical speciality of the study areas, materials & methods, taxonomical details and summery .The material collected is represented by 46 species belonging to 38 genera and 37 families under 13 orders of 4 phyla. The break up of all the species under the fauna collected is given here to show the groupwise strength of the species, genus, family and order. The result shows that all the species have new locality records. Among the fauna Centropyxis spinosa in protozoa, Lennogaster pusillus in earthworm and order Hemiptera in Arthropoda occupied highest number and found in all seasons and shows the dominance. Necessary taxonomic reference to original literature, remarks wherever possible and geographical distribution of each species are incorporated. The paper is based on the collection made by various survey parties of Soil Zoology section of Zoological Survey of India.

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ON SOME MOLLUSCA COLLECTIONS FROM DIFFERENT BEACHES OF SOUTH ODISHA COAST OF INDIA

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INTRODUCTION

The study of the molluscs in India although ows its origin to 18th century initiated by the Asiatic Society of Bengal (1784), marine malacology obtained significance only in 20th century with initiateves taken by the Zoological Survey of India (ZSI), Central marine Fisheries of India (CMFRI) and many maritime universities. Several surveys have been conducted to record the marine molluscan fauna of India starting with Preston (1910,1914) to Subba Rao(1968) and Apte (2009). Venkataraman (2012) has reported that 3370 species of molluscs have been recorded from Indian marine habitats where in over 1000 species were from Andaman and Nicober group of Islands, 428 species from Gulf of Manar and 424 species Lakshadweep. Many of the publications brought out by ZSI on molluscs also mentions about the Odisha coast.

Odisha as maritime state in Indian East coast is bestowed with variety of coastal ecosystems comprising of estuaries, coastal lagoons, creeks, intertidal mudflats, sandy beaches and mangrove swamps sustaining high molluscs diversity. The taxonomic study of molluscs in this state began from Chilka Lake in the early parts of 20th century along with other faunal groups and continued for a long period (Annandale,1915-24; Subba Rao et. al., 1995). The subsequent studies were extended to Mahanadi estuary (Subba Rao, 1968; Subba Rao and Mukherjee,1975; Surya Rao and Maitra, 1998), Rushikulya Estuary (Rama Rao *et. al.*, 1992) and Bahuda Estuary (Pati *et. al.*, 2008). The present communication deals with the faunal diversity of marine and estuarine molluscs of the south Odisha coast comprising of two estuaries, one pocket lagoon and the coastal track between Patisunapur to Rushikulya Sea turtle rookery.

MATERIALS AND METHODS

Study Area

Beach samples were collected from three locations namely Rushikulya estuary (Lat. 190 24' N & Long. 850 05' E), Bahuda estuarary (Lat. 19004'N Long 84035'E) and Gopalpur Creek (Lat.190 10'N & Long.850 35'E) and their adjoining beaches. These three coastal ecosystems are quite diverse in their physiographic features and hydrographical attributes. The Rushikulya estuary is typical shallow tidal estuary having perinial connection with the Bay of Bengal. It is influenced by semi diurnal tide. Sea water penetration can reach upto a distance of 7 km upstream from its mouth. The estuarine basin is predominantly sandy and major part of the basin remains exposed during lowest low water spring. Bahuda estuary is also shallow. positive estuary influenced by similar semidiurnal tide. But, the sea water penetration can reach upto a distance of 10 km upstream from the mouth. The estuary in its mid ridges, forms an expanded mud flat with clam and oyster beds. The Gopalpur creek is a small and shallow brackish water environment that remains cut of from the sea for most part of the year. The process of water exchange have taken place through seepage based on tidal rhythm. The morphology, physicochemical

characteristics and biological attributes of this creek confirms the requirements of a "pocket lagoon" as defined by Phleger (1981). The substratum of this creek is muddy and major part of its upstream remains exposed during lowest low water spring.

METHODOLOGY

Direct search method was adopted in this study. Monthly survey was conducted for one year from May, 2011 - April, 2012 for sample collections. Collection of samples were made during low tide period. Live spacimens and dead slells were colleted through hand picking from randomly selected areas of the exposed substratum of the study areas. The number of samples of each species veried from 1-5 depending upon their abundance. Each sample was washed in sea water thoroughly at the collection sites to remove the impurities. After studying the morphological characters, live specimens were fixed with 5% neutralised formaldehyde and brought to the laboratory. They are finally preserved in glycerin ethyl alcohol mixture in the ratio of 1:19 as recommended by Gosner (1971). Washed shells were preserved in polythene bags. Each specimen were photographed before their preservation.

Identification procedure

The identification of specimens were made based on their morphological characters following the taxonomic monographs of Vaught (1989).

RESULTS

Detailed information on the first report till last published records have been cited for each specimen. A brief description of each sample viz. location, collector, year of collection and number of examples is presented.

Class GASTROPODA
Subclass PROSOBRANCHIA

Prosobranch gastropods have either gills situated within the mantle cavity towards the front of the animal, for which they can enable to occupy the different kind of habitats. They have different types of radula, which are so distinct that have been the basis for classification of the group. Most of the radula consists of transverse rows of teeth, variously arranged. The member of the superfamily Conoidea have harpoon like detachable barbs associated with a poison apparatus. Many species have a chitinous or calcareous plate, the operculum attached to the foot. This structure assumes different forms according to the species and is important aid to identification, Many species enable to seal their aperture with the help of this structure, but in some group e.g cones, it is so reduced in size that it seems to serve no useful function.

Subfamily NERITINAE

Genus ***Theodoxus*** Montfort, 1810

1852. *Theliostyla* Moerch, *Cat. Conch, Yoldi.*, **1**: 167. Type Species: *Nerita albicilla* Linnaeus

Subgenus ***Clithon*** Montfort, 1810

1852. *Theliostyla* Moerch, *Cat. Conch, Yoldi.*, **1**: 167. Type Species: *Nerita albicilla* Linnaeus

1. ***Theodoxus (Clithon) oualaniensis*** (Lesson)

1830. *Theodoxus oualaniensis* Lesson in Duprey, *Voy. Coq. Zool.*, **2**: 379.(Type locality: Oulan, Fiji).

1916. *Theodoxus oualaniensis*: Preston, *Rec. Indian Mus.*, **12**(2): 92.

1940. *Smaragdia oualaniensis*: Crichton, *J. Bombay nat. Hist. Soc.*, **42:** 340.

1952. *Neritina oualaniensis*: Satyamurti, *Bull. Madras Govt. Mus. New Ser. (Nat. Hist)*, **1(2)**: 62, pl.4, figs.1 a & 1b.

1986. *Clithon oualaniensis*: Tikader, Daniel and Subba Rao, *Sea shore animals of Andaman and Nicobar Islands*, Zool. Surv. India, p. 167, no. 78.

1991. *Clithon oualaniensis*: Rao, Rao and Maitra, *Fauna of Orissa, State Fauna series*, **1(3):** 36,pl. 3, figs. 1, 2. Zool. Surv. India.

1995. *Clithon oualaniensis*: Subba Rao, Surya Rao and Manna, *Fauna of Chilka lake, Wetland Ecosystemseries*, **1:** 395. Zool. Surv. India.

2001. *Clithon oualaniensis*: Mahapatra, *Fauna of Godavari Estuary, Estuarine Ecosystem series*, **4:** 59. Zool. Surv. India.

2004. *Clithon oualaniensis*: Rao, Maitra, Barua and Ramakrishna, *Fauna of Gujarat, State Fauna series*, **8**(2): 284. Zool. Surv. India.

2007. *Theodoxus (Clithon) oualaniensis*: Ramakrishna, Dey, Barua and Mukhopadhya, *Fauna of Andhra Pradesh, State Fauna series,* **5(7):** 38. Zool. Surv. India.

2008. *Theodoxus (Clithon) oualaniensis*: Mahapatra, *Fauna of Krishna Estuary, Estuarine Ecosystem series,* **5:** 118. Zool. Surv. India.

2008. *Theodoxus (Clithon) oualaniensis*: Roy, Dey, Banerjee and Nandi, *Zoological Research in Human Welfare,* p. 28.

2010. *Theodoxus (Clithon) oualaniensis*: Mahapatra, *Fauna of Vamsadhara and Nagavali Estuary, Estuarine Ecosystem series,* **6:** 54. Zool. Surv. India.

Material Examined: 2 exs.

Measurement: Length 7-8 mm

Diagonistic Characters: Shell small, moderately ovate, polished, olive green and marked finely in black and crimson lines in various patterns, irregularly or in spiral bands.

Distribution: India: Andaman and Nicobar Islands, Andhra Pradesh, Gujarat, Karnataka, Kerala, Orissa, Tamil Nadu.

Elsewhere: Sri Lanka, Thailand, Indonesia: Java, Sumatra; Polynesia.

Remarks: Occurs on intertidal grass flats. Common.

Place of collection: Rushikulya estuary

Order MESOGASTROPODA
Family CERITHIIDAE
Subfamily CERITHIINAE
Genus ***Cerithium*** Bruguiere, 1789

1789. *Cerithium* Bruguiere, *Encyl. Meth. Vers.,* **1**(2): 546. Type species: *Cerithium adamsoni* Bruguiere

2. ***Cerithium scabridum*** (Philippi)

1848. *Cerithium scabridum* Philippi, *Zeits. f. Malak.,* **5**: 23.

1898. *Cerithium carnaticum*: Melvill and Standen, *Proc. malac. Soc.* London, (Type locality: Madras)

1952. *Cerithium scabridum*: Satyamurti, *Bull. Madras Govt. Mus. New Ser. (Nat. Hist),* **1**(2): 86, pl. 6, fig.5.

1961. *Cerithium scabridum*: Menon, Datta Gupta and Das Gupta, *J. Bombay nat. Hist. Soc.,* **58**(2): 483, pl. 4, fig. 39.

1970. *Cerithium scabridum*: Gopalakrishnan, *J. mar. biol. Ass. India,* **12** (1 & 2): 28.

1974. *Cerithium scabridum*: Starmuehlner, *J. mar. biol. Ass. India,* **16**(1): 58.

1982. *Cerithium scabridum*: Rajagopal and Mookherjee, *Rec. zool. Surv. India, Occ. Paper No.,* **28**: 37.

2003. *Cerithium scabridum*: Subba Rao, *Rec. zool. Surv. India Occ. Paper No.,* **192:** 127, pl.20, figs. 4, 5.

Materials examine: 2 exs.

Measurement: Length 1.9-2 cm.

Diagonistic Characters: Shell small, slender and oblong, turreted, with 10-14 whorls and distinct sutures. Aperture narrow and obliquely ovate with short and wide anterior canal and shallow posterior canal, flanked by strong columellar plait, outer lip thickened outside and crenulated inside, colunmella concave with strong callus. Colour white with reddish brown spots on cords and nodules, aperture and columella white.

Distribution: India: Gujarat, Tamil Nadu.

Elsewhere: Red sea, Persian Gulf, Gulf of Aden, Australia.

Remarks: Occurs in sand in subtidal zone.

Place of collection: Rushikulya estuary.

Family BURSIDAE
Genus ***Bursa*** Roeding, 1798

1798. *Bursa* Roeding, *Mus. Bolten.,* **2:** 128.

3. ***Bursa rana*** (Linnaeus)

1758. *Murex rana* Linnaeus, *Syst. Nat.,* ed. **10: 748**. (Type locality: O Asiatico).

1942. *Bursa rana*: Gravely, *Bull. Madras Govt. Mus. New Ser. (Nat. Hist),* **5** (2): 45.

1985. *Bursa (Bufonaria) rana*: Mookherjee, *Rec. zool. Surv. India,* Occ. *Paper,* **75**: 84, pl.14, figs. 59.

1990. *Bursa rana*: Pinn, *Sea Snails of Pondicherry,* Nehru Science Centre, p. 63, fig. 106.

1991. *Bursa rana*: Rao, Rao and Maitra, *Fauna of Orissa, State Fauna series,* **1**(3): 61. Zool. Surv. India.

2000. *Bufonaria rana*: Subba Rao and Dey, *Rec. zool. Surv. India Occ. Paper No.,* **187:** 92

2003. *Bursa (Bufonaria) rana*: Subba Rao, *Rec. zool. Surv. India Occ. Paper No.,* **192:** 213, pl. 48, figs. 8, 9.

2007. *Bufonaria rana*: Ramkrishna, Dey, Barua and Mukhopadhya, *Fauna of Andhra Pradesh, State Fauna series,* **5**(7): 81, Pl.6, figs. 69 & 70. Zool. Surv. India.

2008. *Bursa rana*: Mahapatra, *Fauna of Krishna Estuary, Estuarine Ecosystem series*, **5**: 129. Zool. Surv. India.

2010. *Bursa rana*: Mahapatra, *Fauna of Vamsadhara and Nagavali Estuary, Estuarine Ecosystem series*, **6**: 58. Zool. Surv. India.

Material Examined: 1exs.

Measurement: Length 7 cm.

Diagonistic Characters: Shell moderately large, oblong-ovate, dorsoventrally depressed; spire conical and elevated, varices prominent and with spines; sculpture with fine granulose spiral threads and spinose nodes; body whorls with 2 rows of nodes and the lower rows smaller , ridges at the lower part finely granular and undulated; outer lip denticulate, columella lacks a calloused parietal shield; aperture oblong, ovate, sipphonal canal short or extended; white or creamy stained with reddish brown.

Distribution: India: Andaman and Nicobar Islands, Andhra Pradesh, Orissa, Puducherry, Tamil Nadu, West Bengal; Elsewhere: Indo-Pacific.

Remarks: Offshore, beached. Common.

Place of collection: Rushikulya estuary

Order NEOGASTROPODA
Superfamily MURICOIDEA
Family MURICIDAE
Subfamily MURICINAE
Genus ***Murex*** Linnaeus, 1758

1758. *Murex* Linnaeus, *Syst. Nat.*, ed. **10:** 746. (Type species: *Murex tribulus* Montfort, 1810 (non lightfoot, 1786).

4. Murex carbonnieri (Jousseaume)

1881. *Acupurpurea carbonnieri* Jousseaume, Le Naturliste., **44**: 345.

1993. *Murex carbonnieri, Subba Rao and Surya Rao, Rec, zool. Surv. India. Occ. Paper No.*, **153**: 33.pl. 4, figs. 1-3.

Material Examined: 2 exs.

Measurement: Length 8.2-8.4 cm.

Diagonistic Characters: Shell club shaped, spire elevated, consist of 7-9 whorls; whorls subangulate, suture simple, deep, crossed by growth lamellae; aperture acute, ovate, outerlip margin crenulated, lower part with small labial tooth, inner lip partly adherent on posterior, body whorl large, preceding the whorls along with the body whorl with three prominent varices, provided with long spines, shoulder spine largest, open straight curved terminally, sculpture consists of three prominent spirals cords; siphonal canal and cords, provided with straight spines up to two third of its length, gradually decreases in length.

Distribution: India: Andaman Islands, Andhra Pradesh, Maharashtra, Orissa, Puducherry, Tamil Nadu; Elsewhere: Mauritius, Zanzibar, Sri Lanka, Bangladesh, Philippines.

Remarks: Intertidal, rocks, corals, Indo-pacific

Place of collection: Rushikulya estuary

5. ***Bullia vittata*** (Linnaeus)

1767. *Bullia vittata* Linnaeus, *Syst. Nat.*, ed.**12:** 126. (Type locality: ?).

1846. *Bullia livida* Reeve, *Conch. Icon.*,**3**, *Bullia* sp. No., 10, pl.2, fig. 10 a-b.

1898. *Bullia vittata*: Melvill and Sykes, *Proc. malac. Soc.* London, **3**: 37.

1915. *Bullia vittata*: Preston, *Rec Indian Mus.*, **11**: 290.

1940. *Bullia livida*: Crichton, *J. Bombay nat. Hist. Soc.*, **42:** 324.

1940. *Bullia vittata*: Crichton, *J. Bombay nat. Hist. Soc.*, **42:** 324.

1942. *Bullia livida*: Gravely, *Bull. Madras Govt. Mus. New Ser. (Nat. Hist)*, **5** (2): 59, 99.

1952. *Bullia vittata*: Subramanyam, Karandikar and Murti, *J. Univ. Bombay*, **21** (3): 49, fig. 127.

1968. *Bullia (Dorsanum) vittata*: Ray, *Bull. Indian Mus.*, **3** (1&2): 22, Text fig.15.

1969. *Bullia vittata*: Nagabhushanam, *Proc. zool. Soc.* Calcutta, **22** (1): 6.

1990. *Bullia vittata*: Pinn, *Sea Snails of Pondicherry*, Nehru Science Centre, p. 76, fig. 132.

1991. *Bullia (Leiodomus) livida*: Rao, Rao and Maitra, *Fauna of Orissa, State Fauna series*, **1** (3): 75. Zool. Surv. India.

1991. *Bullia (Dorsanum) vittata*: Rao, Rao and Maitra, *Fauna of Orissa, State Fauna series*,**1**(3): 75. Zool. Surv. India.

1995. *Bullia (Dorsanum) vittata*: Subba Rao, Surya Rao and Manna, *Fauna of Chilka lake, Wetland Ecosystemseries*, **1**: 406. Zool. Surv. India.

2000. *Bullia vittata*: Subba Rao and Dey, *Rec. zool. Surv. India Occ. Paper No.*, **187**: 130.

2003. *Bullia (Dorsanum) vittata*: Subba Rao, *Rec. zool. Surv. India Occ. Paper No.*, **192**: 265, Fig. 34, pl. 63, fig.1.

2007. *Bullia vittata*: Ramkrishna, Dey, Barua and Mukhopadhya, *Fauna of Andhra Pradesh, State Fauna series*, **5(7)**: 111. Zool. Surv. India.

2008. *Bullia vittata*: Mahapatra, *Fauna of Krishna Estuary, Estuarine Ecosystem series*, **5**: 134. Zool. Surv. India.

2010. *Bullia vittata*: Mahapatra, *Fauna of Vamsadhara and Nagavali Estuary, Estuarine Ecosystem series*, **6**: 60. Zool. Surv. India.

Material Examined: 5 shells

Measurement: Length 1.3-3.6 cm

Diagonistic Characters: Shell moderate, elongated, turreted, protoconch consists of three whorls, aperture wide, outer lip smooth, callus smooth, anterior canal short; sculpture with irregular spiral grooves and subsutural ridges, spiral groove more prominent at the base of the body whorl, yellowish to pale brown often with dark brown wavy axial streaks.

Distribution: India: Andaman Islands, Andhra Pradesh, Maharashtra, Orissa, Puducherry, Tamil Nadu; Elsewhere: Mauritius, Zanzibar, Sri Lanka, Bangladesh, Philippines.

Remark: Estuarine

Place of Collection: Rushikulya estuary

Family OLIVIDAE
Subfamily OLIVINAE
Genus ***Oliva*** Bruguiere, 1789

1789. *Oliva* Bruguiere, *Encyl. Meth. Vers.*, **(1)**: 15.

6. ***Oliva oliva*** (Linnaeus)

1758. *Voluta oliva* Linnaeus, *Syst. Nat.*, ed.**10**: 729, sp. No 350. (Type locality: M. Indico).

1898. *Oliva ispidula*: Melvill and Sykes, *Proc. malac. Soc.* London, **3**: 39.

1906. *Oliva ispidula*: Comber, *J. Bombay nat Hist. Soc.*, **17**: 212.

1940. *Oliva oliva* and *Oliva ispidula*: Crichton, *J. Bombay nat. Hist. Soc.*, **42**: 324.

1942. *Oliva oliva*: Gravely, *Bull. Madras Govt. Mus. New Ser. (Nat. Hist)*, **5**(2): 63.

1952. *Oliva oliva*: Satyamurti, *Bull. Madras Govt. Mus. New Ser. (Nat. Hist)*, **1**(2): 190, pl.18, fig.3.

1952. *Oliva oliva* and *Oliva ispidula*: Subramanyam, Karandikar and Murti, *J. Univ. Bombay*, **21**(3): 52, figs. 144 & 146.

1986. *Oliva oliva*: Tikader, Daniel and Subba Rao, *Sea shore animals of Andaman and Nicobar Islands*, Zool. Surv. India, p.171, no 349.

1990. *Oliva Oliva*: Pinn, *Sea Snails of Pondicherry*, Nehru Science Centre, p. 85, fig. 152.

1990. *Oliva ispidula*: Pinn, *Sea Snails of Pondicherry*, Nehru Science Centre, p. 85, fig. 153.

1991. *Oliva oliva*: Rao, Rao and Maitra, *Fauna of Orissa, State Fauna series*, **1**(3): 77. Zool. Surv. India.

1995. *Oliva oliva*: Subba Rao, Surya Rao and Manna, *Fauna of Chilka lake, Wetland Ecosystemseries*, **1**: 407. Zool. Surv. India.

1998. *Oliva ispidula*: Apte, *Indian Shells, Bombay nat. Hist. Soc.*, p.76, pl. X, fig.6.

2000. *Oliva oliva*: Subba Rao and Dey, *Rec. zool. Surv. India Occ. Paper No.*, **187**: 138.

2003. *Oliva oliva*: Subba Rao, *Rec. zool. Surv. India Occ. Paper No.*, **192**: 291, pl. 71, fig.2 and Pl. 72, fig. 4.

2004. *Oliva oliva*: Rao, Maitra, Barua and Ramakrishna, *Fauna of Gujarat, State Fauna series*, **8**(2): 316. Zool. Surv. India

2007. *Oliva oliva*: Ramkrishna, Dey, Barua and Mukhopadhya, *Fauna of Andhra Pradesh, State Fauna series*, **5**(7): 116, pl.9, figs. 105 & 106. Zool. Surv. India.

Material Examined: 18 shells

Measurement: Length 1.4-3 cm

Diagonistic Characters: Shell moderate, polished, spire short, sutural grooves narrow and deep, aperture narrow, columella with a callus on the anterior two- third and oblique, highly variable in colour, white , creamy, brown, yellow or black, ornamented with dark spots and blotches, aperture brown, white or pink.

Distribution: India: Andaman and Nicobar Islands, Andhra Pradesh, Gujarat, Lakshadweep,

Maharashtra, Orissa, Puducherry, Tamil Nadu;

Elsewhere: Tropical Indo-pacific.

Remarks: Common.

Place of collection: Rushikulya estuary

Genus ***Olivancillaria*** d'Orbigny, 1841

1841. *Olivancillaria* d' Orbigny, *Amer. Marid. (Moll)*, p. 420.

7. *Olivancillaria gibbosa* (Born)

1778. *Voluta gibbosa* Gmelin, *Index Rer. Natr.Cae. Vinod.*, p.202.

1898. *Oliva (Agaronia) gibbosa*: Melvill and Sykes, *Proc. malac. Soc.London*, **3:** 40.

1940. *Oliva gibbosa*: Crichton, *J. Bombay nat. Hist. Soc.*, **42:** 324.

1942. *Oliva gibbosa*: Gravely, *Bull. Madras Govt. Mus. New Ser. (Nat. Hist)*, 5(2): 63.

1952. *Oliva gibbosa*: Satyamurti, *Bull. Madras Govt. Mus. New Ser. (Nat. Hist)*, **1**(2): 189, pl. 18, figs. 2a & 2b.

1952. *Oliva gibbosa*: Subramanyam, Karandikar and Murti, *J. Univ. Bombay*, **21**(3): 52, fig. 145.

1961. *Oliva gibbosa*: Menon, Datta Gupta and Das Gupta, *J. Bombay nat. Hist. Soc.*, **58**(2): 489, pl.9, fig. 70.

1970. *Olivancillaria gibbosa*: Gopalakrishnan, *J. mar. biol. Ass.India*, **12** (1&2): 22 &27.

1977. *Olivancillaria gibbosa*: Ray, *Contribution to the knowledge on the Molluscan fauna of Maungmagan, Lower Burma*, p. 60.

1986 *Olivancillaria (Agaronia) gibbosa*: Tikader, Daniel and Subba Rao, *Sea shore animals of Andamanand Nicobar Islands*, Zool. Surv. India, p. 171, no 352.

1990. *Olivancillaria (Oliva) Gibbosa*: Pinn, *Sea Snails of Pondicherry*, Nehru Science Centre, p. 85, fig. 155.

1991. *Olivancillaria gibbosa*: Rao, Rao and Maitra, *Fauna of Orissa, State Fauna series*, **1**(3): 78. Zool. Surv. India.

1992. *Olivancillaria gibbosa*: Subba Rao, Dey and Barua, *Fauna of West Bengal, State Fauna series*, **3**(9): 197, pl.8, fig. 4 & 5. Zool. Surv. India.

1995. *Olivancillaria gibbosa*: Subba Rao, Surya Rao and Manna, *Fauna of Chilka lake, Wetland Ecosystemseries*, **1:** 407. Zool. Surv. India.

1998. *Oliva gibbosa*: Apte, *Indian Shells, Bombay nat. Hist. Soc.*, p.76, pl. X, fig. 4.

2000. *Olivancillaria gibbosa*: Subba Rao and Dey, *Rec. zool. Surv. India Occ. Paper No.*, **187:** 139.

2003. *Olivancillaria gibbosa*: Subba Rao, *Rec. zool. Surv. India, Occ. Paper No.*, **192:** 292, pl. 72, fig. 14.

2007. *Olivancillaria gibbosa*: Ramkrishna, Dey, Barua and Mukhopadhya, *Fauna of Andhra Pradesh, State Fauna series*, **5**(7): 118, pl.10, figs. 109 & 110. Zool. Surv. India.

2008. *Olivancillaria gibbosa*: Mahapatra, *Fauna of Krishna Estuary, Estuarine Ecosystem series*, **5:** 135. Zool. Surv. India.

2010. *Olivancillaria gibbosa*: Mahapatra, *Fauna of Vamsadhara and Nagavali Estuary, Estuarine Ecosystem series*, **6:** 60. Zool. Surv. India.

Material Examined: 2 shells

Measurement: Length 5-5.7 cm

Diagonistic Characters: Shell thick, solid, moderate, elongately ovate, spire acuminate, short, body whorl inflated, suture channelled, aperture wide with slit like posterior canal, columella with thick callus, pale yellowish brown with prominent yellow band at base, mottled or streaked with black spots, sometimes with zigzag transpiral brownish bands, aperture bluish white.

Distribution: India: Andaman and Nicobar Islands, Andhra Pradesh, Gujarat, Maharashtra, Orissa, Puducherry, Tamil Nadu, West Bengal; Elsewhere: Sri Lanka, Bangladesh, Myanmar.

Remarks: Common.

Place of collection: Rushikulya estuary

Superfamily NATICOIDEA
Family NATICIDAE Forbes, 1838
Subfamily POLINICINAE
Genus ***Polinices*** Montfort, 1810

1810. *Polinices* Montfort, *Conchyl. Syst.*, **2:** 222. Subgenus *Glossaulax* Pilsbry, 1929

1929. *Glossaulax* Pilsbry, *Nautilus*, **42:** 113.

8. *Polinices (Glossaulax) didyma (Roeding)*

1798. *Albula didyma* Roeding, *Mus. Bolten.*, p. 20.

1906. *Natica (Neverita) didyma* : Comber, *J. Bombay nat Hist. Soc.*, **17:** 208.

1940. *Natica didyma*: Crichton, *J. Bombay nat. Hist. Soc.*, **42:** 333, pl.2, fig. 5.

1942. *Natica didyma*: Gravely, *Bull. Madras Govt. Mus. New Ser. (Nat. Hist)*, **5(2)**: 37.

1952. *Natica didyma*: Satyamurti, *Bull. Madras Govt. Mus. New Ser. (Nat. Hist)*, **1(2)**: 110, pl.8, fig.5.

1952. *Neverita didyma*: Subramanyam, Karandikar and Murti, *J. Univ. Bombay*, **21** (3): 39.

1961. *Natica didyma*: Menon, Datta Gupta and Das Gupta, *J. Bombay nat. Hist. Soc.*, **58** (2): 484, pl.5, figs.43 & 44.

1985. *Polinices (Glossaulax) didyma*: Mookherjee, *Rec. zool. Surv. India*, Occ. *Paper*, **75**: 54, pl. 9, figs. 37 a & 37 b.

1990. *Natica didyma*: Pinn, *Sea Shells of Pondicherry*, Nehru Science Centre, p. 35, fig. 50.

1991. *Polinices (Glossaulax) didyma*: Rao, Rao and Maitra, *Fauna of Orissa, State Fauna series*, **1** (3): 54. Zool. Surv. India.

1992. *Polinices didyma*: Subba Rao, Dey and Barua, *Fauna of West Bengal, State Fauna series*, **3** (9): 183. Zool. Surv. India.

2001. *Polinices (Glossaulax) didyma*: Mahapatra, *Fauna of Godavari Estuary, Estuarine Ecosystem series*, **4**: 65. Zool. Surv. India.

2003. *Polinices (Glossaulax) didyma*: Subba Rao, *Rec. zool. Surv. India Occ. Paper No.*, **192**: 189.

2004. *Polinices (Glossaulax) didyma*: Rao, Maitra, Barua and Ramakrishna, *Fauna of Gujarat, State Fauna series*, **8** (2): 297. Zool. Surv. India.

2007. *Polinices (Glossaulax) didyma*: Ramkrishna, Dey, Barua and Mukhopadhya, *Fauna of Andhra Pradesh, State Fauna series*, **5** (7): 64. Zool. Surv. India.

2008. *Polinices (Glossaulax) didyma*: Mahapatra, *Fauna of Krishna Estuary, Estuarine Ecosystem series*, **5**: 126. Zool. Surv. India.

Material Examined: 1 shell

Measurement: Length 3 cm

Diagonistic Characters: Shell small (up to3 cm long), ovate-conic in shape, with globose body whorl, short conical spire, convex whorls and moderately impressed suture. Outer surface smoothish. Umbilicus deep and narrowly open, U-shaped, partly occluded centrally by a broad and rounded internal rib forming a callus at columellar margin. Calloused margin of posterior part of inner lip poorly developed, not confluent with the central callus of umbilicus. Operculum calcareous, with a single spiral groove along its outer margin. Outside of shell creamy white, with a dense pattern of wavy, axial orange-brown lines, becoming thicker, less numerous and strongly pointing forward within 3 spiral bands, those below the suture and near periphery being strongest. Base and umbilical area white, with a single spiral row of short or ange brown streaks.

Distribution: India: Andhra Pradesh, Orissa, Puducherry, Tamil Nadu, West Bengal;

Elsewhere: Indo-Pacific.

Remarks: Indo-pacific

Place of collection: Bahuda estuary

Family FICIDAE

Genus ***Ficus*** Roeding, 1798

1798. *Ficus* Roeding, *Mus. Bolten.*, p. 148.

9. ***Ficus gracilis*** (Sowerby)

1825. *Pyrula gracilis* Sowerby, *Cat. Tank.*, pl. 17.

1990. *Ficus gracilis*: Pinn, *Sea Shells of Pondicherry*, Nehru Science Centre, p. 53, fig. 87.

1991. *Ficus gracilis*: Rao, Rao and Maitra, *Fauna of Orissa, State Fauna series*, **1** (3): 58. Zool. Surv. India.

1992. *Ficus gracilis*: Subba Rao, Dey and Barua, *Fauna of West Bengal, State Fauna series*, **3** (9): 187, pl.7, fig. 1. Zool. Surv. India.

2000. *Ficus gracilis*: Subba Rao and Dey, *Rec. zool. Surv. India Occ. Paper No.*, **187**: 84.

2003. *Ficus gracilis*: Subba Rao, *Rec. zool. Surv. India Occ. Paper No.*, **192**: 199, pl. 42, figs.1-4.

2007. *Ficus gracilis*: Ramkrishna, Dey, Barua and Mukhopadhya, *Fauna of Andhra Pradesh, State Fauna series*, **5** (7): 72, Pl. V, figs. 53 & 54. Zool. Surv. India.

2008. *Ficus gracilis*: Mahapatra, *Fauna of Krishna Estuary, Estuarine Ecosystem series*, **5**: 128. Zool. Surv. India.

Material Examined: 1shell

Measurement: Length 9 cm

Diagonistic Characters: Shell thin, pear-shaped, drawn out anteriorly into a long, tapered and gracefully curved siphonal canal. Operculum absent.

Distribution: India: Andhra Pradesh, Orissa, Pondicherry, West Bengal; Elsewhere: Persian Gulf, Malagasy, Seychelles, South Japan.

Remarks: Indo-pacific

Place of collection: Gopalpur Beach

Family HARPIDAE
Subfamily HARPINAE
Genus ***Harpa*** Roeding, 1798

1798. *Harpa* Roeding, *Mus. Bolten.*, p. 149.

10. ***Harpa major*** (Roeding)

1798. *Harpa major* Roeding, *Mus. Bolten.*, pt. **2:** 149.

1822. *Harpa conoidalis* Lamarck, *Hist. Nat. Anim. Sans. Vert.*, **7:** 255.

1940. *Harpa conoidalis*: Crichton, *J. Bombay nat. Hist. Soc.*, **42:** 330.

1952. *Harpa conoidalis*: Subramanyam, Karandikar and Murti, *J. Univ. Bombay*, **21(3):** 52, fig. 151.

1990. *Harpa conoidalis*: Pinn, *Sea Shells of Pondicherry*, Nehru Science Centre, p. 96, fig. 161.

2000. *Harpa major*: Subba Rao and Dey, *Rec. zool. Surv. India Occ. Paper No.*, **187:** 136.

2003. *Harpa major*: Subba Rao, *Rec. zool. Surv. India Occ. Paper No.*, **192:** 299, pl. 73, figs. 8-9.

2007. *Harpa major*: Ramkrishna, Dey, Barua and Mukhopadhya, *Fauna of Andhra Pradesh, State Fauna series*, **5** (7): 115, IX, figs. 103 & 104. Zool. Surv. India

Material Examined: 1shell

Measurement: Length 7.5 cm

Diagonistic Characters: shell ovate, with an inflated body whorl and a small conical spire. Surface glossy, with strong axial ribs. Inner lip covered by a smooth, large callus. Columella without folds. Siphonal canal short and wide. Operculum absent.

Distribution: India: Andhra Pradesh, Pondicherry, Tamil Nadu.

Elsewhere: Indo-Pacific.

Remarks: Indo-pacific

Place of collection: Gopalpur Beach

Subclass HETEROBRANCHIA
Order ALLOGASTROPODA
Superfamily ARCHITECTONICOIDEA
Family ARCHITECTONICIDAE
Genus ***Architectonica*** (Roeding), 1798

1798. *Architectonica* Roeding, *Mus. Bolten.*, **2:** 78

11. ***Architectonica laevigata*** (Lamarck)

1822. *Architectonica laevigata* Lamarck, *Hist. nat. Anim. Sans. Vert.*, **7:** 3.

1942. *Architectonica laevigata*: Gravely, *Bull. Madras Govt. Mus. New Ser. (Nat. Hist)*, **5** (2): 23.

1952. *Architectonica laevigata*: Satyamurti, *Bull. Madras Govt. Mus. New Ser. (Nat. Hist)*, **1** (2): 73, pl. 4, figs. 11a & b.

1952. *Architectonica laevigata*: Subramanyam, Karandikar and Murti, *J. Univ. Bombay*, **21** (3): 32.

1956. *Architectonica laevigata*: Gideon, Menon, Rao and Jose, *J. Bombay nat. Hist. Soc.*, **54** (3): 699.

1961. *Architectonica laevigata*: Menon, Datta Gupta and Das Gupta, *J. Bombay nat. Hist. Soc.*, **58** (2): 482, pl. 4, figs. 32 & 33.

1963. *Architectonica laevigata*: Ray, *Indian Mus. Bull.*, **3** (1&2): 17.

1982. *Architectonica laevigata*: Rajagopal and Mookherjee, *Rec. zool. Surv. India, Occ. Paper No.*, **28**: 21.

1990. *Architectonica laevigata*: Pinn, *Sea Shells of Pondicherry*, Nehru Science Centre, p. 16, fig. 19.

1991. *Architectonica laevigata*: Rao, Rao and Maitra, *Fauna of Orissa, State Fauna series*, **1** (3): 40; Zool. Surv. India

2000. *Architectonica laevigata*: Subba Rao and Dey, *Rec. zool. Surv. India Occ. Paper No.*, **187:** 177.

2003. *Architectonica laevigata*: Subba Rao, *Rec. zool. Surv. India Occ. Paper No.*, **192:** 340, pl. 90, fig. 4.

2007. *Architectonica laevigata*: Ramkrishna, Dey, Barua and Mukhopadhya, *Fauna of Andhra Pradesh, State Fauna series*, **5** (7): 137, XII, figs. 133 & 134. Zool. Surv. India

Material Examined: 1 shell

Measurement: Length 3 cm

Diagonistic Characters: Shell wider than long, with a large, rather flat base. Umbilicus broadly open, within which can be seen the inverted larval shell. A nodular spiral rib bordering the umbilicus. Aperture without a siphonal canal. Operculum corneous, with a tubercle internally. Soft body coloration resulting from a combination of black and white markings in the epidermis and from the internal organ Coloration showing through most developed on tentacles and the anterior part of the foot.

Distribution: India: Andhra Pradesh, Orissa, Pondicherry, Tamil Nadu, West Bengal; Elsewhere: Persian Gulf, South African coast, Pakistan coast, Iran.

Remarks: Tropical, Warm-temperate

Place of collection: Bahuda estuary

Class BIVALVIA
Subclass PROTOBRANNCHIA
Order MYTILOIDA
Superfamily MYTILOIDEA
Family MYTILIDAE
Subfamily MYTILINAE
Genus ***Perna*** Philipsson, 1788

1788. *Perna* Philipsson, *Diss. Nova. Test. Gen.*, **1788**: 20. Type species: *P. magellanica* Linnaeus = *Mya perna* Linnaeus; subsequent designation, Soot-Ryen, 1955

12. ***Perna viridis*** (Linnaeus)

1758. *Mytilus viridis* Linnaeus, *Syst. Nat.*, ed 10: 706.

1758. *Mytilus smargdinus* Chemnitz, *Conch. Cab.*, **8:** pl, 83, fig. 745.

1906. *Mytilus smargdinus*: Comber, *J. Bombay nat Hist. Soc.*, **17:** 214.

1915. *Mytilus smargdinus*: Preston, *Rec. Indian Mus.*, **11**: 297.

1921. *Mytilus viridis*: Hornell, *Madras Fish. Bull.*, **14**: 156, fig. 38.

1940. *Mytilus viridis*: Crichton, *J. Bombay nat. Hist. Soc.*, **42:** 336.

1956. *Mytilus viridis*: Satyamurti, *Bull. Madras Govt. Mus. New Ser. (Nat. Hist)*, **1** (2), pt. 7: 42, pl.5, fig.1.

1968. *Mytilus viridis*: Cheriyan, *Proc. Symp. Molluscs, Mar. biol. Ass. India*, part **1:** 128.

1965. *Mytilus viridis*: Kundu, *J. Bombay nat. Hist. Soc.*, **62** (1): 90, pl.5, figs.15a & 15b.

1986. *Perna viridis*: Tikader, Daniel and Subba Rao, *Sea shore animals of Andaman and Nicobar Islands*, Zool. Surv. India, p.175.

1991. *Perna viridis*: Rao, Rao and Maitra, *Fauna of Orissa, State Fauna series*, **1** (3): 106. Zool. Surv. India.

1992. *Perna viridis*: Subba Rao, Dey and Barua, *Fauna of West Bengal, State Fauna series*, **3** (9): 220, pl.16, fig.1. Zool. Surv. India.

1995. *Perna viridis*: Subba Rao, Surya Rao and Manna, *Fauna of ChilkaLake, Wetland Ecosystem series*, **1:** 414. Zool. Surv. India.

2000. *Perna viridis*: Subba Rao and Dey, *Rec. zool. Surv. India Occ. Paper No.*, **187:** 207.

2007. *Perna viridis*: Dey and Ramkrishna, *Fauna of Andhra Pradesh, State Fauna series*, **5** (7): 181. Zool. Surv. India.

2008. *Perna viridis*: Mahapatra, *Fauna of Krishna Estuary, Estuarine Ecosystem series*, **5:** 147. Zool. Surv. India.

Material Examined: 2 valves

Measurement: Length 4.2-7.5 cm

Diagonistic Characters: Shell thick, elongate, triangularly-ovate, inequilateral; umbo terminal; lunule bent in wards forming 1-2 tooth like ridges; sculpture smooth and only with growth lines; ligament thick; anterior adductor scar absent, posterior adductor scar large, cylindrical and located at the posterior half of the shell; greenish or ochre brown.

Distribution: India:Andman and Nicobar Islands, Andhra Pradesh, Goa, Gujarat, Karnataka, Kerala, Maharashtra, Orissa, Puducherry, Tamil Nadu, West Bengal;

Elsewhere: Red sea, Pakisthan coast, Thailand, Indonesia, Philippnes, China.

Remark: Indo-pacific, estuarine

Place of collection: Gopalpur beach

Superfamily MACTROIDEA
Family MACTRIDAE
Subfamily MACTRINAE
Genus ***Mactra*** Linnaeus, 1767

1767. *Mactra* Linnaeus, *Syst. Nat.* **ed. 12**:1125. Type species: *Cardium sultorium* Linnaeus,1758; subsequent designation Fleming, 1818

Subgenus ***Mactra*** s.st.
13. ***Mactra grandis*** (Gmelin)

1791. *Mactra grandis* Gmelin, *Syst. Nat.*, ed., **13**: 3259.

1991. *Mactra grandis*: Rao, Rao and Maitra, *Fauna of Orissa, State Fauna series*, **1** (3): 125. Zool. *Surv. India.*

1995. *Mactra grandis*: Subba Rao, Surya Rao and Manna, *Fauna of Chilka Lake, Wetland Ecosystem series*, **1:** 420. Zool. Surv. India.

Material Examined: 6 valves

Measurement: Length 3.3-3.6 cm

Diagonistic Characters: Shell triangular in shape, equilateral, moderately thick, inflated; umbo small, dorsal margin on either side of umbo gradually sloping, anterior margin broadly rounded, posterior narrower, ventral evenly rounded; surface smooth except for growth lines; hinge narrow, arrangement of teeth similar to that in the preceding species; colour light brown, umbonal region and tip violet; interior smooth , white , with violet blotch near umbonal cavity.

Distribution: India: Orissa;

Elsewhere: African coast, Persian Gulf, Myanmar, Singapore.

Remarks: Intertidal area

Place of Collection: Rushikulya estuary

14. ***Mactra symmetrica*** (Deshayes)

1853. *Mactra symmetrica* Deshayes, *Proc. zool. Soc.* London, **1853**: 17.

1991. *Mactra symmetrica*: Rao, Rao and Maitra, *Fauna of Orissa, State Fauna series*, **1(3)**: 127. Zool. Surv. India.

2008. *Mactra symmetrica*: Mahapatra, *Fauna of Krishna Estuary, Estuarine Ecosystem series*, **5**: 153. Zool. Surv. India.

Material Examined: 2 valves

Measurement: Length 3.1-4.8 cm

Diagonistic Characters: Shell triangular in shape, equilateral, moderately thick, inflated; umbo small, dorsal margin on either side of umbo gradually sloping, anterior margin broadly rounded, posterior narrower, absent of concentric grooves on its anterior part and violet in colouration.

Distribution: India: Andhra Pradesh, Orissa;

Elsewhere: Red sea, Sri Lanka, Myanmar.

Remarks: Marine, Sandy soft bottom

Place of collection: Rushikulya estuary

Genus ***Siliqua*** Megerle, 1811

1811. *Siliqua* Megerle, *Mag. Ges. Nat. Fr. Berlin*, **5**: 44. Type species: *Solen radiata* Linnaeus, 1758

15. ***Siliqua radiata*** (Linnaeus)

1758. *Solen radiata* Linnaeus, *Syst. Nat.*, **ed., 10**: 1114.

1898. *Siliqua radiata*: Melvill and Sykes, *Proc. malac. Soc.* London, **3**: 229.

1956. *Siliqua radiata*: Satyamurti, *Bull. Madras Govt. Mus. New Ser. (Nat. Hist)*, **1** (2), pt. **7**: 157, pl.14, figs.1a and 1b.

1986. *Siliqua radiata*: Tikader, Daniel and Subba Rao, *Sea shore animals of Andamanand Nicobar Islands*, Zool. Surv. India, p.177.

1991. *Siliqua radiata*: Rao, Rao and Maitra, *Fauna of Orissa, State Fauna series*, **1** (3): 132. Zool. Surv. India.

1992. *Siliqua radiata*: Subba Rao, Dey and Barua, *Fauna of West Bengal, State Fauna series*, **3** (9): 232, pl.21, figs, 8 & 9. Zool. Surv. India.

1995. *Siliqua radiata*: Subba Rao, Surya Rao and Manna, *Fauna of Chilka Lake, Wetland Ecosystem series*, **1**: 422. Zool. Surv. India.

2000. *Siliqua radiata*: Subba Rao and Dey, *Rec. zool. Surv. India Occ. Paper No.*, **187**: 252.

2007. *Siliqua radiata*: Dey and Ramkrishna, *Fauna of Andhra Pradesh, State Fauna series*, **5(7)**: 214. Zool. Surv. India.

2008. *Siliqua radiata*: Mahapatra, *Fauna of Krishna Estuary, Estuarine Ecosystem series*, **5**: 158. Zool. Surv. India.

Material Examined: 1and half valve

Measurement: Length 7.7 cm

Diagonistic Characters: Shell thin, elongately compressed, elliptical, gaping at both the ends; umbo anterior, beaks slightly in front of midline; anterior side short, excavated near umbone; posterior elongated; dorsal margin almost straight; ventral margin convex, arched, sloping upwards towards the end of both sides; internal ribs almost straight; brown to lilac with four white radial rays.

Distribution: India: Andaman and Nicobar Islands, Andhra Pradesh, Goa, Gujarat, Kerala, Maharashtra, Orissa, Tamil Nadu, West Bengal; Elsewhere: South African coast, Sri Lanka, Maynmar, Indonesia, Philippines.

Remarks: Estuarine

Place of collection: Bahuda estuary

Superfamily VENEROIDEA
Family VENERIDAE
Subfamily VENERINAE
Subfamily SUNETTINAE
Genus ***Sunetta*** Link, 1807

1807. *Sunetta* Link, *Beschr. Nat. Samml. Uni. Rostock*, **(3)**: 148. Type species: *Donax scripta* Linnaeus; subsequent designation, Dall, 1902.

16. ***Sunetta meroe*** (Linnaeus)

1758. *Venus meroe* Linnaeus, *Syst. Nat.*, **10**: 687.

1914. *Meroe chilkaensis* Preston, *Rec. Indian Mus.*, **10:** 304, figs 13-13a. Type locality: Satpara, Chilka lake, Orissa.

1991. *Sunetta meroe*: Rao, Rao and Maitra, *Fauna of Orissa, State Fauna series*, **1**(3): 147. Zool. Surv. India.

1995. *Sunetta meroe*: Subba Rao, Surya Rao and Manna, *Fauna of Chilka Lake, Wetland Ecosystem series*, **1:** 428. Zool. Surv. India.

2007. *Sunetta meroe*: Dey and Ramkrishna, *Fauna of Andhra Pradesh, State Fauna series*, **5** (7): 236. Zool. Surv. India.

Material Examined: 9 valves

Measurement: Length 1.8-4.7 cm

Diagonistic Characters: Shell subovate, anterior end rounded, posterior subtruncate; umbo posterior; beak slightly in front of mid line; sculpture with prominent concentric ridges; more prominent in the middle; escutcheon deeply excavated; beigh to lilac; with dark brown or yellowish brown zig-zag lines throughout the body; inner ventral margin crenulated.

Distribution: India: Andhra Pradesh, Maharashtra, Orissa, Puducherry, Tamil Nadu;

Elsewhere: Indian Ocean.

Remarks: Indo-pacific, estuarine

Place of Collection: Rushikulya estuary

17. ***Sunetta scripta*** (Linnaeus)

1758. *Donax scripta* Linnaeus, *Syst. Nat.*, **10**: 683.

1914. *Meroe satparaensis* Preston, *Rec. Indian Mus.*, **10:** 305-306, figs 12-12a. Type locality: Satpara, Chilka lake, Orissa; types: NZC, ZSI.

1940. *Sunetta scripta*: Crichton, *J. Bombay nat. Hist. Soc.*, **42:** 325.

1941. *Sunetta scripta*: Gravely, *Bull. Madras Govt. Mus. New Ser. (Nat. Hist)*, **5** (1): 50.

1956. *Sunetta scripta*: Satyamurti, *Bull. Madras Govt. Mus. New Ser. (Nat. Hist)*, **1** (2), pt.7 : 115, pl.17, figs.1a and 1b.

1965. *Sunetta scripta*: Kundu, *J. Bombay nat. Hist. Soc.*, **62** (2): 214, pl.19, figs. 61a & 61b.

1991. *Sunetta scripta*: Rao, Rao and Maitra, *Fauna of Orissa, State Fauna series*, 1(3): 146. Zool. Surv. India.

1995. *Sunetta scripta*: Subba Rao, Surya Rao and Manna, *Fauna of Chilka Lake, Wetland Ecosystem series*, **1:** 428. Zool. Surv. India.

2000. *Sunetta scripta*: Subba Rao and Dey, *Rec. zool. Surv. India Occ. Paper No.*, **187:** 275.

2007. *Sunetta scripta*: Dey and Ramkrishna, *Fauna of Andhra Pradesh, State Fauna series*, **5** (7): 237. Zool. Surv. India.

Material Examined: 5 valves

Measurement: Length 1.9-3.8 cm

Diagonistic Characters: Shell wedge shaped; umbo posterior, beak slightly infront of midlines; anterior end rounded, posterior truncate; sculpture at smooth only growth lines; escutcheon deeply excavated; variable in colour pattern, white or beigh, lilac with brown violet zig-zag lines or with deep violet patches; inner ventral margin crenulated.

Distribution: India: Andhra Pradesh, Goa, Gujarat, Karnataka, Kerala, Orissa, Tamil Nadu; Elsewhere: Sri Lanka, Indonesia, Myanmar, Philippines.

Remarks: Indo-pacific, estuarine

Place of collection: Rushikulya estuary

Subfamily MERETRICINAE

Genus ***Meretrix*** Lamarck, 1799

1799. *Meretrix* Lamarck, *Mem. Soc. Hist. nat. Paris*, p. 85. Type species: *Venus meretrix* Linnaeus, 1758

18. ***Meretrix casta*** (Gmelin)

1791. *Venus casta* Gmelin, *Syst. Nat.*, **13**: 3278.

1915. *Meretrix casta*: Preston, *Rec. Indian Mus.*, **11:** 300.

1915. *Meretrix ovum*: Preston, *Rec. Indian Mus.*, **11:** 300.

1916. *Meretrix casta*: Preston, *Rec. Indian Mus.*, **12**: 35.

1916. *Meretrix ovum*: Preston, *Rec. Indian Mus.*, **12**: 35.

1916. *Meretrix ovum*: Annandale and Kemp, *Mem. Indian Mus.*, **5** (4): 351.

1917. *Meretrixcasta* : Hornell, *Rec. Indian Mus.*, **13**: 166, pl. 5, figs. 30-33.

1941. *Meretrix casta*: Gravely, *Bull. Madras Govt. Mus. New Ser. (Nat. Hist)*, **5** (1): 50.

1941. *Meretrix ovum*: Gravely, *Bull. Madras Govt. Mus. New Ser. (Nat. Hist)*, **5** (1): 50.

1956. *Meretrix casta*: Satyamurti, *Bull. Madras Govt. Mus. New Ser. (Nat. Hist)*, **1** (2), pt. 7: 111, pl.16, figs. 2a & 2b.

1965. *Meretrix casta*: Kundu, *J. Bombay nat. Hist. Soc.*, **62** (1): 103, pl.15, figs. 52a & 52b.

1968. *Meretrix casta*: Cheriyan, *Proc. Symp. Molluscs, Mar. biol. Ass. India*, part 1: 130.

1968. *Meretrix ovum*: Cheriyan, *Proc. Symp. Molluscs, Mar. biol. Ass. India*, part 1: 130.

1975. *Meretrix casta*: Durve, *Rec. zool. Surv. India*, **68:** 423.

1991. *Meretrix casta*: Rao, Rao and Maitra, *Fauna of Orissa, State Fauna series*, **1** (3): 148. Zool. Surv. India.

1995. *Meretrix casta*: Subba Rao, Surya Rao and Manna, *Fauna of Chilka Lake, Wetland Ecosystem series*, **1:** 428. Zool. Surv. India.

2000. *Meretrix casta*: Subba Rao and Dey, *Rec. zool. Surv. India Occ. Paper No.*, **187:** 276.

2001*Meretrix casta*: Mahapatra, *Fauna of Godavari Estuary, Estuarine Ecosystem series*, **4:** 78. Zool. Surv. India.

2007. *Meretrix casta*: Dey and Ramkrishna, *Fauna of Andhra Pradesh, State Fauna series*, **5** (7): 240. Zool. Surv. India.

2008. *Meretrix casta*: Mahapatra, *Fauna of Krishna Estuary, Estuarine Ecosystem series*, **5:** 163. Zool. Surv. India.

Material Examined: 10 valves

Measurement: Length 3.9-4 cm

Diagonistic Characters: Shell medium, solid, but less heavy than *M. meretrix*; umbo slightly anterior, beak more attenuated; lunule well developed and about two-third or more of anterior dorsal margin; variable in shape and colour; anterior cardinal teeth more strong on left valve; pallial line well impressed, pallial sinus absent.

Distribution: India: Andaman and Nicobar Islands, Andhra Pradesh, Gujarat, Karnataka, Kerala, Orissa, Puducherry, Tamil Nadu;

Elsewhere: Indo-Pacific.

Remarks: Estuarine, common

Place of collection: Rushikulya estuary and Bahuda estuary

19. *Meretrix meretrix* (Linnaeus)

1758. *Venus meretrix* Linnaeus, *Syst. Nat.*, **10**: 686.

1906. *Meretrix morphina*: Comber, *J. Bombay nat Hist. Soc.*, **17:** 215.

1915. *Meretrix morphina*: Preston, *Rec. Indian Mus.*, **11:** 300.

1917. *Meretrix meretrix* var. *aurora* Hornell, *Rec. Indian Mus.*, **13**: 162, pl. 4, figs.9-11.Type locality: Tellicherry, Kerala; types: NZC, ZSI.

1917. *Meretrix meretrix* var. *impudica*: Hornell, *Rec. Indian Mus.*, **13**: 160, pl. 5, figs.14-18, pl.7, figs 39, 40.

1917. *Meretrix meretrix* var. *castenea*: Hornell, *Rec. Indian Mus.*, **13**: 161, pl. 4, fig.12.

1917. *Meretrix meretrix* var. *zonaria*: Hornell, *Rec. Indian Mus.*, **13**: 162.

1917. *Meretrix meretrix* var. *morphina* : Hornell, *Rec. Indian Mus.*, **13**: 163, pl. 4, figs.5-8.

1965. *Meretrix meretrix*: Kundu, *J. Bombay nat. Hist. Soc.*, **62** (1): 102, pl.15, figs. 51a & 51b.

1975. *Meretrix meretrix*: Durve, *Rec. zool. Surv. India*, **68:** 423.

1986*Meretrix meretrix*: Tikader, Daniel and Subba Rao, *Sea shore animalsof Andamanand Nicobar Islands*, Zool. Surv. India, p.178.

1991. *Meretrix meretrix*: Rao, Rao and Maitra, *Fauna of Orissa, State Fauna series*, **1** (3): 148. Zool. Surv. India.

1992.*Meretrix meretrix*: Subba Rao, Dey and Barua, *Fauna of West Bengal, State Fauna series*, **3** (9): 242, pl.25, figs 1 & 2. Zool. Surv. India.

1995. *Meretrix meretrix*: Subba Rao, Surya Rao and Manna, *Fauna of Chilka Lake, Wetland Ecosystem series*, **1:** 428. Zool. Surv. India.

2000. *Meretrix meretrix*: Subba Rao and Dey, *Rec. zool. Surv. India Occ. Paper No.*, **187:** 276.

2001. *Meretrix meretrix*: Mahapatra, *Fauna of Godavari Estuary, Estuarine Ecosystem series*, **4:** 78. Zool. Surv. India.

2006. *Meretrix meretrix*: Dey, Handbook on Mangrove associate Molluscs of Sundarbans, *Zool. Surv. India Kolkata*, p. 76.

2007. *Meretrix meretrix*: Dey and Ramkrishna, *Fauna of Andhra Pradesh, State Fauna series*, **5** (7): 241. Zool. Surv. India.

2008. *Meretrix meretrix*: Mahapatra, *Fauna of Krishna Estuary, Estuarine Ecosystem series*, **5:** 164. Zool. Surv. India.

Material Examined: 4 valves

Measurement: Length 2.2-4.6 cm

Diagonistic Characters: Shell moderately large, heavy, ventricose, compressed, hinge narrow; umbo almost central, beak attenuated; lunule heart shaped and almost half of anterior dorsal margin; sculpture smooth only growth lines; anterior cardinal teeth more strong on left valve; muscle scars well impressed, anterior adductor smaller, semilunar, posterior adductor scar large with narrow anterior end; pallial line slightly arched posteriorly; variable in colour.

Distribution: India: Andaman and Nicobar Islands, Andhra Pradesh, Goa, Gujarat, Karnataka, Kerala, Orissa, Puducherry, Tamil Nadu.

Elsewhere: Widely distributed in Indo-Pacific.

Remarks: Indo-pacific, common

Place of collection: Bahuda estuary

Genus ***Marcia*** H. and A. Adams, 1857

1857. *Marcia* H. and A. Adams,*Gen. Rec. Moll.*, **2:** 423. Type species: *Venus pinguis* Chemnitz = *Venus opima* Gmelin; subsequent designation, Kobelt, 1881

20. ***Marcia pinguis*** (Schroeter)

1788. *Venus pinguis* Schroeter, *Nomen. Register*, **10**: 112.

1906. *Venus (Chione) pinguis* : Comber, *J. Bombay nat Hist. Soc.*, **17:** 215.

1915. *Tapes pinguis*: Preston, *Rec Indian Mus.*, **11**: 300.

1915. *Tapes ceylonensis* : Preston, *Rec Indian Mus.*, **11**: 301.

1948. *Katelysia opima*: Ray, *Rec Indian Mus.*, **46**: 118.

1941. *Catelysia opima*: Gravely, *Bull. Madras Govt. Mus. New Ser. (Nat. Hist)*, **5** (1): 52.

1956. *Catelysia opima*: Satyamurti, *Bull. Madras Govt. Mus. New Ser. (Nat. Hist)*, **1** (2), pt. 7: 128, pl.19, figs. 6a -c.

1968. *Catelysia opima*: Cheriyan, *Proc. Symp. Molluscs, Mar. biol. Ass. India*, part **1:** 131.

1975. *Katelysia opima*: Durve, *Rec. zool. Surv. India*, **68:** 423.

1991. *Marcia pinguis*: Rao and Rao, *Fauna of Lakshadweep, State Fauna series*, **2:** 357. Zool. Surv. India.

1991. *Marcia pinguis*: Rao, Rao and Maitra, *Fauna of Orissa, State Fauna series*, **1** (3): 152; *Zool. Surv. India.*

1995. *Marcia pinguis*: Subba Rao, Surya Rao and Manna, *Fauna of Chilka Lake, Wetland Ecosystem series*, **1:** 429. Zool. Surv. India.

2000. *Marcia pinguis*: Subba Rao and Dey, *Rec. zool. Surv. India Occ. Paper No.*, **187:** 282.

2001. *Marcia pinguis*: Mahapatra, *Fauna of Godavari Estuary, Estuarine Ecosystem series*, **4:** 79. Zool. Surv. India.

2007. *Marcia pinguis*: Dey and Ramkrishna, *Fauna of Andhra Pradesh, State Fauna series*, **5** (7): 243. Zool. Surv. India.

2008. *Marcia pinguis*: Mahapatra, *Fauna of Krishna Estuary, Estuarine Ecosystem series*, **5:** 165. Zool. Surv. India.

Material Examined: 2 valves

Measurement: Length 3.5-4.8 cm

Diagonistic Characters: Shell medium, subovate, anterior rounded, posterior becoming subtruncate; umbo anterior, beak more attenuated; lunule well defined, depressed and cordate; sculpture smooth with growth lines only; adductor muscles scars almost equal; pallial line deep, pallial sinus well developed and more than half of the shell; beige with brown, grey umbonal region.

Distribution: India: Andaman and Nicobar Islands, Andhra Pradesh, Gujarat, Kerala, Lakshadweep, Orissa, Tamil Nadu;

Elsewhere: Indo-Pacific.

Remarks: Indo-Pacific

Place of collection: Rushikulya estuary

21. ***Marcia recens*** (Dillwyn)

1795. *Venus recens* Chemnitz, *Syst. Conch. Cab.* **11**: 229, fig. 1979. Type loclaity Indian coasts of Coromandel.

1991. *Marcia (Marcia) recens*: Rao, Rao and Maitra, *Fauna of Orissa, State Fauna series*, **1(3):** 152. Zool. Surv. India.

Material Examined: 2 shells

Measurement: Length 2.3-3.2 cm

Diagonistic Characters: The shell surface is more or less concentrically grooved and gives a varnished look. The tip of the umbo is some times pink or blue.

Distribution: India: Maharshtra, Orissa, Tamil Nadu;

Elsewhere: Indo-Pacific.

Remarks: Indo-Pacific, estuarine

Place of collection: Rushikulya estuary

Genus ***Paphia*** Roeding, 1758

1798. *Paphia* Roeding,*Mus. Bolten.*, p. 175. Type species: *Paphia alapapilionis* = *Venusrotundata* Linnaeus; subsequent designation, Dall, 1902 Subgenus *Paphia s.st*

22. ***Paphia alapapiliones*** Roeding

1798. *Paphia alapapiliones* Roeding, *Mus. Bolten.*, **1798**: 175.

1940. *Paphia alapapiliones*: Crichton, *J. Bombay nat. Hist. Soc.*, **42:** 331.

1941. *Paphia alapapiliones*: Gravely, *Bull. Madras Govt. Mus. New Ser. (Nat. Hist)*, **5** (1): 52.

1956. *Paphia alapapiliones*: Satyamurti, *Bull. Madras Govt. Mus. New Ser. (Nat. Hist)*, **1**(2), pt. **7**: 130, pl.20, fig.2.

1965. *Paphia alapapiliones*: Kundu, *J. Bombay nat. Hist. Soc.*, **62** (2): 212, pl.16, figs. 55a & 55b.

2000. *Paphia alapapiliones*: Subba Rao and Dey, *Rec. zool. Surv. India Occ. Paper No.*, **187:** 282.

Material Examined: 2 valves

Measurement: Length 4.6 cm

Diagonistic Characters: Shell elongately-ovate, arched, much longer than high; umbo anterior; beak well infront of midline; lunule developed; sculpture with concentric ridges, fine on umbonal region and gradually coarse and more on the posterior slope; colour orange brown with four brown blotches arranged in longitudinal fashion.

Distribution: India: AndmanIslands, Gujarat, Tamil Nadu.

Elsewhere: Indian Ocean.

Remarks: Indian Ocean, estuarine

Place of collection: Rushikulya estuary, Gopalpur beach

23. ***Paphia malabarica*** (Schroeter)

1788. *Venus malabarica* Schroeter, *Namen. Register.*, p. 112, pl.6, figs 4, 4a, 4b.

1898. *Tapes malabarica*: Melvill and Skyes, *Proc. malac. Soc.* London, **3:** 47.

1906. *Tapes (Pullastra) malabarica* : Comber, *J. Bombay nat Hist. Soc.*, **17:** 215.

1940. *Paphia malabarica*: Crichton, *J. Bombay nat. Hist. Soc.*, **42:** 331.

1941. *Paphia malabarica*: Gravely, *Bull. Madras Govt. Mus. New Ser. (Nat. Hist)*, **5** (1): 52.

1956. *Paphia malabarica*: Gideon, Menon, Rao and Jose, *J. Bombay nat. Hist. Soc.*, **54** (3): 703.

1956. *Paphia malabarica*: Satyamurti, *Bull. Madras Govt. Mus. New Ser. (Nat. Hist)*,**1** (2), pt.7:130, pl.20, figs.3a and 3b.

1965. *Paphia malabarica*: Kundu, *J. Bombay nat. Hist. Soc.*, **62** (2): 211, pl.16, figs. 54a & 54b.

1968. *Paphia malabarica*: Cheriyan, *Proc. Symp. Molluscs, Mar. biol. Ass. India*, part **1:** 131.

1986. *Paphia malabarica*: Tikader, Daniel and Subba Rao, *Sea shore animals of Andaman and Nicobar Islands*, Zool. Surv. India, p.178.

1991. *Paphia malabarica*: Rao, Rao and Maitra, *Fauna of Orissa, State Fauna series*, **1** (3): 153. Zool. Surv. India.

1992. *Paphia malabarica*: Subba Rao, Dey and Barua, *Fauna of West Bengal, State Fauna series*, **3** (9): 245, pl. 26, fig. 1. Zool. Surv. India.

2000. *Paphia malabarica*: Subba Rao and Dey, *Rec. zool. Surv. India Occ. Paper No.*, **187:** 282.

2001. *Paphia malabarica*: Mahapatra, *Fauna of Godavari Estuary, Estuarine Ecosystem series*, **4:** 79. Zool. Surv. India.

2007. *Paphia malabarica*: Dey and Ramkrishna, *Fauna of Andhra Pradesh, State Fauna series*, **5** (7): 246. Zool. Surv. India.

Material Examined: 2 shells

Measurement: Length 5.2 cm

Diagonistic Characters: Shell cordately-ovate, arched, much longer than high; umbo anterior; beak well infront of midline; lunule developed and two third of the length of anterior dorsal margin; sculpture with concentric ridges, fine on umbonal region and gradually coarse and more on the posterior slope; beige to orange brown; adductor muscle scars almost equal; pallial sinuis developed towards the umbo and occupy more than half of the width of shell.

Distribution: India: Andaman and Nicobar Islands, Andhra Pradesh, Gujarat, Kerala, Maharashtra, Orissa, Tamil Nadu.

Elsewhere: Persian Gulf, Gulf of Aden, Pakistan, Sri Lanka, Myanmar, Malaysia, Indonesia, Philippines, China.

Remarks: Indian Ocean, estuarine

Place of collection: Rushikulya estuary

Order ARCOIDA
Super family ARCOIDEA
Suborder PINNINA
Superfamily PINNOIDEA
Order VENEROIDA
Superfamily CARDITOIDEA
Superfamily MACTROIDEA
Superfamily VENEROIDEA
Class BIVALVIA
Subclass PROTOBRANNCHIA
Subfamily ANADARINAE
Genus ***Anadara*** Gray, 1847

1847. *Anadara* Gray, *Proc. zool. Soc.* London, **15**: 198, 206. Type species: *Arca antiquata* Linnaeus, 1758

24. ***Anadara antiquata*** (Linneaus)

1758. *Arca antiquata* Linnaeus, *Syst. Nat.* ed **10**: 1114.

2007. *Anadara antiquata*: Dey and Ramkrishna, *Fauna of Andhra Pradesh, State Fauna series*, **5** (7): 172. Zool. Surv. India.

Material Examined: 2 bivalves

Measurement: Length 5.9 cm

Diagonistic Characters: Shell inequivalve, solid, inequilateral, obliquely ovate and elongate in outline, with an extended posteroventral part. Umbones much inflated, situated rather forwards, cardinal area narrow and elongate. About 40 radial ribs (35 to 44) at each valve; ribs usually with a narrow median groove on top, most visible towards the anterior ventral margin of valves in mature specimens. Periostracum coarse and velvety, often eroded on umbones. Internal margins with strong crenulations corresponding with the external radial ribs. No byssal gape. Colour: outside of shell greyish white, often stained darker grey on umbonal and posterior areas; periostracum dark brown. Inner side white, sometimes light yellow in the umbonal cavity.

Distribution: India: Andaman and Nicobar Islands, Andhra Pradesh, Goa, Gujarat, Kerala, Maharashtra, Orissa, Tamil Nadu; Elsewhere: Sri Lanka, Maynmar, Indonesia, Philippines.

Remarks: Inertidal, estuarine

Place of collection: Bahuda estuary

Superfamily CARDITOIDEA
Family CARDITIDAE
Subfamily CARDITESTINAE
Genus ***Cardites*** Link, 1807

1807. *Cardites* Link, *Beschr. Nat. Samml. Univ. Rostock*, **(3)**: 153. Type species: *Chama antiquata* Linnaeus, 1758

25. ***Cardites bicolor*** (Lamarck)

1819. *Cardita bicolor* Lamarck, *Hist. nat. Anim. Sans. Vert.*, **6**: 427.

2007. *Cardita bicolor*: Dey and Ramkrishna, *Fauna of Andhra Pradesh, State Fauna series*, **5** (7): 199. Zool. Surv. India.

Material Examined: 1 valve

Measurement: Length 1.9 cm

Diagonistic Characters: Shell equivalve, often stout and inflated, trigonal ovate to trapezoidal in outline, inequilateral. Umbones generally anterior, prosogyrate, and prominent. Lunule short and deep. Exterior mostly withstrong radial ribs. Ligament external, attached behind umbones on well-marked nymphs. Hinge plate strong, usually with 2 cardinal teeth, unequal and often with fine transverse striations; lateral teeth frequently more or less reduced to absent. Two adductor muscle scars slightly inequal.

Distribution: India: Andhra Pradesh, Goa, Gujarat, Puducherry, Tamil Nadu; Elsewhere: Sri Lanka, Myanmar.

Remarks: Indo-pacific

Place of collection: Rushikulya estuary

DISCUSSION AND CONCLUSION

During the present study, a total of 11 examples of gastropods and 14 examples of bivalves consisting of 20 genera and 25 species were identified. Most of the molluscs were marine forms except for one (*Bellamya bengalensis*) whose occurrence is of accidental in nature and not a

common species in the coastal area of south Odisha. However, further investigations is necessary which may reveal new species and new records from the coast.

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Rajagopal, A. S. & H. P. Mookherjee. 1978. Contribution to the molluscan fauna of India. Part-I Marine molluscs of the Coromandel Coast, Palk Bay and Gulf of Mannar: Archaeogastropoda. *Records of zoological Survey of India, Occasional Papers*, **12**: 1-48.

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Subba Rao, N. V. & H. P. Mookherjee. 1975. On a collection of Mollusca from the Mahanadi estuary, Orissa. In: *Recent Researches in Estuarine Biology* (Natarajan, R. ed.). Hindustan Publications, New Delhi: 165-176.

Subba Rao, N. V. & K. V. Surya Rao. 1993. Contribution to the Knowledge of Indian marine Molluscs-Pt. 3. Family: Muricidae. *Records of zoological Survey of India, Occasional Papers,* **153**: 133 pp., 14 pls.

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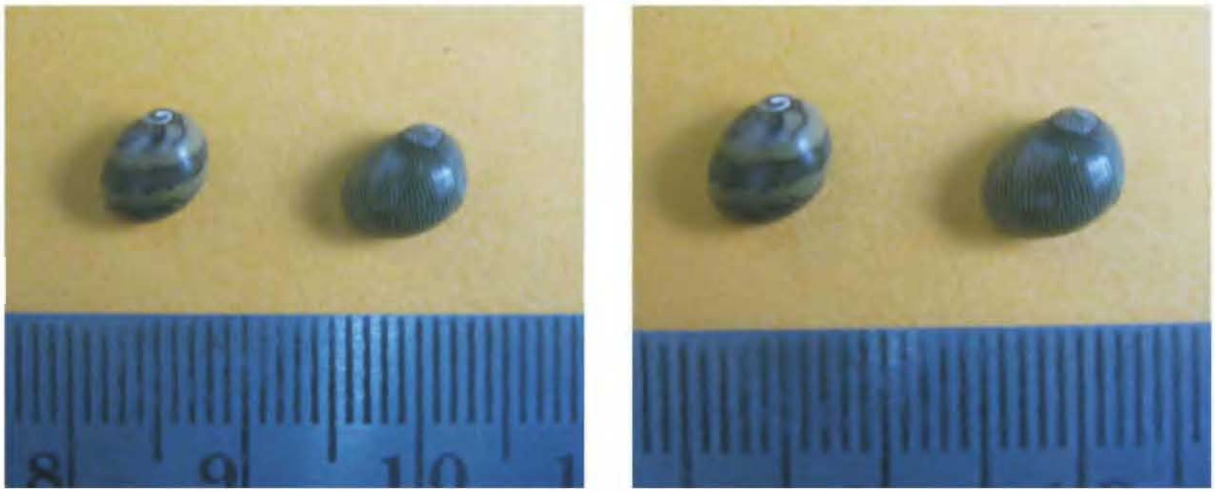
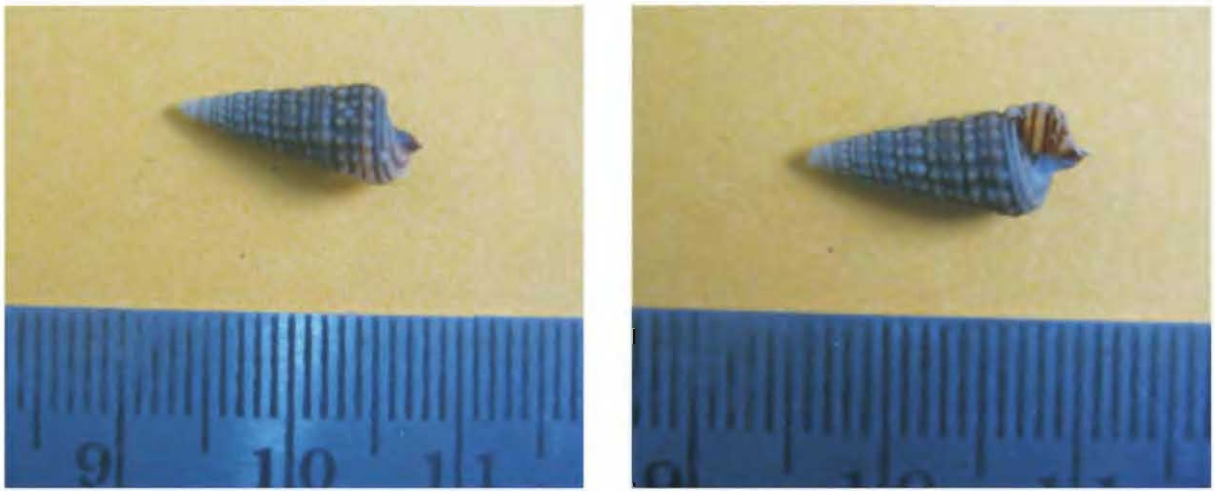
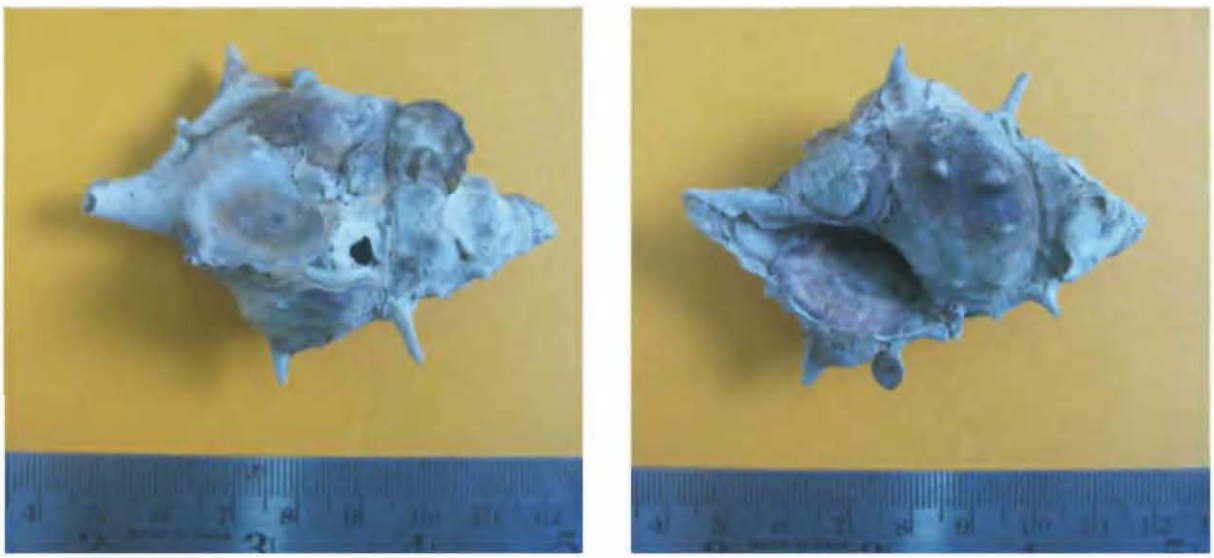


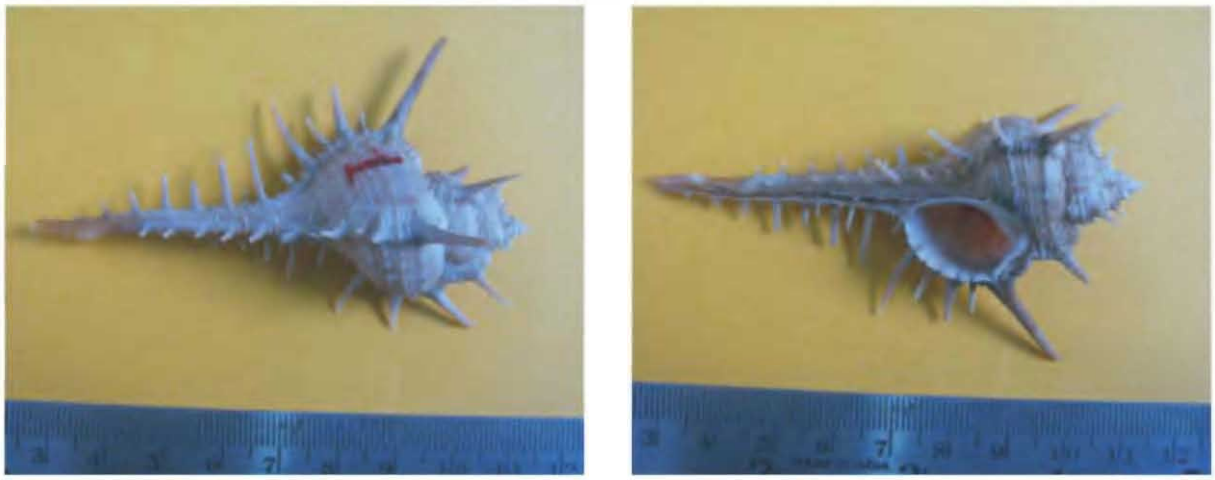
Theodoxus oualaniensis



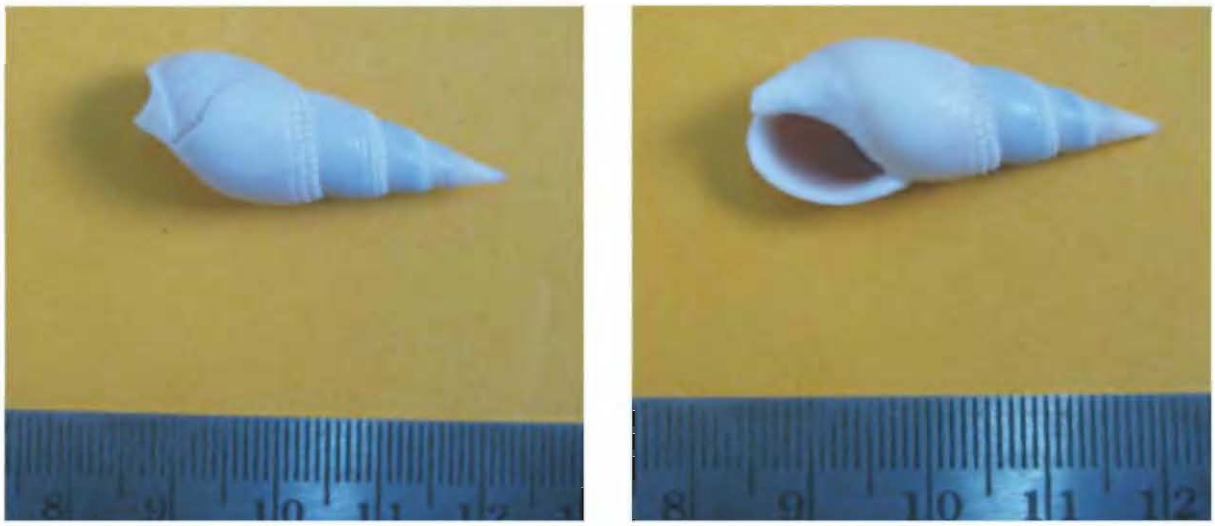
Cerethium scabnidum



Bursa rana

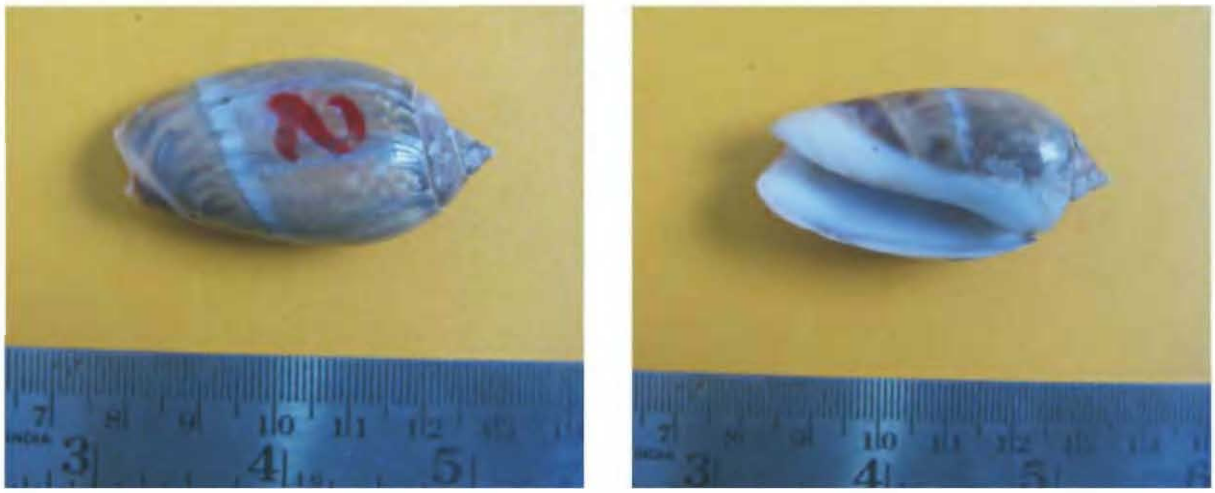


Murex carbonneiri

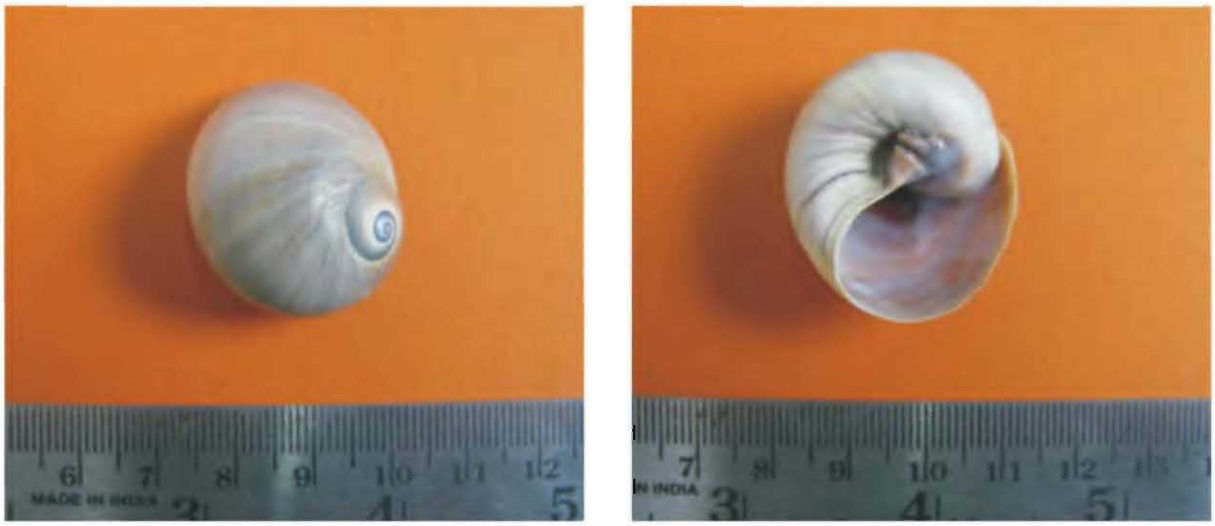


Bullia vittata

Oliva oliva



Olivancillaria gibbosa



Polinices didyma

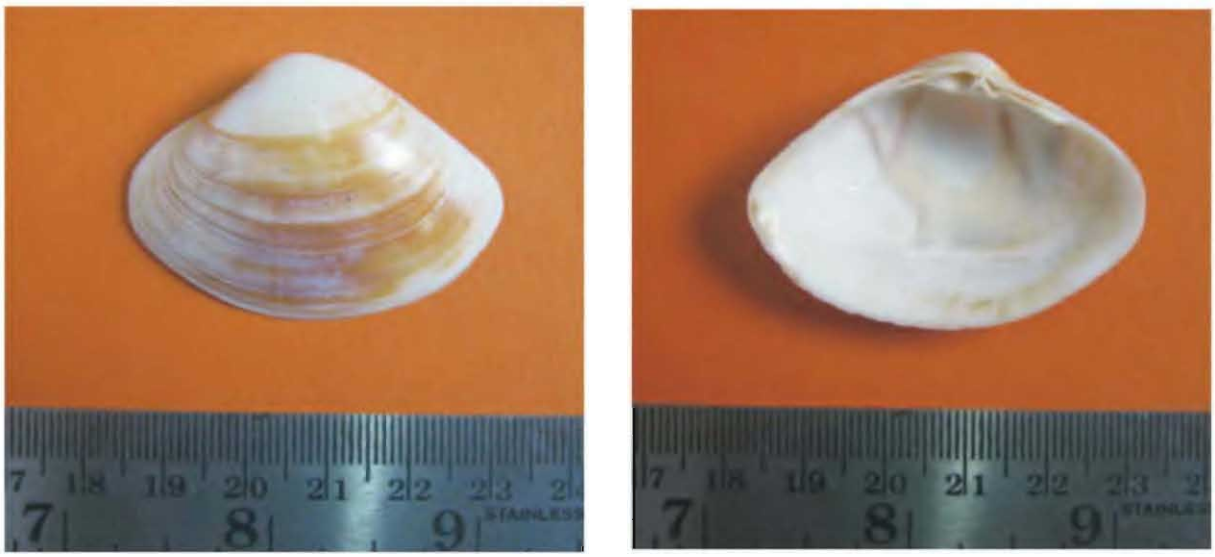
Ficus gracilis

Harpa major

Architectonick laevigata

Perna virdis

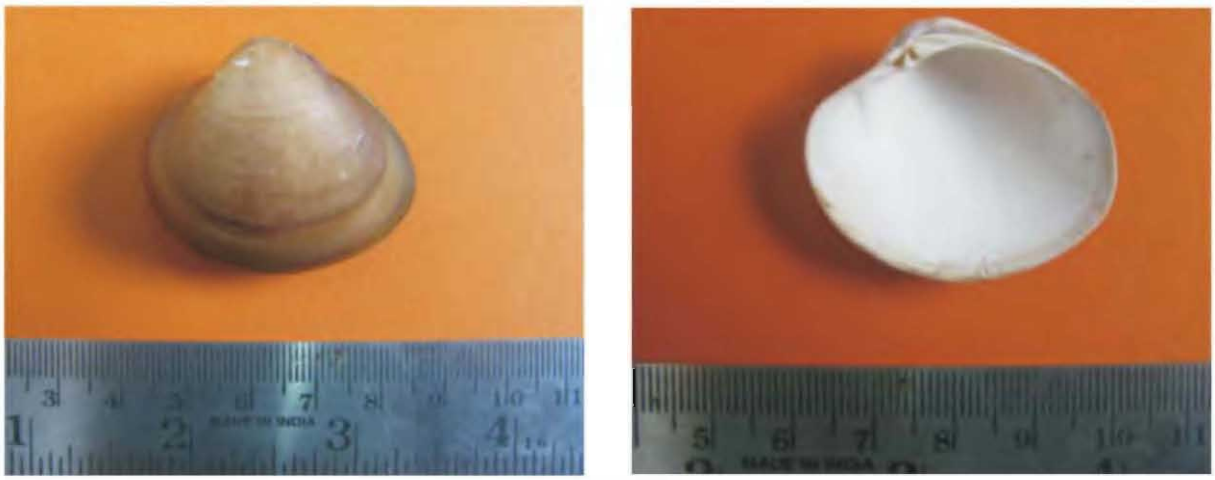
Mactra grandis



Mactra symmetrica

Sunetta meroe

Sunetta scripta

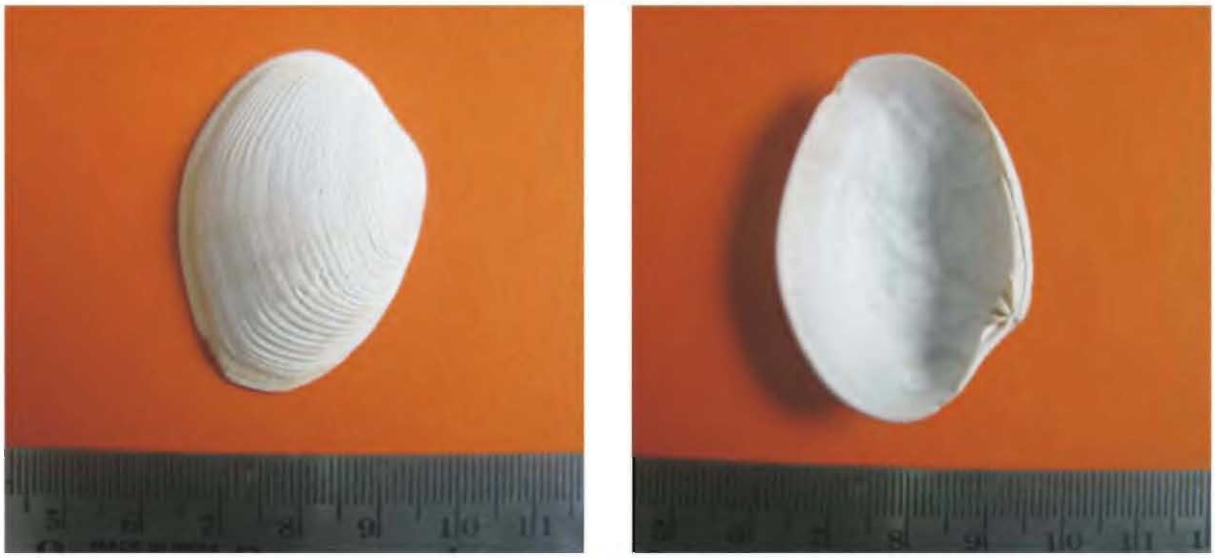


Meretrix casta

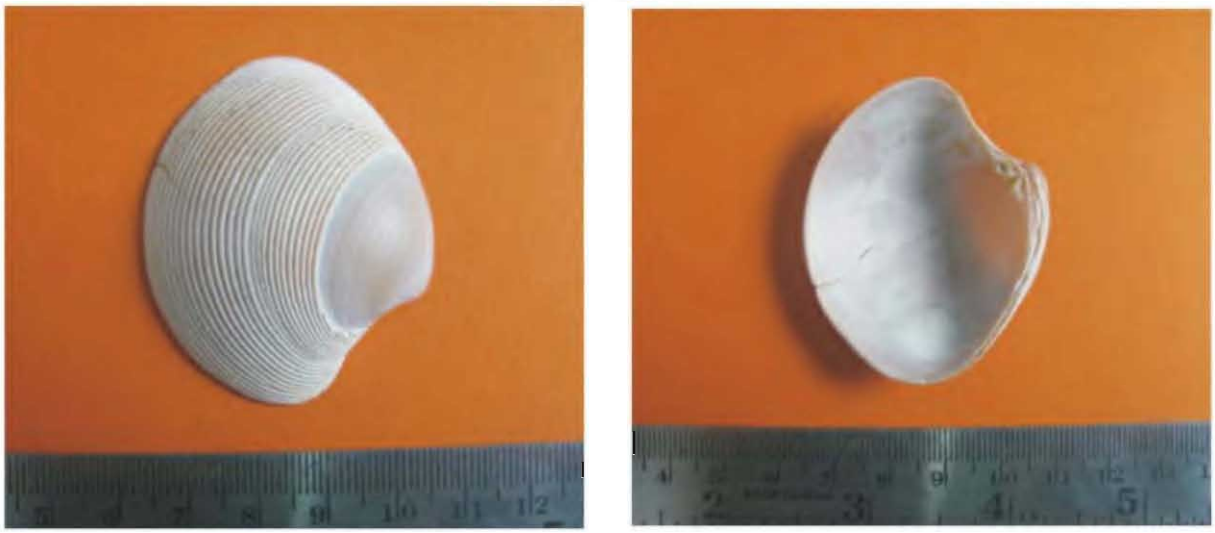
Meretrix meretrix

Marcia pinguis

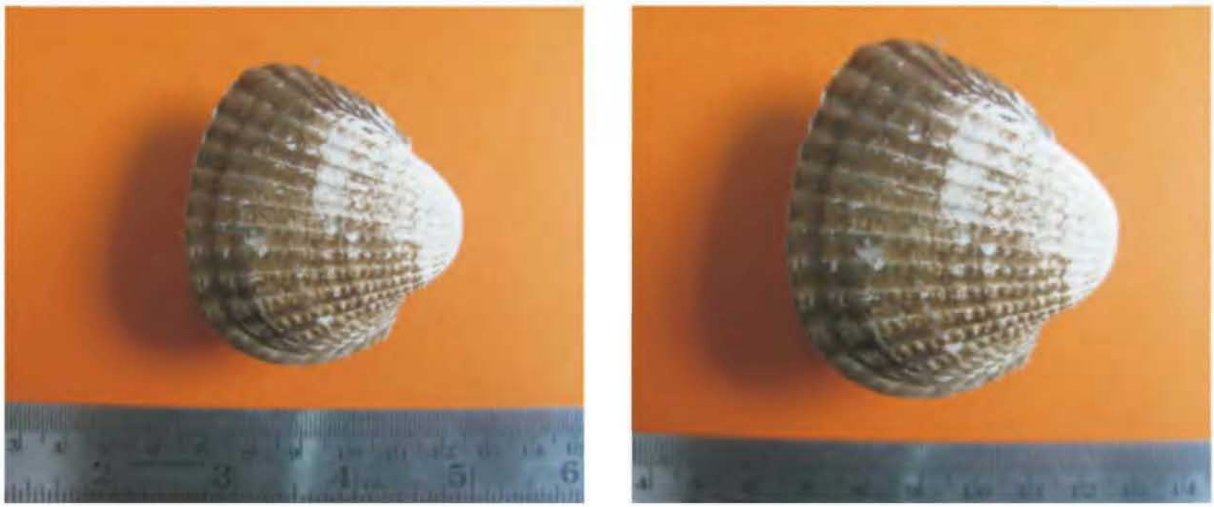
Marcia recens



Paphia alapapilio



Paphia malabaria



Anadara antiquata

Cardites bicolor

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A PRELIMINARY STUDY ON THE AQUATIC INSECTS IN FRESHWATER WETLANDS OF NORTH EASTERN KOLKATA

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INTRODUCTION

Among various biological components of freshwaters, the aquatic insects play an important role not only in the trophic dynamics of the ecosystem but also in the indication of changes in the quality of water due to pollution or degradation because of their ability to respond, quickly to such changes. While most of the aquatic insect species constitute the food of many commercially important fishes, some others are predaceous, feeding upon spawn and frys or competing with them directly for natural food. Besides, several species, particularly of belostomatid Hemiptera are known to predate heavily upon the mosquito larvae and thereby limiting their population size.

A large number of species belonging to several orders have adapted to aquatic mode of life completely or partially. It is estimated that about 3% of the total insects are aquatic, spending atleast a part of their life cycles in the water, and these comprise about 25,000 to 30,000 species (Cheng, 1976). The highly diverse aquatic forms are spread over 10 orders viz. Collembola, Plecoptera, Ephemeroptera, Odonata, Hemiptera, Neuroptera, Trichoptera, Lepidoptera, Coleoptera and Diptera. Out of these, taxa belonging to only a few groups like Ephemeroptera, Odonata, Hemiptera, Coleoptera and Diptera constitute the dominant components of fauna of the freshwater wetlands of this region.

Some of the important contributions on taxonomy of aquatic insects are done mainly by Distant (1902, 1906, 1910), d'Orchymont (1928), Ochs (1930), Vazirani (1968, 1970). Srivastava and Sinha (1995) on Odonata; Bal and Basu (1994a, 1994b) on Hemiptera; Biswas *et al.*, (1995a, 1995b), Biswas and Mukhopadhyay (1995) on Coleoptera. Some taxo-ecological works are also done by Roy (1982), Roy and Sharma (1983), Roy *et al.*, (1988), De (Pal) and Sengupta (1993), Bhattacharya (2000), Pal *et al.*, (2000) & Khan and Ghosh (2001).

The areas which have been selected for detailed study are as follows :-

i. Two freshwater wetlands (Ponds) in Kestopur (Rabindrapally Pond and Majherpara Pond), N. 24 Parganas.

ii. One freshwater wetland (Pond) near Dumdum Park (Dumdum Park Pond), N. 24 Parganas and

iii. Sewage-fed wetland of Kestopur Canal, N. 24 Parganas.

All the materials under study were collected by the first author (R.Debnath) and the same are deposited in the collections of Vidyasagar College, Kolkata.

No consolidated account of Biodiversity of aquatic freshwaterbodies of North East Kolkata is available so far except a stray work on the occurrence of only aquatic Coleoptera in and around Kolkata (De and Sengupta, 1993). No study on seasonal abundance of the aquatic

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insects from the area under study is on record. This has prompted to take up the present project work as preliminary study in this field.

MATERIAL AND METHODS

The materials for the present study were collected during the period October, 2009 to April, 2010, in the freshwater wetlands of North eastern Kolkata as mentioned earlier.

The collection was made with the help of hand operated net by randomly netting different areas of the wetland. Aquatic forms of insects adults/nymphs/larvae were collected by water net which has a close meshed nylon net supported by metal ring and long handle.

After netting the accumulated materials were kept in a plastic tray. The aquatic weeds, stones, mud were removed and aquatic insects were collected. Later, the collected insects were preserved in 70% alcohol. After a few days the preserved aquatic insects were set, pinned and preserved into the insect box.

Specimens were identified with the help of available literature. Most of the identifications were later confirmed by Zoological Survey of India, Kolkata.

SYSTEMATIC LIST OF AQUATIC AND SEMI-AQUATIC SPECIES

A. Order HEMIPTERA

Family NEPIDAE

1. *Laccotrephes griseus* (Guerin)
2. *Ranatra sordidula* Dohrn.

Family NOTONECTIDAE

3. *Nychia marshalli* (Scott.)

Family GERRIDAE

4. *Limnogonus nitidus* (Mayr)
5. *Limnogonus fossorum* (Fabr.)
6. *Neogerris parvula* (Stal)

Family BELOSTOMATIDAE

7. *Diplonychus rusticus* (Fabr.)
8. *Diplonychus annulatum* (Fabr.)
9. *Lethocerus indicus* (Lep. & Serv.)

Family PLEIDAE

10. *Plea* sp.

Family MESOVELIIDAE

11. *Mesovelia* sp.

Family CORIXIDAE

12. *Micronecta* sp.

B. Order COLEOPTERA

Family HYDROPHILIDAE

13. *Amphiops pedestris* Sharp
14. *Berosus indicus* Mots
15. *Berosus fairmairei* Zaitzev
16. *Helochares anchoralis* Sharp
17. *Regimbertia attenuata* Fab.
18. *Sternolophus rufipes* (Fab.)

Family DYTISCIDAE

19. *Canthydrus laetabilis* (Walker)
20. *Canthydrus luctuosus* (Aube)
21. *Hydaticus* sp.
22. *Laccophilus anticatus anticatus* Sharp .
23. *Laccophilus parvulus parvulus* Aube
24. *Laccophilus basalis* Mots.
25. *Laccophilus flexuosus* Aube
26. *Laccophilus sharpi* Regimbart

Family CHRYSOMELIDAE

27. *Cassida* sp.
28. *Paridea* sp.
29. *Altica* sp.

Family CARABIDAE

30. *Tetragonoderus arcuatus* Dejean

Family GYRINIDAE

31. *Dineutus (Protodineutus) indicus* Aube

SYSTEMATIC ACCOUNT

Order HEMIPTERA

Hemiptera is one of the large groups of aquatic and semiaquatic insects. Mouthparts are piercing and sucking type beak-like structure,

inserted near the anterior end of the head. Leathery anterior pair of wings at the base and membranous apically and second pair completely membranous. Metamorphosis simple and gradual. The size-range is very vast, from minute to very large. The body shape varies greatly from long, cylindrical to oval and sometimes considerably flattened. The prothorax is large and free, meso and metathorax united, scutellum very prominent and antennae 4-5 segmented. There are generally 5 nymphal stages and the nymphs look like adults except they're comparatively of smaller sizes and sexual immaturity.

There are a series of aquatic and semiaquatic families that show a gradual transition of habitats from damp shores to subsurface waters (Pennak, 1978). Some remain confined to the shore, some venture further and abound the floating algal mats and other floating objects, and some skate rapidly over the surface of water. The true aquatic species are normally found below the surface. They are highly predaceous, feeding upon micro and macro invertebrates and sometimes on fish eggs and fry. For this, forelegs are highly modified for seizing and holding the prey while body fluids are sucked up through the mouthparts with the muscular pharynx (Pennak, 1978). The eggs are generally laid on the surface or within the tissue of submerged macrophytes.

Family NEPIDAE

The insects belonging to this family are commonly known as "Water Scorpions".The body is dorso-ventrally flattened or cylindrical with long slender legs, the anterior pair being raptorial with long and stout femur used mainly for capture of prey. 1- jointed tarsi and absence of ocelli are the characteristic feature of the family. Head set into prothorax, fore tarsi not fringed; hind coxae globular; antennae 3-jointed.

They are usually found in trash and mud or remain entangled with aquatic vegetation in the shallow littoral region of the wetlands. Highly predaceous insect species feed mainly on live insects and their nymphs. The prey is captured with the help of raptorial forelegs.

1. ***Laccotrephes griseus*** (Guerin)

1829. *Nepa greseus* Guerin, *Iconogr Regne Anim. Ins.*, : 352

2001. Khan, R. A. and Ghosh, L. K. *Rec. zool. Surv. India, Occ. Paper* No. **194** : 38

2007. Thirumalai, G. *Rec. zool. Surv. India. Occ. Paper No.*, **273** : 1-84

Material examined : 1 ex., Rabindrapally pond, 11.X.2009; 1 ex., Kestopur Canal, 11.X.2009; 1 ex., Dumdum Park Pond, 17.I.2010; 1 ex., Rabindrapally Pond, 21.II.2010; 1 ex., Dumdum Park Pond, 21.III.2010; 1 ex., Dumdum Park Pond, 18.IV.2010.

Diagonosis : Abdomen above with light bluish tinge; anterior area of prosternum provided with a strong acute spine-like structure; abdominal appendages distinctly shorter than body; the parameres are symmetrical and slightly hooked.

Distribution : India : West Bengal (Kolkata, North 24-Parganas, Darjeeling), Pondicherry, Tamil Nadu; Elsewhere : Malaysia; Myanmar; Seychelles; SriLanka; Thailand.

Remarks : The species was recorded from Rabindrapally & Dumdum Park freshwater Pond & sewage-fed Kestopur Canal . This is a very sluggish species and very common in Peninsular India and occurs in permanent pond near the edges (Thirumalai 1994).

2. ***Ranatra sordidula*** Dohrn

1859. *Ranatra sordidula* Dohrn., *Stettin. Ent. Ztg.*, **21**: 409

2001. Khan, R. A. and Ghosh, L. K. *Rec. zool. Surv. India, Occ. Paper* No. **194** : 40

Material examined : 3 exs., Rabindrapally Pond, 11.X.2009; 2 exs., Kestopur Canal, 11.X.2009; 1 ex., Majherpara Pond, 11.X.2009; 4 exs. Dumdum Park Pond, 15.XI.2009; 1 ex., Majherpara Pond, 20.XII.2009; 2 exs., Majherpara Pond, 17.I.2010; 1 ex., Rabindrapally Pond, 21.II.2010; 1 ex., Dumdum Park Pond, 21.II.2010; 1 ex., Majherpara Pond, 21.II.2010; 3 exs., Rabindrapally Pond, 21.III.2010; 8 exs., Majherpara Pond, 21.III.2010; 4 exs., Rabindrapally Pond, 18.IV.2010; 16 exs., Majherpara Pond, 18.IV.2010.

Diagnosis : Body elongated, 23-24 mm. Long, abdominal appendages approximately shorter

than body; inter ocular space slightly greater than diameter of an eye; pronotum provided with an indistinct ridge at the posterior angle on each side; metasternal process posteriorly projectile with lateral concavity on each side; anterior tibia shorter.

Distribution : India : West Bengal (Kolkata, Hooghly, North 24-Parganas); Orissa; Elsewhere : Malay Peninsula; Sri Lanka; Thailand.

Remarks : This spacies was recorded from Majherpara freshwater pond and Rabindrapally freshwater pond.

Family : NOTONECTIDAE

The members of this family are usually called as "backswimmers" because they have peculiar habit of swimming on their backs. At surface these can be seen resting with their dorsal sides downwards, body at an angle and the tip of abdomen in contact with air. They are strikingly coloured, sometimes multicoloured, on the dorsal surface of the head and thorax. Body long and slender, flat ventrally and convex dorsally; eyes are large, remiform; antennae short. Rostrum short. First two pairs of legs are adapted for grasping and the last is flattened and fringed, densely setose for swimming.

They are mainly carnivores. While adults feed on aquatic insects, other invertebrates and fish eggs and fry, the nymphal food mainly comprises microcrustaceans, zooplankton.

3. ***Nychia marshalli*** (Scott.)

1872. *Antipalocoris marshalli* Scott, *Entomologist's mon. Mag.*, **8**:245

1994. Bal, Animesh and Basu, R. C. Insecta : Hemiptera : Belostomatidae, Nepidae, Notonectidae and Pleidae. *Fauna of West Bengal, State Fauna Series 3* : Part **5**:550

Material examined : 1ex., Rabindrapally Pond, 11.X.2009; 2 exs., Rabindrapally Pond, 15.XI.2009; 1 ex., Majherpara Pond, 15.XI.2009; 3 exs., Rabindrapally Pond, 20.XII.2009; 1 ex., Majherpara Pond, 20.XII.2009; 7 exs., Rabindrapally Pond, 17.I.2010; 2 exs., Majherpara Pond, 17.I.2010; 12 exs., Rabindrapally Pond, 21.II.2010; 6 exs., Majherpara Pond, 21.II.2010; 38 exs., Rabindrapally Pond, 21.III.2010; 21 exs., Majherpara Pond, 21.III.2010; 63 exs., Rabindrapally Pond, 18.IV.2010; 10 exs., Majherpara Pond, 18.IV.2010;

Diagnosis: Male (5.2 mm) a little longer than female (4.8 mm). Head with vertex a little raised, postero leteral margin of eye "E"-shaped; pronotum short and transverse with punctate anterior angles; hemelytra without any clavus; posterior legs slender and longer than body; hemelytra fully cover the body in females while in males, last three abdominal segments remain uncovered.

Distribution : India : West Bengal (Birbhum, North 24-Parganas). Elsewhere : Africa, Europe, Sri Lanka.

Remarks : This species was collected from Majherpara freshwater pond and Rabindrapally freshwater pond in good number. It was absent in sewage-fed Kestopur canal and Dumdum Park freshwater pond.

Family : GERRIDAE

These insects are commonly known as "Water Striders" or "Pond Skaters". They are semiaquatic long-legged hemipterans. Body oval-shaped and covered with a hydrofuge hairpile. They are of black, grey or brown in colour, with light grey or yellow spots or lines on the dorsum. Antennae long, 4-segmented , ocelli absent. The forelegs are relatively short and raptorial, widely separated from the closely spaced and middle and hind legs. The middle legs longer than the others. Both winged and non-winged forms occur, but the latter are more common.

These insects are found skating or leaping about on the surface film of wetlands. They feed upon a number of microcrustaceans and insects.

4. ***Limnogonus nitidus*** (Mayr)

1865. *Hydrometra nitida* Mayr, *Verh. Zool. Bot. Ges. Wien*, **15**:443

2001. Khan, R. A. and Ghosh, L. K. *Rec. zool. Surv. India, Occ. Paper* No. **194**:47

Material examined : 3 exs., Rabindrapally Pond, 11.X.2009; 3 exs., Rabindrapally Pond, 20.XII.2009;

Diagnosis : Body of moderate size (6-8 mm in length); antennae 4 - jointed, 2nd. and 3rd. joints shortest and nearly subequal in length; 4th antennal joint slightly smaller than the 1st joint or subequal; pronotum with the mid-longitudinal carination moderately prominent, posterior tip of pronotum remarkably angular; 7th abdominal segment with connexival spines.

Distribution : India : West Bengal (Kolkata, North 24-Parganas, South 24-Parganas, Hooghly, Bankura, Birbhum, Purulia), Andaman Is. ,Andhra Pradesh, Assam, Bihar, Delhi, Karnataka, Kerala, Orissa, Rajasthan, Uttar Pradesh, Tamil Nadu, Tripura. Elsewhere : Bangladesh; Burma; Java; Malaya; Sri Lanka; Sumatra.

Remarks : The species was collected from Rabindrapally freshwater pond for the first time.

5. ***Limnogonus fossorum*** (Fabr.)

1775.*Cimex fossarum* Fabricius, *Systema Entomologiae* : 727

2001. Khan, R. A. and Ghosh, L. K. *Rec. zool. Surv. India, Occ. Paper* No. **194**:47

Material examined : 4 exs., Majherpara Pond, 11.X.2009; 1 ex., Rabindrapally Pond, 15.XI.2009; 2 exs., Dumdum Park Pond, 15.XI.2009;

Diagnosis : Body elongate, 9-10 mm. long; antennae 4-jointed, 1st. joint longest, 2nd. 3rd. and 4th. joints shortest and subequal in length; pronotum with mid-longitudinal carination conspicuous and prominently present all along the length; anterior part of pronotum with a pair of irregular patches.

Distribution : India : West Bengal (Kolkata, North 24-Parganas, South 24-Parganas, Howrah, Darjeeling), Andaman & Nicobar Is., Andhra Pradesh, Assam, Bihar, Delhi, Goa, Haryana, Himachal Pradesh, Jammu & Kashmir, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Orissa, Pondicherry, Rajasthan, Tamil Nadu. Elsewhere : Australia; Burma; China; Formosa; Java; Malacca; Philippines; Sumatra.

Remarks : This species is reported to be very common in Rabindrapally freshwater pond, Dumdum Park freshwater pond and Majherpara freshwater pond.

6. ***Neogerris parvula*** (Stal)

1906. *Gerris parvula* Stal, *K. Svenska Eng. Zool.*, **4**:265

2001. Khan, R. A. and Ghosh, L. K. *Rec. zool. Surv. India, Occ. Paper* No. **194**:48

Material examined : 1 ex., Majherpara Pond, 20.XII.2009;

Diagnosis : Body elongated 6.0 mm. long; posterior tip of pronotum more or less convex, anterior part of pronotum with yellow patches; 1st antennal segment, longest and as long as or a little longer than the 2nd and 3rd segments together, 4th antennal segment remarkably smaller than the 1st segment; anterior part of pronotum with a single roundish yellow patch which separates it from all other known species.

Distribution : India : West Bengal (Kolkata, North 24-Parganas, South 24-Parganas, Darjeeling Jalpaiguri, Murshidabad, Purulia), Andhra Pradesh, Assam, Bihar, Kerala, Orissa, Pondicherry, Uttar Pradesh, Tamil Nadu. Elsewhere : Bangladesh; Burma; China; Iran; Japan; Java; Malay Peninsula; Myanmar;New Guuinea; Oman; Philippines; Pakistan; Singapore; Sri Lanka; Solomon Is.; Taiwan; Thailand; Vietnam.

Family : BELOSTOMATIDAE

The Belostomatids, are commonly called as "Giant Waterbugs" due to their large sizes (10-110mm in length). Body flat, oval, brown or dull greenish colour, antennae 4-segmented and concealed in the pockets beneath the head; eyes prominent. The strong and thick front legs are raptorial and used for grasping. Posterior tibiae flattened and fringed with hairs, fitted for swimming. The most characteristic feature in adult is the presence of retractile strap-like appendages at the abdominal apex which are used to obtain air.

They are generally found on the bottom in shallower littoral zones where emergent macrophytes are in abundance. The larger species live in deeper waters. They are highly predaceous and feed on all kinds of aquatic

organisms including fish eggs and fry. They secrete a toxic slivery substance that kills the prey within a short time.

7. *Diplonychus rusticus* (Fabr.)

1794. *Nepa rustica* Fabricius, *Ent. Syst.* **4** : 62

2001. Khan, R. A. and Ghosh, L. K. *Rec. zool. Surv. India, Occ. Paper* No. **194** : 42

2007. Thirumalai, G. *Rec. zool. Surv. India. Occ. Paper No.*, **273** : 1-84

Material examined : 2 exs., Rabindrapally Pond, 11.X.2009; 8 exs. Kestopur Canal, 11.X.2009; 3 exs., Majherpara Pond, 11.X.2009; 2 exs., Rabindrapally Pond, 15.XI.2009; 9 exs., Kestopur Canal, 15.XI.2009; 5 exs., Majherpara Pond, 15.XI.2009; 6 exs., Rabindrapally Pond, 20.XII.2009; 4 exs., Kestopur Canal, 20.XII.2009; 9 exs., Majherpara Pond, 20.XII.2009; 10 exs., Rabindrapally Pond, 17.I.2010; 4 exs., Kestopur Canal, 17.I.2010; 4 exs., Majherpara Pond, 17.I.2010; 7 exs., Kestopur Canal, 21.II.2010; 5 exs., Majherpara Pond, 21.II.2010; 27 exs., Rabindrapally Pond, 21.III.2010; 26 exs., Kestopur Canal, 21.III.2010; 58 exs., Majherpara Pond, 21.III.2010; 80 exs., Rabindrapally Pond, 18.IV.2010; 17 exs., Kestopur Canal, 18.IV.2010; 43 exs., Majherpara Pond, 18.IV.2010;

Diagnosis : Head shorter than the inocular space; body 15-17 mm. long; lateral basal margins of pronotum and embolium pale; suboval shaped, greatest expanse of hemeelytra together is shorter than its length. Tarsi 1-jointed and with a smaller claw long, ventro lateral stripe of fine hairs on abdomen is narrower.

Distribution : India : West Bengal (Kolkata, North 24-Parganas, South 24-Parganas, Hooghly, Bankura, Murshidabad), Bihar, J. & K. State, Orissa, Kerala, Maharashtra, Tamil Nadu,. Elsewhere : Austria; Burma; China; Formosa; Indonesia; Japan; Java; Malay Peninsula; New Zealand; Philippines; Sri Lanka; Sumatra; Thailand; New Guinea.

Remarks : This species was abundantly collected from Rabindrapally freshwater pond, sewage-fed Kestopur canal and Majherpara freshwater pond.

8. *Diplonychus annulatum* (Fabr.)

1803. *Nepa annulatum* Fabricius, *Systema Rhyngotorum : 106*

2001. Khan, R. A. and Ghosh, L. K. *Rec. zool. Surv. India, Occ. Paper* No. **194** : 41

2007. Thirumalai, G. *Rec. zool. Surv. India. Occ. Paper No.*, **273** : 1-84

Material examined : 3 exs., Dumdum Park Pond, 11.X.2009; 6 exs., Dumdum Park Pond, 15.XI.2009; 5 exs., Dumdum Park Pond, 20.XII.2009; 5 exs., Dumdum Park Pond, 17.I.2010; 13 exs., Dumdum Park Pond, 21.II.2010; 18 exs., Dumdum Park Pond, 21.III.2010; 21 exs., Dumdum Park Pond, 18.IV.2010;

Diagnosis : Body broad and oval, maximum width of hemelytra together is almost equal to their length; head as long as the interocular space; anterior tarsus with two segments. Body more than 20 mm. long.

Distribution : India : West Bengal (Kolkata, North 24-Parganas, South 24-Parganas, Bankura; Burdwan, Howrah, Hooghly, Murshidabad), Assam, Bihar, Orissa. Elsewhere : Bangladesh; Pakistan.

Remarks : This species was collected from only Dumdum Park freshwater pond.

9. *Lethocerus indicus* (Lep. & Serv.)

1825. *Belostoma indica* Lepeletier and Serville, *Encycl. Meth,* : 272

2001. Khan, R. A. and Ghosh, L. K. *Rec. zool. Surv. India, Occ. Paper* No. **194** : 42

2007. Thirumalai, G. *Rec. zool. Surv. India. Occ. Paper No.*, **273** : 1-84

Material examined : 1 ex., Rabindrapally Pond, 11.X.2009;

Diagnosis : Body dorsoventrally flattened with large size (70 mm.). Head between eyes with parallel sides; pronotum with a transverse fasciae at the basal end and a fine longitudinal carination in the middle; thick sets of swimming hairs on intermediate and posterior legs on the ventral side.

Distribution : India : West Bengal (Kolkata, North 24-Parganas, Darjeeling, Purulia), Assam,

Bihar, Kerala, Maharashtra, Mizoram, Orissa, Uttar Pradesh. Elsewhere : Burma; Java; Malay Peninsula; Pakistan; Philippines; Sumatra.

Family : PLEIDAE

The members of this family, are commonly called as "Pigmy backswimmers". They are smallest aquatic Hemiptera with compact and strongly arched body. Head relatively large, rostrum short and 3-segmented; antennae short and concealed; legs subequal, tibiae and tarsi not flattened and ciliated along margins; anterior leg modified for grasping.

These insects prefer dense submerged macrophyte strands of *Ceratophyllum* and *Chara*. Where they remain attached or clinging on leaves and stems. They feed vigorously on a variety of micro-invertebrates. The eggs are inserted into macrophytes.

10. ***Plea*** sp.

Material examined : 3 exs., Rabindrapally Pond, 21.III.2010; 2 exs., Majherpara Pond, 21.III.2010; 1 ex., Rabindrapally Pond, 18.IV.2010; 2 exs., Majherpara Pond, 18.IV.2010;

Diagnosis : Body sub-ovate, sub-convexly raised, a bit laterally compressed dorsally; 3-segmented rostrum distinctly longer than broad; pronotum antero-medially scarcely convex; clavus of hemelytra very prominently present.

Family : MESOVELIIDAE

The members of Mesovelidae are known as "Water Treaders" or "Pond weed bugs". Body small, slender, semiaquatic, saw-like ovipositor; thorax divided into 3 simple segments; scutellum exposed.

These insects occupy almost all types of wetland and found near the edge of waterbodies among emergent or floating vegetation and other objects.They run rapidly on the water surface.They feed upon small living or dead insects falling upon the water surface.Females deposit the eggs in the tissue of emergent macrophytes.

11. ***Mesovelia*** sp.

Material examined : 1 ex., Dumdum Park Pond, 21.III.2010; 1 ex., Majherpara Pond, 21.III.2010; 1 ex., Rabindrapally Pond, 18.IV.2010;

Diagnosis : Body elongate with prominent head; eyes large and almost touching anterior margin of pronotum; pronotum with lateral angles tuberculously sub-prominent; 4th segment of antenna longer than 3rd segment.

Family : CORIXIDAE

The Corixids are commonly called as "water boatmen"(usually 2-16mm in length). Body flattened; colour dark grayish with yellow or black markings. Wing membrane without veins. Head triangular; antennae short; concealed; consist of 3-4 segments; scutellum concealed. Front tarsus 1-jointed; flattened and scoop-like called "Pala" which is the characteristics of the family.

Corixids occur in both stagnant and running waters, generally at bottom near the littoral zone. The corixids are good flier and take off easily from the surface of water. They swim by their dorsum.

12. ***Micronecta*** sp.

Material examined : 2 exs., Majherpara Pond, 18.IV.2010;

Diagnosis : Antennae 3-segmented; scutellum exposed; in male 9th segment of abdomen and upper paramere not forming supports for the aedeagus; small species hardly over 4.5mm in length.

Order : COLEOPTERA

Coleoptera is one of the large group of mainly terrestrial but a few aquatic or semiaquatic insects. The aquatic coleopterans are commonly known as water beetles.They are minute to large (0.6-15 cm) in size and usually sclerotised insects. Front wings are much thickened, veinless and meeting in mid dorsal straight line, the hindwings are membranous. Mouthparts biting or chewing type. Antennae 9-11 segmented. Larvae worm-like, usually with 3 pairs of thoracic legs, which are 5 or 6, with 10 segments and sometimes with

prominent circi. The pupae are with appendages and do not form a puparium. The water beetles show wide diversity of colour, form and life pattern.

The aquatic coleopterans are also very diverse in their mode of life and behaviour. Some are very good swimmer and efficient diver and some others are whirling. The feeding habits vary from highly predaceous to scavenger.

Family : HYDROPHILIDAE

The members of this family are commonly termed as water scavenger beetles, are characterized by their short-clubbed antennae. Maxillary palps nearly always longer than the antennae of which the first 3-5 segments are glabrous, the next segment cup like, and the last ones form a strong pubescent club. Head usually with a Y-shaped impressed line on the front. Wings usually with cantharid venation. Habits truly aquatic. Antennal club hairy.

Adults are good fliers and some leave the water and crawl on land.They feed mainly on detritus, algae and decaying vegetative matter.

13. ***Amphiops pedestris*** Sharp

1890 *Amphiops pedestris* sharp, *Trans. Ent. Soc. Lond.*: 354

2001. Khan, R. A. and Ghosh, L. K. *Rec. zool. Surv. India, Occ. Paper* No. **194**: 72

Material examined : 1 ex., Majherpara Pond, 17.I.2010; 3 exs., Dumdum Park Pond, 21.III.2010; 2 exs., Dumdum Park Pond, 18.IV.2010;

Diagnosis : Body rounded and punctate, about 3mm long; head reddish brown, eyes divided by a conspicuous and complete canthus reaching the vertex; prothorax concolourous with head, scutellum triangular; elytra yellowish brown; legs simple, armed with spines; posterior legs without swimming hairs. Ventral surface punctate and dark brown in colour.

Distribution : India : West Bengal (Kolkata, North 24-Parganas), Bihar, Pondicherry and Tamil Nadu.

Remarks : It was found only from Dumdum Park freashwater pond.

14. ***Berosus indicus*** Mots.

1861. *Berosus indicus* Motschulsky, *Bull. Soc. Imp. Nat. Moscou*, **34**: 110.

2001. Khan, R. A. and Ghosh, L. K. *Rec. zool. Surv. India, Occ. Paper* No. **194**: 74.

Material examined : 1 ex., Rabindrapally Pond, 11.X.2009;

Diagnosis : Body elongate with brown to yellow colour and punctate; head markedy deflexed; eyes prominent; antennae 7 - segmented; prothorax brownish yellow, with dense punctures specially on disc of pronotum; scutellum long, triangle; elytra highly patterned, narrowed; legs with long swimming hairs; ventral surface punctate and dark brown in colour.

Distribution : India : West Bengal (Kolkata, North and South 24-Parganas, Murshidabad), Assam, Bihar and Maharashtra.

15. ***Berosus fairmairei*** Zaitzev

1908. *Berosus fairmairei* Zaitzev, *Horae Soc. Ent. Ross*, **38** : 355.

1995. *Berosus fairmairei*, Biswas and Mukhopadhyay, *zool. Surv. India, State Fauna Series* **3** : *Fauna of West Bengal*, Part 6 (A) : 162 - 163.

Material Examined : 1 ex., Rabindrapally Pond, 11.X.2009;

Diagnosis : Body elongate with brown to yellowish colour; eyes prominent; antennae segmented; prothorax brownish yellow; scutellum long; legs with long swimming hairs.

Distribution : India : Manipur; West Bengal; Bihar; Rajasthan; Delhi; Kerala; Andaman Is. Elsewhere : Indo - China, Formosa, Indonesia, Tonkin, Laos, Annam, Siam, F.M.S., Philippines, Nepal, Pakistan, Bangladesh, Myanmar, China, Hongkong, Japan, Taiwan, Thailand, Malaysia.

16. ***Helochares anchoralis*** Sharp

1980. *Helochares anchoralis* Sharp , *Trans.Ent.Soc.Lond.* : 35

2001. Khan, R. A. and Ghosh, L. K. *Rec. zool. Surv. India, Occ. Paper* No. **194**: 69.

Material examined : 1 ex., Rabindrapally Pond, 11.X.2009; 1 ex., Rabindrapally Pond, 15.XI.2009; 1 ex., Kestopur Canal, 15.XI.2009; 2 exs.,

Rabindrapally Pond, 17.I.2010; 1 ex., Majherpara Pond, 17.I.2010; 1 ex., Rabindrapally Pond, 21.II.2010; 2 exs., Rabindrapally Pond, 18.IV.2010;

Diagnosis : Body elongate, about 6mm long, dark brown with blackish patches; head densely punctate, dark posteriorly and with Y-shaped frontal suture; antennae 9-segmented; prothorax densely punctate; scutellum small; elytra densely and evenly punctate; legs with distinct claws and spines; ventral surface dark brown.

Distribution : India : West Bengal (Kolkata, North & South 24-Parganas);

Elsewhere : Indochina, Indonesia and SriLanka.

Remarks : This species was found both from Rabindrapally freashwater pond, sewage-fed Kestopur canal and Majherpara freashwater pond.

17. ***Regimbertia attenuata*** (Fabricius)

1801. *Hydrophilus attenuate* Fabricius, Syst. Eleuth, **1** : 235.

2001. Khan, R. A. and Ghosh, L. K. *Rec. zool. Surv. India, Occ. Paper* No. **194**:74.

Material examined : 1 ex., Rabindrapally Pond, 11.X.2009;

Diagnosis : Strongly convex, elongate, compressed on sides, deep and shinning black and punctate. Head rounded anteriorly; eyes large; antennae 8-segmented; elytra strongly narrowed posteriorly; scutellum elongate and triangled; legs with spines and swimming hairs, mid and hind tibiae with long swimming hairs on inner side. Body black ventrally.

Distribution : India : Bihar, Maharashtra, West Bengal (Kolkata, North 24-Parganas) :

Elsewhere : Sri Lanka, Indochina, China, Cambodia, Sumatra, Philippines, Formosa, Japan and Australia.

18. ***Sternolophus rufipes*** (Fab.)

1792. *Hydrophilus rufipes* Fabricus, *Entom. Syst.* **1** : 183.

2001. Khan, R. A. and Ghosh, L. K. *Rec. zool. Surv. India, Occ. Paper* No. **194**:71.

Material examined : 1 ex., Rabindrapally Pond, 11.X.2009; 1 ex., Kestopur Canal, 17.I.2010;

Diagnosis: Body elongate, shinny black; head with Y-shaped frontal suture, maxillary palpi reddish brown; antennae 9-segmented, brownish black and pubescent; elytra punctured; scutellum triangular; legs at base with silky and dense pubescence; ventral surface black and pubescent.

Distribution : India : West Bengal (Kolkata, North and South 24 Parganas, Burdwan, Murshidabad, Purulia, and Medinipur), Bihar, Kashmir, Maharashtra, Punjab and South India;

Elsewhere : East Asia, Sunda Island.

Remarks : This species was found from Rabindrapally freashwater pond and sewage-fed Kestopur Canal.

Family : DYTISCIDAE

The members of this family of Coleoptera have adapted perfectly well to aquatic life. All adults and larvae are aquatic. These beetles generally occupy clean and fresh macrophytic leaves near the bottom along littoral zone. Some species are known to leave water and fly from one wetland to other. They are active swimmers and swift divers.

Body covered with an adherent layer of grease, which holds dust particles or detritus. They are usually black or brownish black in colour, sometimes marked with dull yellow, orange or bronze shades. Hind coxae very large; hind legs flattened, elongated and hairy; antennae very long, threadlike 11-segmented. The spiracles open in subelytral chambers and help in oxygen supply. During submergence, these beetles utilize the oxygen of the tracheae and subelytral chambers. The beetles can remain in submerged condition only for a very short duration and come to surface for oxygen replacement at the interval of every few minutes. The contact of the terminal spiracles with atmosphere maintains the oxygen supply in elytra. In males of some genera the first three segments of anterior tarsi are greatly swollen to form an acetabulum, which helps in holding two individuals during copulation. The females generally deposit the eggs on floating macrophyte leaves near the shore.

These beetles are highly predaceous and feed vigorously upon almost all invertebrates and fish

eggs and fry. Because of their highly predatory nature, these are commonly known as 'predaceous diving beetles'.

19. ***Canthydrus laetabilis*** (Walker)

1859. *Hydroporus Lactabilis* Walker, *Ann. Mag. Nat. Hist.* **3(2)** : 205

2001. Khan, R. A. and Ghosh, L. K. *Rec. zool. Surv. India, Occ. Paper* No. **194** : 56.

Material examined : 2 exs., Rabindrapally Pond, 21.II.2010; 1 ex., Rabindrapally Pond, 21.III.2010; 1 ex., Kestopur Canal, 21.III.2010; 2 exs., Majherpara Pond, 18.IV.2010;

Diagnosis : Body oblong-oval; head brownish yellow; eyes large; antennae brownish yellow, short and slender; prothorax with its front margin darker and with dark punctures; elytra streamlined, brownish black with two basal orange yellow spots; legs with front tibiae short and its apical spur curved, hind tarsi with swimming hairs, claws simple.

Distribution : India : West Bengal (Kolkata, North and South 24 Parganas), Andhra Pradesh, Assam, Bihar, Kerala, Orissa, Punjab, Rajasthan, Uttar Pradesh.

Remarks : This species occurs both in Rabindrapally and Majherpara freashwater pond, and sewage-fed Kestopur Canal.

20. ***Canthydrus luctuosus*** (Aube)

1838. *Hydrocanthus luctuosus* Aube, *in Dejean's species coleopteres*, Paris, **6** : 408

2001. Khan, R. A. and Ghosh, L. K. *Rec. zool. Surv. India, Occ. Paper* No. **194** : 56.

Material examined : 1 ex., Kestopur Canal, 20.XII.2009; 3 exs., Kestopur Canal, 17.I.2010; 3 exs., Rabindrapally Pond, 21.II.2010; 5 exs., Kestopur Canal, 21.II.2010; 3 exs., Majherpara Pond, 21.II.2010; 21 exs., Kestopur Canal, 21.III.2010; 10 exs., Majherpara Pond, 21.III.2010; 27 exs., Kestopur Canal, 18.IV.2010; 1 ex., Majherpara Pond, 18.IV.2010;

Diagnosis: Body 3.0-3.25 mm. long; head brownish black with anterior portion yellowish; prothorax black merging into orange-yellow on sides; elytra black with orange-yellow markings and ventral surface deep brown.

Distribution : India : West Bengal (Kolkata, North 24-Parganas and South 24-Parganas), Andhra Pradesh, Bihar, Karnataka, Kerala, Maharashtra, Orissa, Tamil Nadu.

Remarks : This species was found from Rabindrapally and Majherpara freashwater pond and sewage-fed Kestopur Canal.

21. ***Hydaticus*** sp.

Material examined : 1 ex., Kestopur Canal, 21.III.2010;

Diagnosis: Suture between the metaepisternum and metasternal wing straight, apical spurs of the hind tibiae blunt; posterior claws unequal.

22. ***Laccophilus anticatus anticatus*** Sharp.

1890. *Laccophilus anticatus* Sharp, *Trans. Ent. Soc. London* :341

2001. Khan, R. A. and Ghosh, L. K. *Rec. zool. Surv. India, Occ. Paper* No. **194** : 58.

Material examined : 1 ex., Majherpara Pond, 20.XII.2009; 1 ex., Majherpara Pond, 21.II.2010; 2 exs., Majherpara Pond, 21.III.2010;

Diagnosis: Body oval, 3.0-3.2 mm. Long; head brownish yellow, and often with faint brownish markings; eyes large; antennae brownish-yellow, long and narrow; prothorax transverse; elytra blackish, with yellow patches on anterior half and a pair of small patches on posterior half, punctures present; hind tarsi with swimming hairs and with a single straight claw.

Distribution : India : West Bengal (Kolkata, Hooghly, Murshidabad, North 24-Parganas), Assam, Bihar, Orissa and Manipur.

Remarks : It was recorded only from Majherpara freshwater pond.

23. ***Laccophilus parvulus parvulus*** Aube

1838. *Laccophilus parvulus* Aube, *in Dejean's species coleopteres, Paris, 6* : 429.

2001. Khan, R. A. and Ghosh, L. K. *Rec. zool. Surv. India, Occ. Paper* **No. 194** : 58.

Material examined : 1 ex., Rabindrapally Pond, 11.X.2009;

Diagnosis : Body elongate, about 3.6 mm. long; head brownish yellow; eyes large; antennae concolourous with head, long and narrow; prothorax transverse, also brownish yellow; elytra testaceous - reddish with zigzag double markings, generally thick and coalescent; hind tarsi with swimming hairs and single, straight claw.

Distribution : India : West Bengal (Medinipur, North 24-Parganas), Andhra Pradesh, Assam, Bihar, Goa, Gujarat, Madhya Pradesh, Maharashtra, Manipur, Orissa, Rajasthan, Tamil Nadu. Elsewhere : West Pakistan, Indochina (Saigon),Thailand, Indonesia, Ceylon.

24. ***Laccophilus basalis*** Mots.

1858. *Laccophilus basalis Mots., Etud. Ent.*, **8** : 45.

Material examined : 1 ex., Rabindrapally Pond, 21.II.2010;

Diagnosis : Elytra testaceous, with irrotations well marked. In males penis very much narrowed in the anterior part.

Distribution : India : West Bengal (North 24-Parganas), Andaman Is.

25. ***Laccophilus flexuosus*** Aube

1838. *Laccophilus flexuosus Aube, in Dejean's species coleopteres*, **6** : 430.

Material examined : 1 ex., Rabindrapally Pond, 15.XI.2009;

Diagnosis : Elytra markings flexuosus, excessively irregular and covering the entire surface excepting the lateral margins.

Distribution: Andhra Pradesh, Bihar, Madhya Pradesh, Maharashtra, Karnataka, Orissa, Rajasthan, Gujarat, Uttar Pradesh, Himachal Pradesh, West Bengal (North 24-Parganas), Tamil Nadu.

26. ***Laccophilus sharpi*** Regimbart

1889. *Laccophilus sharpi Regimbart, Ann. Soc. ent. Fr.*, **9**:151.

Material examined : 4 exs., Rabindrapally Pond, 18.IV.2010;

Diagnosis : Elytra markings consisting of zigzag double lines, clear and thick but never coalesent; pronotum with transverse black markings, in the middle, along the anterior and posterior margines.

Distribution : Bihar, West Bengal (North 24-Parganas), Madhya Pradesh, Maharashtra, Orissa, Rajasthan, Gujarat, Tamil Nadu, Uttar Pradesh, Andaman Is.

Remarks : This species was collected only from Rabindrapally freshwater pond.

Family : CHRYSOMELIDAE

Body oval, minute to small, convex brightly coloured and measure 3.5 to 12mm. long; antennae widely separated at base, not clubbed; head not produced, hypognathous; eyes not prominent; prothorax laterally margined; prosternum broad and pygidium not exposed beyond elytra. Elytra shining. The third tarsal segment is not bilobed and the forecoxae are transverse.

27. ***Cassida*** sp.

Material examined : 1 ex., Majherpara Pond, 11.X.2009;

Diagnosis : Head imbedded in a cavity under the explanate margin of the prothorax. The eyes are black, oblong and convex. The clypeus is elongate, generally broader near the labrum. The antennae in most cases just pass a little beyond the prothorax. Scutellum triangular, with the surface usually smooth and impunctate. Elytra equal to or a little or much broader than the prothorax at the base, convex, the highest point being posterior to the scutellum, and generally punctate - striate.

28. ***Paridea*** sp.

Material examined : 1 ex., Majherpara Pond, 21.III.2010; 3 exs., Majherpara Pond, 18.IV.2010.

Diagnosis : Body oblong, broadened posteriorly. General colour usually brown with black spots and patches on the elytra. Head together with the eyes narrower than the prothorax, somewhat narrowed in front. Eyes convex but not large. Antenna long, slender, extending nearly to the apical area of elytron.

Prothorax quadrate or slightly broader than long. Scutellum small, triangular, surface somewhat convex, smooth, impunctate. Elytra much broader at base than the prothorax; slightly constricted behind the shoulders.

29. ***Altica* sp.**

Material examined : 1 ex., Majherpara Pond, 18.IV.2010.

Diagnosis : The form is generally oblong, the species are always winged, the colour is blue or greenish-blue. They are moreover characterized by having distinct frontal tubercles and a sharp frontal ridge on the head. The second and third antennal segments are of equal thickness, and the third fourth are almost equal in length. The pronotum is furnished, at the base with a relatively deep transverse depression, which is not bounded by a longitudinal fold on each side. The elytra are confusedly punctate. The anterior coxal cavities are open behind.

Family : CARABIDAE

Body oval, broad and somewhat flattened; antennae filiform, conspicuous and project anteriorly; legs adapted for running or burrowing; clypus not extending laterally in front of base of antennae; lacinia without a movable lobe. Majority of Carabidae carnivorous in their larval and adult stage.

30. ***Tetragonoderus arcuatus* Dejean**

1829. *Tetragonoderus arcuatus Dejean*, Spec. gen. col. IV : 495.

1930. *Tetragonoderus arcuatus*, Trans. Ent. Soc. Lond., L XXVIII : 9.

Material examined : 1 ex., Dumdum Park Pond, 15.XI.2009;

Diagnosis : Supraorbital seta present. Crescent shape marking on elytra. Elytra not completely covering the abdomen. Elytra slightly dilated just before apex. Medial line of prothorax nearly reaching both extremity. Labrum, clypeus emarginate.

Distribution : India : West Bengal (North 24-Parganas).

Elsewhere : Aegypten, Sudan, Mesopotamien, Brit. Indien, Birma, Laos.

Family : GYRINIDAE

The Gyrinids or whirling beetles occur in the groups of a few to thousands on the surface of wetlands. They are generally found in almost all types of ponds, lakes, floodplain, and natural wetlands, river pools etc. in the margin areas. They glide about each other in rapid irregular curves near the shore. When undisturbed for longer duration, they float quietly on water surface. When disturbed they fly quickly in all direction.

Beetles are shinny black in colour; oval in shape with some what depressed body, abdomen extending beyond elytra. Compound eyes divided into dorsal and ventral parts; antennae short and thick. The middle and hind legs are greatly flattened paddle-like and fringed, which help in rapid locomotion.

The air supply is being carried under the elytra when submerged. They are reported to be scavengers, feeding upon dead animal matter and vegetation. Gyrinids are found to breed throughout the year in the wetlands of this region. Eggs are laid on submerged macrophyte.

31. ***Dineutus (Protodineutus) indicus* Aube**

1938. *Dineutus indicus* Aube, *Species coleopteres*, **6** : 772 (India - Orient).

1977. *Dineutus (Protodineutus) indicus* : Vazirani, *Newsl. zool. Surv. India*, **3 (5)** : 251, 279.

Material examined : 2 exs., Kestopur Canal, 11.X.2009;

Diagnosis: Body elongate, black, 6-7 mm. long; antennae very short; prothorax black; elytra without pubescene, elytral straiae indistinct or obsolete; pronotum without pubescenece; scutellum invisible.

Distribution : India : Kashmir, Punjab, Himachal Pradesh, Rajasthan, Gujarat, Uttar Pradesh, Bihar, West Bengal (North 24-Parganas), Orissa, Karnataka, Andhra Pradesh, Tamil Nadu.

Remarks : This species was found only from sewage-fed Kestopur Canal.

RESULT

The present contribution is the result of the studies on aquatic insects carried out during 7 months (October, 2009 - April, 2010) of Wetlands of North East Kolkata.

In Rabindrapally freshwater pond of Kestopur, high organic load due to disposal of kitchen refused and other matters. Sparsely infested with submerged as well as floating macrophytes. Not organised fishing but used extensively for bathing, washing, and other domestic purposes. 9 species belonging to the 6 families of Hemiptera where 2 species of Nepidae, 2 species of Gerridae, 2 species of Belostomatidae, 1 species of Notonectidae, Pleidae and Mesoveliidae are collected. 11 species belonging to 2 families of Coleoptera are observed. Here 6 species of Dytiscidae, 5 species of Hydrophilidae are recorded.

In sewage-fed wetlands of Kestopur canal, high organic load due to input of sewage, dense littoral strands of macrophytes *Eichhornea* sp. 3 species belonging to 2 families of Hemiptera are collected. Here, 2 species of Nepidae, 1 species of Belostomatidae are collected. 6 species belonging to 3 families of Coleoptera are observed. Of these, 3 species of Dytiscidae, 1 species of Gyrinidae and Hydrophilidae are identified.

In Dumdum Park freshwater pond, high organic load due to disposal of kitchen refused and other matters. Moderately infested with macrophytes. Seasonal sport fishing and used extensively for bathing, washing and other domestic purposes. 5 species belonging to the 4 families of Hemiptera are observed. Of these, 2 species belong to Nepidae, 1 species each belongs to Belostomatidae, Gerridae and Mesoveliidae. 2 species under 2 families of Coleoptera are noted. Of these, 1 species of Carabidae and 1 species of Hydrophilidae are recorded.

In Majherpara freshwater pond of Kestopur, high organic load due to disposal of kitchen refused and other matters. Sparsely infested with submerged as well as floating macrophytes. Emergent vegetation moderate. Not organised fishing but used extensively for bathing, washing, and other domestic purposes. 8 species belonging to 7 families of Hemiptera are observed. Of these, 2 species of Gerridae, 1 species each of Nepidae, Notonectidae, Belostomatidae, Pleidae, Mesoveliidae and Corixidae are recorded. 9 species belonging to 4 families of Coleoptera are noted. Here, 3 species of Chrysomelidae and Dytiscidae, 2 species of Hydrophilidae are recorded.

Regarding water parameter of the collection media pH value of water was estimated as about 7.5.

DISCUSSION

The species diversity of Hemiptera is maximum in Rabindrapally freshwater pond and minimum in sewage-fed wetland of Kestopur canal. The species diversity of Coleoptera is maximum also in Rabindrapally freshwater pond and minimum in Dumdum Park freshwater pond. The hemipteran population is profusely abundant in Rabindrapally freshwater pond and minimum in sewage-fed Kestopur Canal. The coleopteran population is richly abundant in sewage-fed Kestopur Canal, and minimum in Dumdum Park freshwater pond.

The total number of species of sewage-fed wetland of Kestopur canal is significantly fewer than Rabindrapally freshwater pond and Majherpara freshwater pond of Kestopur, but greater than Dumdum park freshwater pond.

Hemipteran and coleopteran entomofauna contributed moderately and steadily in all wetlands, showing their comparatively lower sensitivity to organic enrichment but their distribution and abundance were heavily dependent of macrophytes. Their quicker movements and tendency to remain on surface films or macrophytes provided them protection from being extensively grazed by fishes.

SUMMARY

The result obtained from the study on diversity of aquatic insects in freshwater wetlands of North Eastern Kolkata during October, 2009 to April, 2010 in 4 different wetlands, two freshwater ponds of Kestopur, 1 freshwater pond near Dumdum park and sewage-fed wetland of Kestopur canal is incorporated in the present work. It deals with 12 species of Hemiptera belonging to the 10 genera and 7 families. Coleoptera is represented by 20 species belonging to 14 genera and 6 families. The fluctuation of population of insect community in 4 different freshwater bodies and the month-wise collection data are shown in charts.

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Table 1: DETAILS OF WETLANDS STUDIED

Month	Wetland	Order	Family	Genus	Species	Ex(s)
October	RabindraPally Pond	Hemiptera	Nepidae	*Ranatra*	*sordidula* Dohrn	3
				Laccotrephes	*griseus* (Guerin)	1
			Notonectidae	*Nychia*	*marshalli* (Scott.)	1
			Gerridae	*Limnogonus*	*nitidus* (Mayr)	3
			Belostomatidae	*Diplonychus*	*rusticus* (Fabr.)	2
				Lethocerus	*indicus* (Lep & Serv.)	1
		Coleoptera	Dytiscidae	*Laccophilus*	*parvulus parvulus* Aube	1
			Hydrophilidae	*Berosus*	*indicus* Mots	1
				Berosus	*fairmairei* Zaitzev	1
				Helochares	*anchoralis* Sharp	1
				Regimbertia	*attenuata* Fab.	1
				Sternolophus	*rufipes* (Fab.)	1
	Kestopur Canal	Hemiptera	Nepidae	*Ranatra*	*sordidula* Dohrn	2
				Laccotrephes	*griseus* (Guerin)	1
			Belostomatidae	*Diplonychus*	*rusticus* (Fabr.)	8
		Coleoptera	Gyrinidae	*Dineutus (Protodineutus)*	*indicus* Aube	2
	Dumdum Park Pond	Hemiptera	Belostomatidae	*Diplonychus*	*annulatum* (Fabr.)	3
	Majherpara Pond	Hemiptera	Nepidae	*Ranatra*	*sordidula* Dohrn	1
			Gerridae	*Limnogonus*	*fossorum* (Fabr.)	4
			Belostomatidae	*Diplonychus*	*rusticus* (Fabr.)	3
		Coleoptera	Chrysomelidae	*Cassida*	sp.	1
November	RabindraPally Pond	Hemiptera	Notonectidae	*Nychia*	*marshalli* (Scott.)	2
			Gerridae	*Limnogonus*	*fossorum (Fabr.)*	1
			Belostomatidae	*Diplonychus*	*rusticus (Fabr.)*	2
		Coleoptera	Dytiscidae	*Laccophilus*	*flexuosus* (Aube)	1
			Hydrophilidae	*Helochares*	sp.	1
	Kestopur Canal	Hemiptera	Belostomatidae	*Diplonychus*	*rusticus* (Fabr.)	9
		Coleoptera	Hydrophilidae	*Helochares*	*anchoralis* Sharp	1
	Dumdum Park Pond	Hemiptera	Nepidae	*Ranatra*	*sordidula* Dohrn	4
			Belostomatidae	*Diplonychus*	*annulatum (Fabr.)*	6
			Gerridae	*Limnogonus*	*fossorum* (Fabr.)	2
		Coleoptera	Carabidae	*Tetragonoderus*	*arcuatus* Dejean	1
	Majherpara Pond	Hemiptera	Notonectidae	*Nychia*	*marshalli* (Scott.)	1
			Belostomatidae	*Diplonychus*	*rusticus* (Fabr.)	5
December	RabindraPally Pond	Hemiptera	Notonectidae	*Nychia*	*marshalli* (Scott.)	3
			Gerridae	*Limnogonus*	*nitidus* (Mayr)	3

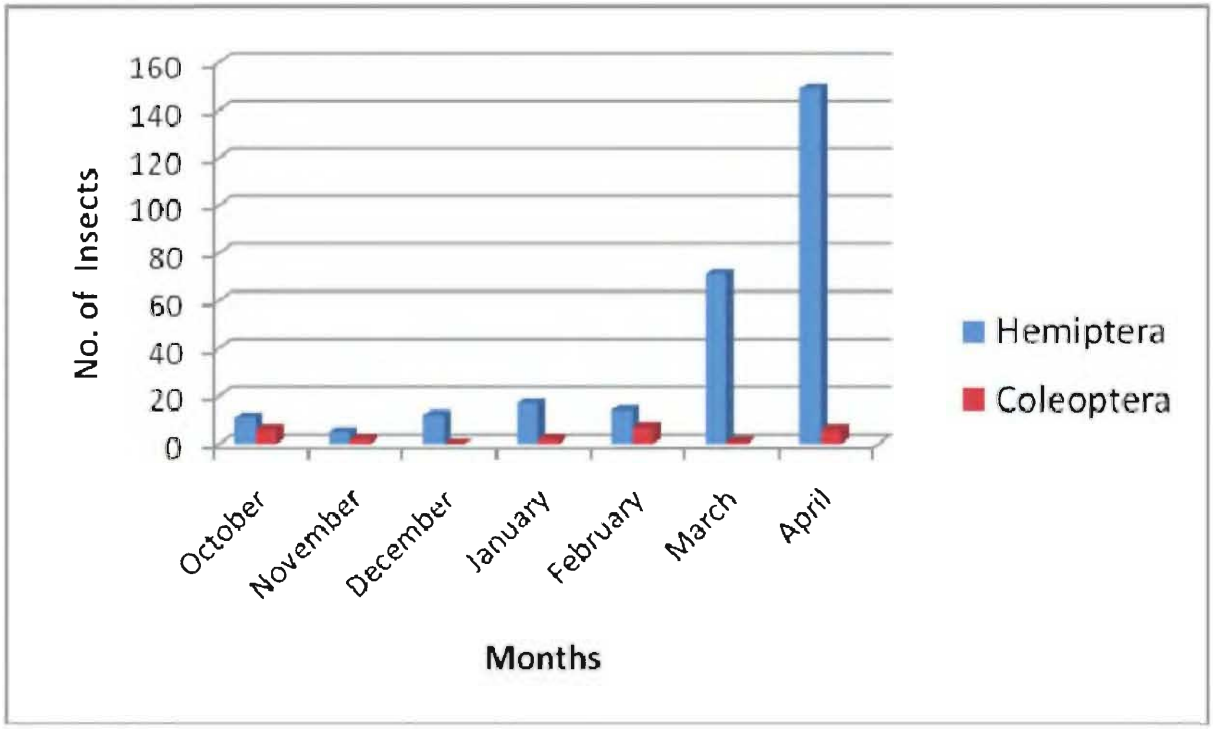
			Belostomatidae	*Diplonychus*	*rusticus* (Fabr.)	6
	Kestopur Canal	Hemiptera	Belostomatidae	*Diplonychus*	*rusticus* (Fabr.)	4
		Coleoptera	Dytiscidae	*Canthydrus*	*luctuosus* (Aube)	1
	Dumdum Park Pond	Hemiptera	Belostomatidae	*Diplonychus*	*annulatum* (Fabr.)	5
	Majherpara Pond	Hemiptera	Nepidae	*Ranatra*	*sordidula* Dohrn	1
			Notonectidae	*Nychia*	*marshalli* (scott.)	1
			Gerridae	*Neogerris*	*parvula* (Stal)	1
			Belostomatidae	*Diplonychus*	*rusticus* (Fabr.)	9
		Coleoptera	Dytiscidae	*Laccophilus*	*anticatus* *anticatus* Sharp	1
January	Rabindra Pally Pond	Hemiptera	Notonectidae	*Nychia*	*marshalli* (Scott.)	7
			Belostomatidae	*Diplonychus*	*rusticus* (Fabr.)	10
		Coleoptera	Hydrophilidae	*Helochares*	*anchoralis* Sharp	2
	Kestopur Canal	Hemiptera	Belostomatidae	*Diplonychus*	*rusticus* (Fabr.)	4
		Coleoptera	Hydrophilidae	*Sternolophus*	*rufipes* (Fab.)	1
			Dytiscidae	*Canthydus*	*luctuosus* (Aube)	3
	Dumdum Park Pond	Hemiptera	Nepidae	*Laccotrephes*	*griseus* (Guerin)	1
			Belostomatidae	*Diplonychus*	*annulatum* (Fabr.)	5
	Majherpara Pond	Hemiptera	Notonectidae	*Nychia*	*marshalli* (Scott.)	2
			Nepidae	*Ranatra*	*sordidula* Dohrn	2
			Belostomatidae	*Diplonychus*	*rusticus* (Fabr.)	4
		Coleoptera	Hydrophilidae	*Amphiops*	*pedestris* Sharp	1
February	RabindraPally Pond	Hemiptera	Nepidae	*Helochares*	*anchoralis* Sharp	1
				Ranatra	*sordidula* Dohrn	1
				Laccotrephes	*griseus* (Guerin)	1
			Notonectidae	*Nychia*	*marshalli* (Scott.)	12
		Coleoptera	Hydrophilidae	*Helochares*	*anchoralis* Sharp	1
			Dytiscidae	*Canthydrus* *Canthydrus* *Laccophilus*	*laetabilis* (Walker) *luctuosus* (Aube) *basalis* Mots.	2 3 1
	Kestopur Canal	Hemiptera	Belostomatidae	*Diplonychus*	*rusticus* (Fabr.)	7
		Coleoptera	Dytiscidae	*Canthydrus*	*luctuosus* (Aube)	5
	Dumdum Park Road	Hemiptera	Nepidae	*Ranatra*	*sordidula* Dohrn	1
			Belostomatidae	*Diplonychus*	*annulatum* (Fabr.)	13
	Majherpara Pond	Hemiptera	Nepidae Notonectidae	*Ranatra* *Nyehia*	*sordidula* Dohrn *marshalli* (Scott.)	1 6

			Belostomatidae	*Diplonychus*	*rusticus* (Fabr.)	5
		Coleoptera	Dytiscidae	*Canthydrus*	*luctuosus* (Aube)	3
				Laccophilus	*anticatus* *anticatus* Sharp	1
March	RabindraPally Pond	Hemiptera	Nepidae	*Ranatra*	*sordidula* Dohrn	3
			Notonectidae	*Nychia*	*marshalli* (Scott.)	38
			Belostomatidae	*Diplonychus*	*rusticus* (Fabr.)	27
			Pleidae	*Plea*	sp.	3
		Coleoptera	Dytiscidae	*Canthydrus*	*laetabilis* (walker)	1
	Kestopur Canal	Hemiptera	Belostomatidae	*Diplonychus*	rusticus (Fabr.)	26
		Coleoptera	Dytiscidae	*Canthydrus*	laetabilis (Walker)	1
				Canthydrus	luctuosus (Aube)	21
				Hydaticus	sp.	1
	Dumdum Park Pond	Hemiptera	Nepidae	*Laccotrephes*	*griseus* (Guerin)	1
			Belostomatidae	*Diplonychus*	*annulatum* (Fabr.)	18
			Mesoveliidae	*Mesovelia*	sp.	1
			Hydrophilidae	*Amphiops*	*pedestreis* Sharp	3
		Coleoptera				
	Majherpara Pond	Hemiptera	Nepidae	*Ranatra*	*sordidula* Dohrn	8
			Notonectidae	*Nychia*	*marshalli* (Scott.)	21
			Belostomatidae	*Diplonychus*	*rusticus* (Fabr.)	58
			Pleidae	*Plea*	sp.	2
			Mesoveliidae	*Mesovelia*	sp.	1
		Coleoptera	Dytiscidae	*Canthydrus*	*luctuosus* (Aube)	10
				Laccophilus	*anticatus* *anticatus* Sharp	2
			Chrysomelidae	*Paridea*	sp.	1
April	RabindraPally Pond	Hemiptera	Nepidae	*Ranatra*	*sordidula* Dohrn	4
			Notonectidae	*Nychia*	*marshalli* (Scott.)	63
			Belostomatidae	*Diplonychus*	*rusticus* (Fabr.)	80
			Pleidae	*Plea*	sp.	1
			Mesoveliidae	*Mesovelia*	sp.	1
		Coleoptera	Hydrophilidae	*Helochares*	*anchoralis* Sharp	2
			Dytiscidae	*Laccophilus*	*sharpi* Regimbart	4
	Kestopur Canal	Hemiptera	Belostomatidae	*Diplonychus*	*rusticus* (Fabr.)	17

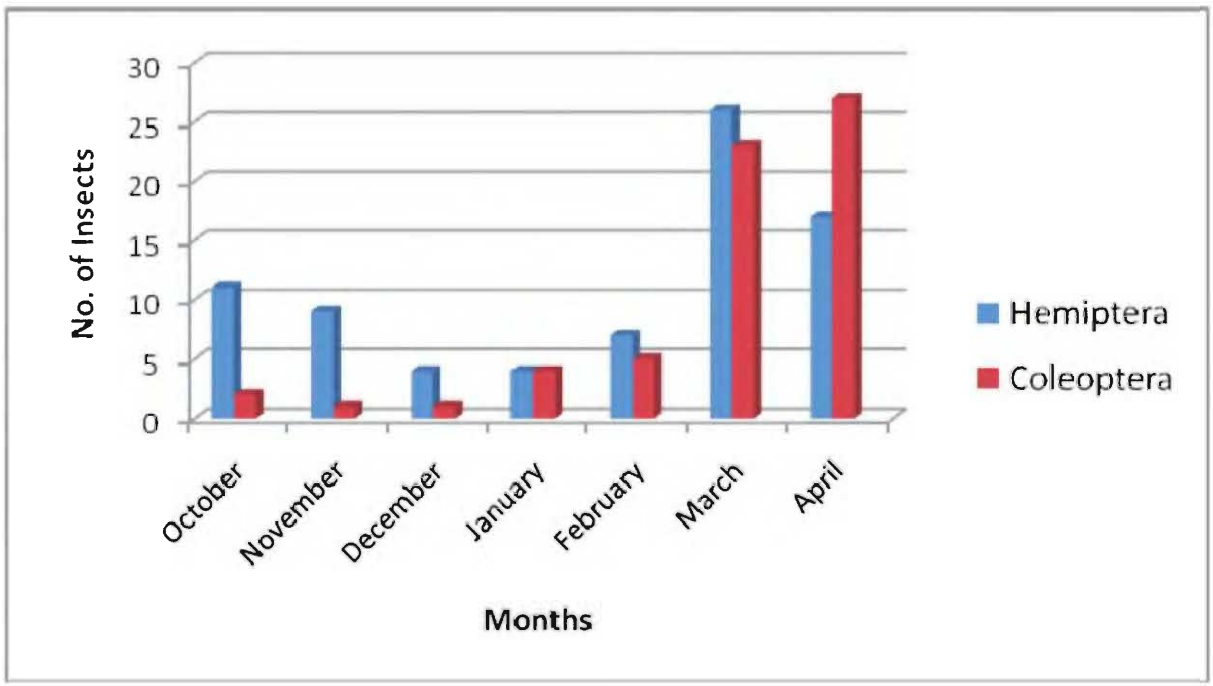
		Coleoptera	Dytiscidae	*Canthydrus*	*luctuosus* (Aube)	27
	Dumdum Park Pond	Hemiptera	Nepidae	*Laccotrephes*	griseus (Guerin)	1
			Belostomatidae	*Diplonychus*	annulatum (Fabr.)	21
		Coleoptera	Hydrophilidae	*Amphiops*	*pedestris* Sharp	2
	Majherpara Pond	Hemiptera	Nepidae	*Ranatra*	*sordidula* Dohrn	16
			Notonectidae	*Nychia*	*marshalli* (Scott.)	10
			Belostomatidae	*Diplonychus*	*rusticus* (Fabr.)	43
			Pleidae	*Plea*	sp.	2
			Corixidae	*Micronecta*	sp.	2
		Coleoptera	Dytiscidae	*Canthydrus*	*laetabilis* (Walker)	2
				Canthydrus	luctuosus (Aube)	1
			Chrysomelidae	*Paridea*	sp.	3
				Altica	sp.	1

BAR DIAGRAMS SHOWING INSECT DIVERSITY IN DIFFERENT FRESHWATER WETLANDS

Rabindrapally Pond



Kestopur Canal



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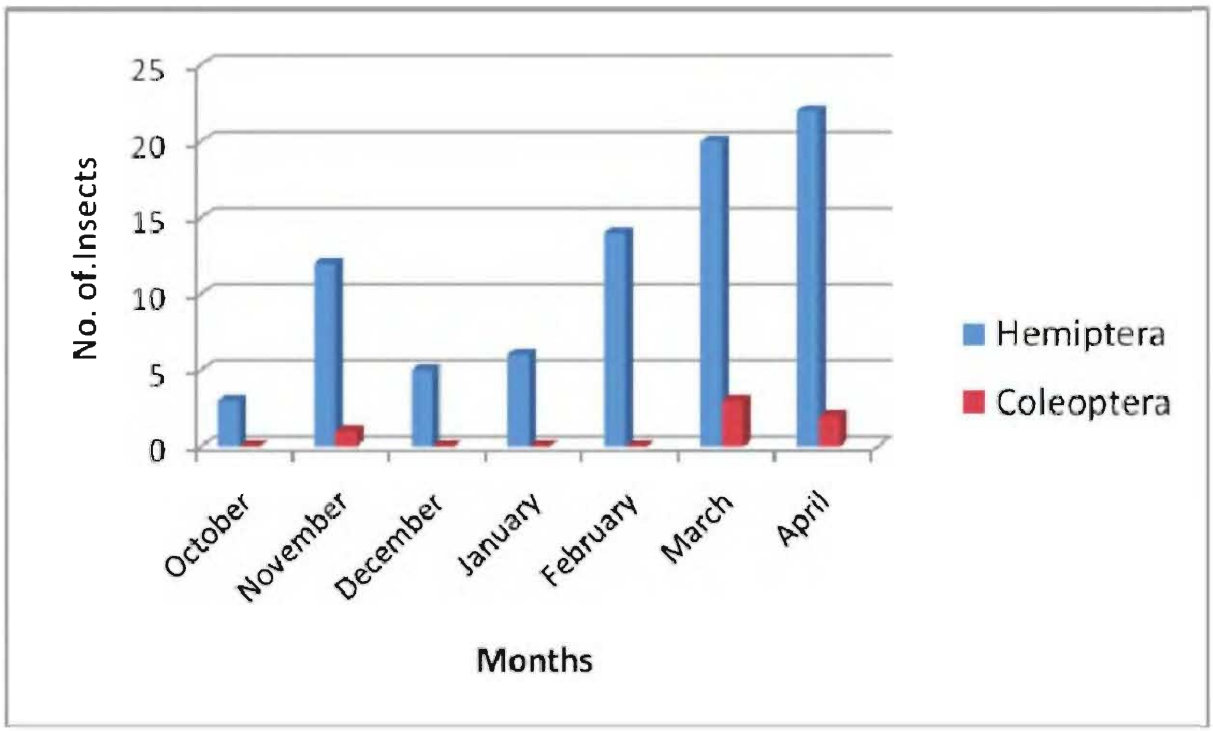
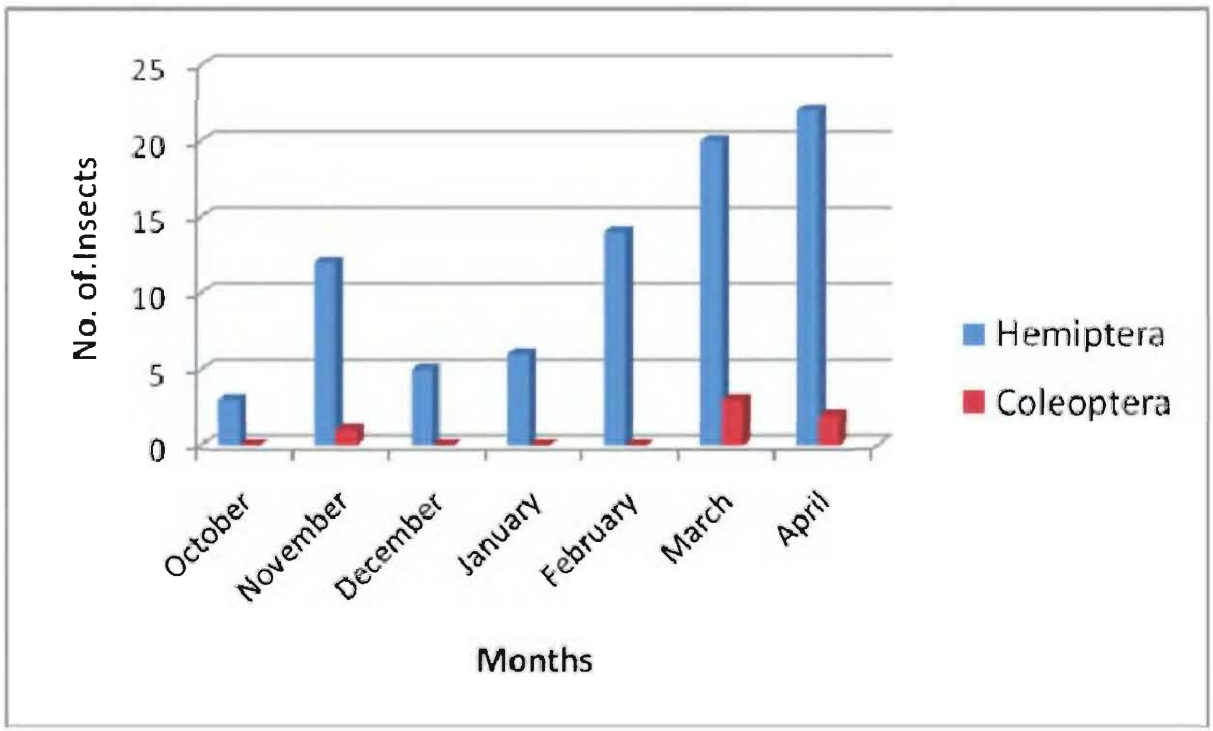


Majherpara Pond



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