

AN APPEAL

Zoological Survey of India (ZSI) is a premier taxonomic research organization, under the Ministry of Environment, Forests and Climate Change (MoEF&CC), Govt. of India, engaged in zoological research and documentation of the faunal resources of the country. It was established on 1st July 1916 to promote the survey, exploration and research on the fauna of the Indian Region.

Zoological Survey of India at the time of its inception had inherited enormous collection of zoological specimens/ exhibits from the erstwhile Asiatic Society of Bengal and the Indian Museum, Kolkata. Since then the Survey has been acting as the custodian of this heritage collection, caring and maintaining them. The collection, comprising the zoological specimens of all groups of animals from microscopic protozoa to huge elephants and whales, is a priceless wealth of the country and is called the “National Zoological Collection” (NZC).

Zoological Survey of India has been making all efforts to enrich its zoological collections by accepting the ‘types’ and other identified faunal materials from animal taxonomists and biodiversity researchers of various zoological institutions and universities in the country and abroad. Zoological Survey of India, Kolkata, including its Regional Centres, has been designated by MoEF&CC to act as the ‘National Repository’ for all faunal groups from India, under the Act, in exercise of the powers conferred by sub-section (1) of Section 39 of the Biological Diversity Act, 2002, read with sections 6 and 12 of Notification S.O. 1911 (E), dated 8th November, 2006.

The zoological collection under the custody of ZSI has grown over the years to become the best and the largest one in South-East-Asia, with the well-represented collections of the fauna of India and adjacent countries, even that of the distant Kampuchea in Southeastern Asia. ZSI has at present in its NZC holding nearly 4.5 million specimens of about 70,000 species, out of the approximately 96,373 species (nearly 8 per cent of the world fauna) so far realized from the Indian Region. Among this collection includes about 18,000 ‘type’ specimens, such as holotypes, paratypes, syntypes, etc., which are unique and of highest scientific importance. They are the original specimens, serving as the voucher specimens, on which new species descriptions have been based. The ‘type specimens’ typify and fix the species/genus name for all time, and remain available for examination, comparison and correction in future studies.

Type specimens and identified reference collections are invaluable to researchers for any taxonomic work as they form the basis for accurate and reliable identification; they are also the fundamental units of bio-resource for new analytical techniques related to higher-level research on taxonomy and systematics (e.g. molecular taxonomy). They represent the irreplaceable national/international asset in perspectives of zoological research and biodiversity informatics.

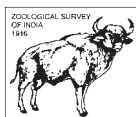
ZSI intends to augment its zoological collection to make it a more complete one, enriching it with species not represented in the collection. Zoological Survey of India is therefore soliciting the

cooperation of the animal taxonomists, biodiversity researchers, scientists and naturalists, appealing to them to deposit their ‘type’ materials—holotype or paratype(s)—and other identified specimens to the ‘National Repository’ of Zoological Survey of India. The researchers may deposit their ‘material’ to ZSI in the following address:

Officer-in-Charge, Identification and Advisory Section,
Zoological Survey of India, M-Block, New Alipore,
Kolkata – 700 053.

The ‘type’ and other identified specimens will be duly registered, and the data will be computerized. The researchers may use the Registration number of their deposited ‘type’(s) in their publications of the new taxon/ taxa.

Dr. K. Venkataraman
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DIVERSITY AND DISTRIBUTION OF HARPACTICOID COPEPODS FROM TAMILNADU COAST, INDIA

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INTRODUCTION

The Harpacticoid Copepod inhabiting the different sediment habitat of Tamilnadu was studied from 2006 and 2007. A brief description of the density, sediment characters, total organic carbon, and vertical distribution in different sediment habitats, diversity and cluster analysis is given. The density of total Copepod individuals in these intertidal sediments ranged from 26 animals/100 cm³ to 1440 animals/100 cm³. Several

genera and species regarded as widespread and cosmopolitan were recorded. The distribution of Copepod species discussed in relation to the nature of the substratum. Highest densities of harpacticoids were recorded at Thondi during 2006 and 2007 (Fig. 2 & 3), while lowest density was observed at Tuticorin and Nagaipattinam respectively during 2006 and 2007. The similarity in the harpacticoid copepod fauna between various stations in the estuary is discussed.

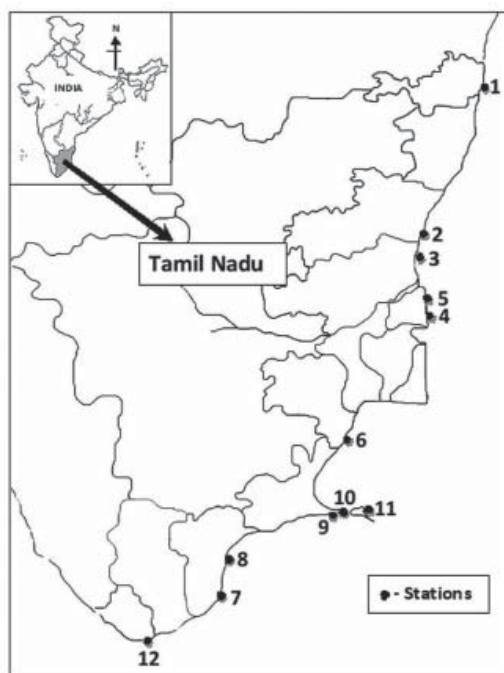


Fig. 1. Study areas

(1. Chennai, 2. Pondicherry, 3. Cuddalore, 4. Karaikal, 5. Nagapattinam, 6. Thondi, 7. Thiruchendur, 8. Tuticorin, 9. Mandapam, 10. Pamban, 11. Rameswaram, 12. Kanyakumari)

MATERIALS AND METHODS

Abundance of meiofauna was analysed in terms of localities within stations using the multivariate analyses cluster analysis and multidimensional scaling MDS. There were performed based on the Bray–Curtis similarity index after fourth root transformation by means of the PRIMER software (Clarke and Warwick, 1994). The significance of differences in spatial variability between localities was determined using One-way analyses of variance (ANOVA). Tests for differences in structure of meiofaunal assemblages were based on k-dominance.

RESULTS

Abundance of harpacticoid copepods

Harpacticoid copepods were the second most dominant group of meiofauna. Their density varied from 85 to 145 ind. 10 cm⁻², 98 to 397 ind. 10 cm⁻², 80 to 475 ind. 10 cm⁻², 45 to 285 ind. 10 cm⁻², 45 to 180 ind. 10 cm⁻², 175 to 530 ind. 10 cm⁻², 120 to 320 ind. 10 cm⁻², 25 to 120 ind. 10 cm⁻², 155 to 235 ind. 10 cm⁻², 125 to 305 ind. 10 cm⁻², 40 to 230 ind. 10 cm⁻² and 90 to 195 ind. 10 cm⁻² at stations 1-12 respectively during 2006 (Table 1-12).

Table-1-12

Table 1. Density of meiofauna communities (ind. 10 cm⁻²) at Station 1 during 2006 and 2007.

2006

S. No.	Fauna	Samples					Total	Mean	SD (±)
		1	2	3	4	5			
1	Harpacticoid copepods	120	145	90	85	105	545	109	24.34

2007

S. No.	Fauna	Samples					Total	Mean	SD (±)
		1	2	3	4	5			
1	Harpacticoid copepods	60	80	215	85	105	545	109	61.38

Table 2. Density of meiofauna communities (ind. 10 cm⁻²) at Station 2 during 2006 and 2007.

2006

S. No.	Fauna	Samples					Total	Mean	SD (±)
		1	2	3	4	5			
1	Harpacticoid copepods	310	157	98	228	397	1190	238	119.09

2007

S. No.	Fauna	Samples					Total	Mean	SD (±)
		1	2	3	4	5			
1	Harpacticoid copepods	120	190	96	45	239	690	138	76.88

Table 3. Density of meiofauna communities (ind. 10 cm⁻²) at Station 3 during 2006 and 2007.**2006**

S. No.	Fauna	Samples					Total	Mean	SD (±)
		1	2	3	4	5			
1	Harpacticoid copepods	475	180	80	120	260	1115	223	156.35

2007

S. No.	Fauna	Samples					Total	Mean	SD (±)
		1	2	3	4	5			
1	Harpacticoid copepods	105	220	520	120	285	1250	250	168.04

Table 4. Density of meiofauna communities (ind. 10 cm⁻²) at Station 4 during 2006 and 2007.**2006**

S. No.	Fauna	Samples					Total	Mean	SD (±)
		1	2	3	4	5			
1	Harpacticoid copepods	285	90	190	45	220	830	166	97.56

2007

S. No.	Fauna	Samples					Total	Mean	SD (±)
		1	2	3	4	5			
1	Harpacticoid copepods	105	120	70	170	310	775	155	93.81

Table 5. Density of meiofauna communities (ind. 10 cm⁻²) at Station 5 during 2006 and 2007.**2006**

S. No.	Fauna	Samples					Total	Mean	SD (±)
		1	2	3	4	5			
1	Harpacticoid copepods	80	90	155	180	45	550	110	55.79

2007

S. No.	Fauna	Samples					Total	Mean	SD (±)
		1	2	3	4	5			
1	Harpacticoid copepods	20	80	10	90	25	225	45	37.08

Table 6. Density of meiofauna communities (ind. 10 cm⁻²) at Station 6 during 2006 and 2007.**2006**

S. No.	Fauna	Samples					Total	Mean	SD (±)
		1	2	3	4	5			
1	Harpacticoid copepods	320	175	210	255	530	1490	298	140.56

2007

S. No.	Fauna	Samples					Total	Mean	SD (±)
		1	2	3	4	5			
1	Harpacticoid copepods	735	345	950	440	230	2700	540	295.91

Table 7. Density of meiofauna communities (ind. 10 cm⁻²) at Station 7 during 2006 and 2007.**2006**

S. No.	Fauna	Samples					Total	Mean	SD (±)
		1	2	3	4	5			
1	Harpacticoid copepods	320	145	230	120	245	1060	212	80.67

2007

S. No.	Fauna	Samples					Total	Mean	SD (±)
		1	2	3	4	5			
1	Harpacticoid copepods	290	440	680	150	215	1775	355	211.36

Table 8. Density of meiofauna communities (ind. 10 cm⁻²) at Station 8 during 2006 and 2007.**2006**

S. No.	Fauna	Samples					Total	Mean	SD (±)
		1	2	3	4	5			
1	Harpacticoid copepods	120	25	90	70	85	390	78	34.75

2007

S. No.	Fauna	Samples					Total	Mean	SD (±)
		1	2	3	4	5			
1	Harpacticoid copepods	45	90	50	70	20	275	55	26.46

Table 9. Density of meiofauna communities (ind. 10 cm⁻²) at Station 9 during 2006 and 2007.**2006**

S. No.	Fauna	Samples					Total	Mean	SD (±)
		1	2	3	4	5			
1	Harpacticoid copepods	205	235	195	215	155	1005	201	29.66

2007

S. No.	Fauna	Samples					Total	Mean	SD
		1	2	3	4	5			
1	Harpacticoid copepods	220	180	265	330	205	1200	240	59.06

Table 10. Density of meiofauna communities (ind. 10 cm⁻²) at Station 10 during 2006 and 2007.**2006**

S. No.	Fauna	Samples					Total	Mean	SD (±)
		1	2	3	4	5			
1	Harpacticoid copepods	125	140	170	225	305	965	193	73.37

2007

S. No.	Fauna	Samples					Total	Mean	SD (±)
		1	2	3	4	5			
1	Harpacticoid copepods	160	120	220	270	380	1150	230	101.49

Table 11. Density of meiofauna communities (ind. 10 cm⁻²) at Station 11 during 2006 and 2007.**2006**

S. No.	Fauna	Samples					Total	Mean	SD (±)
		1	2	3	4	5			
1	Harpacticoid copepods	120	80	230	110	40	580	116	70.92

2007

S. No.	Fauna	Samples					Total	Mean	SD (±)
		1	2	3	4	5			
1	Harpacticoid copepods	60	105	155	60	245	625	125	77.70

Table 12. Density of meiofauna communities (ind. 10 cm⁻²) at Station 12 during 2006 and 2007.**2006**

S. No.	Fauna	Samples					Total	Mean	SD (±)
		1	2	3	4	5			
1	Harpacticoid copepods	90	120	95	100	195	600	120	43.45

2007

S. No.	Fauna	Samples					Total	Mean	SD (±)
		1	2	3	4	5			
1	Harpacticoid copepods	180	157	133	75	125	670	134	39.40

1	Harpacticoid copepods	120	145	90	85	105	545	109	24.34
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During 2007, the fluctuation was from 60 to 215 no/10 cm², 45-239 no/10 cm², 105-520 no/10 cm², 70-310 no/10 cm², 10-90 no/10 cm², 230-950 no/10 cm², 150-680 no/10 cm², 20-90 no/10 cm², 180-330 no/10 cm², 120-380 no/10 cm², 60-245 no/10 cm² and 75-180 no/10 cm² at stations 1-12.

The mean harpacticoid copepods density ranged between 75 no/10 cm² and 298 no/10 cm² during 2006 and between 45 no/10 cm² and 540 no/10 cm² during 2007. Highest densities of harpacticoids were recorded at station 6 during 2006 and 2007 (Fig. 2 & 3), while lowest density was observed at stations 8 and 5 respectively during 2006 and 2007 (Fig. 2 & 3).

Species composition of harpacticoid copepods

A total of 9 species belonging to 9 genera were recorded. The number of species in stations various ranged between 4 and 9. The dominant harpacticoid copepods were *Leptastacus* sp. (1.69-10.43%), *Diathrodes* sp. (1.36-7.12%), *Tisbe furcata* (1.19-6.99%) and *Euterpina acutifrons* (0-5.96%). Three species namely *Leptastacus* sp, *Tisbe furcata* and *Diathrodes* sp. occurred in all the 12 stations, two other species namely (*Metis* sp. and *Cylindropsyllus* sp.) were occurred sporadically.

Family level composition of harpacticoid copepods

A total of 8 families namely Canullidae, Tachidiidae, Thalestridae, Diosaccidae, Cylindropsyllidae, Metidae, Tisbidae, and Tetragnonicipitidae were identified. The dominant families were in descending order Cylindropsyllidae (1.69-11.38%), Thalestridae (1.36-7.12%) and Tisbidae (1.19-6.99%).

Families such as Canullidae and Tetragnonicipitidae were occurred sporadically in less numbers.

Diversity indices of harpacticoid copepods

The highest diversity was observed in station 9, which was more sandy in nature (Table 13). The lowest was observed at station 4; it must be also stated that the sediment here was muddy.

Table 13. Diversity of harpacticoids species at various stations of Tamil Nadu Coast during 2006 and 2007.

Stations	S	N	D	J'	H'(log ²)	1-Lambda'
1	6	109	1.066	0.9673	2.5	0.823
2	9	238	1.462	0.7999	2.536	0.7551
3	8	223	1.295	0.8853	2.656	0.8053
4	4	166	0.5869	0.9745	1.949	0.7384
5	7	110	1.276	0.8495	2.385	0.7718
6	6	298	0.8776	0.9135	2.361	0.781
7	5	212	0.7467	0.9814	2.279	0.791
8	5	78	0.9181	0.903	2.097	0.7529
9	9	201	1.508	0.9401	2.98	0.8628
10	8	193	1.33	0.9669	2.901	0.863
11	8	116	1.473	0.9256	2.777	0.8391
12	5	120	0.8355	0.9647	2.24	0.7843

Note- (S = Number of species; N = Number of animals; D = Margalef Richness; J' Evenness; H = Shannon - Wiener diversity, 1- Lambda – Simson richness).

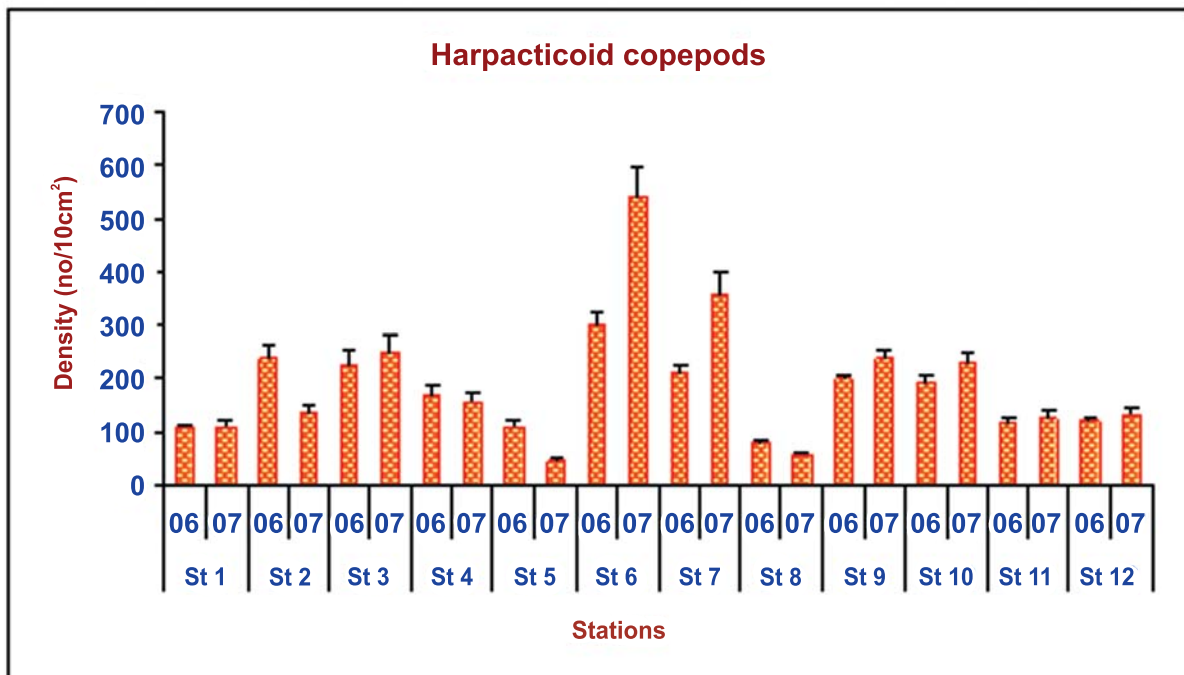


Fig. 2. Mean density of harpacticoid copepods of Tamil Nadu coast during 2006 and 2007 (average of five replicates)

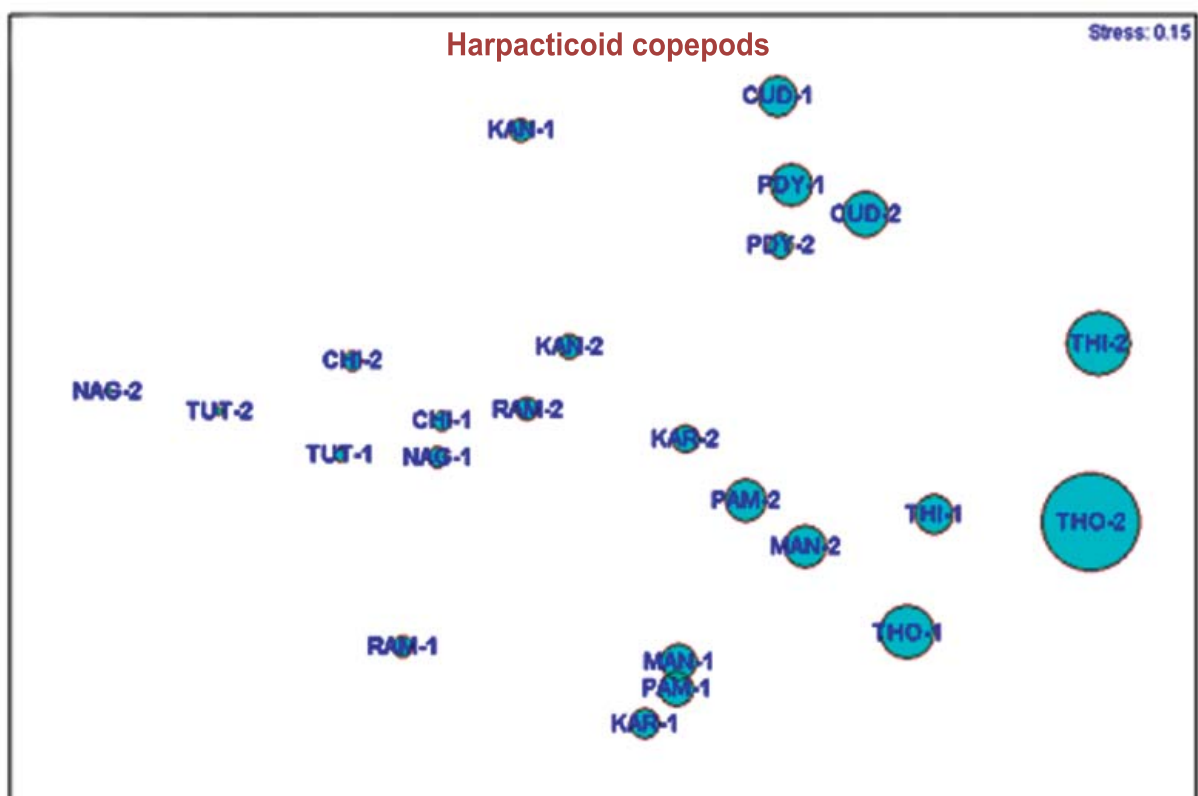


Fig. 3. MDS for harpacticoid copepods of Tamil Nadu coast during 2006 and 2007. CHI-Chennai; PDY-Puducherry; CUD-Cuddalore; KAR-Karaikal; NAG Nagapattinam; THO-Thondi; THI-Thiruchendur; TUT-Tuticorin; MAN Mandapam; PAM-Pamban; RAM Rameswaram; KAN Kanyakumari; 1 2006: 2-2007.

No significance differences in the abundance of harpacticoid copepod between the station ($p > 0.05$ level) (Table 14).

Table 14. One-way ANOVA of all species of harpacticoid copepods and different stations.

Factor	SS	Df	Ms	F(cal)	P(F≤F(cal))		F(0.05)
A (Between Groups)	5360.00	11	487.27	1.208	N.S. ($P > 0.05$)	0.292	1.890
R(A) (Within Groups)	38732.67	96	403.47				
AR (Total)	44092.67	107					

The k-dominance curves for the harpacticoid copepod species and stations show that in terms of dominance and diverse are not similar (Fig. 4). The k-dominance curves were no significant different from the stations. Nonetheless, at stations 8 is the most highly dominated. Probably because station 8 is situated very close to Tuticorin Port,

which was highly polluted. In general harpacticoid copepods are decreasing with increasing pollution. These findings support the results of ANOVA and MDS analysis. The differences between the other stations are less amenable interpretation as the curves cross (Fig. 4).

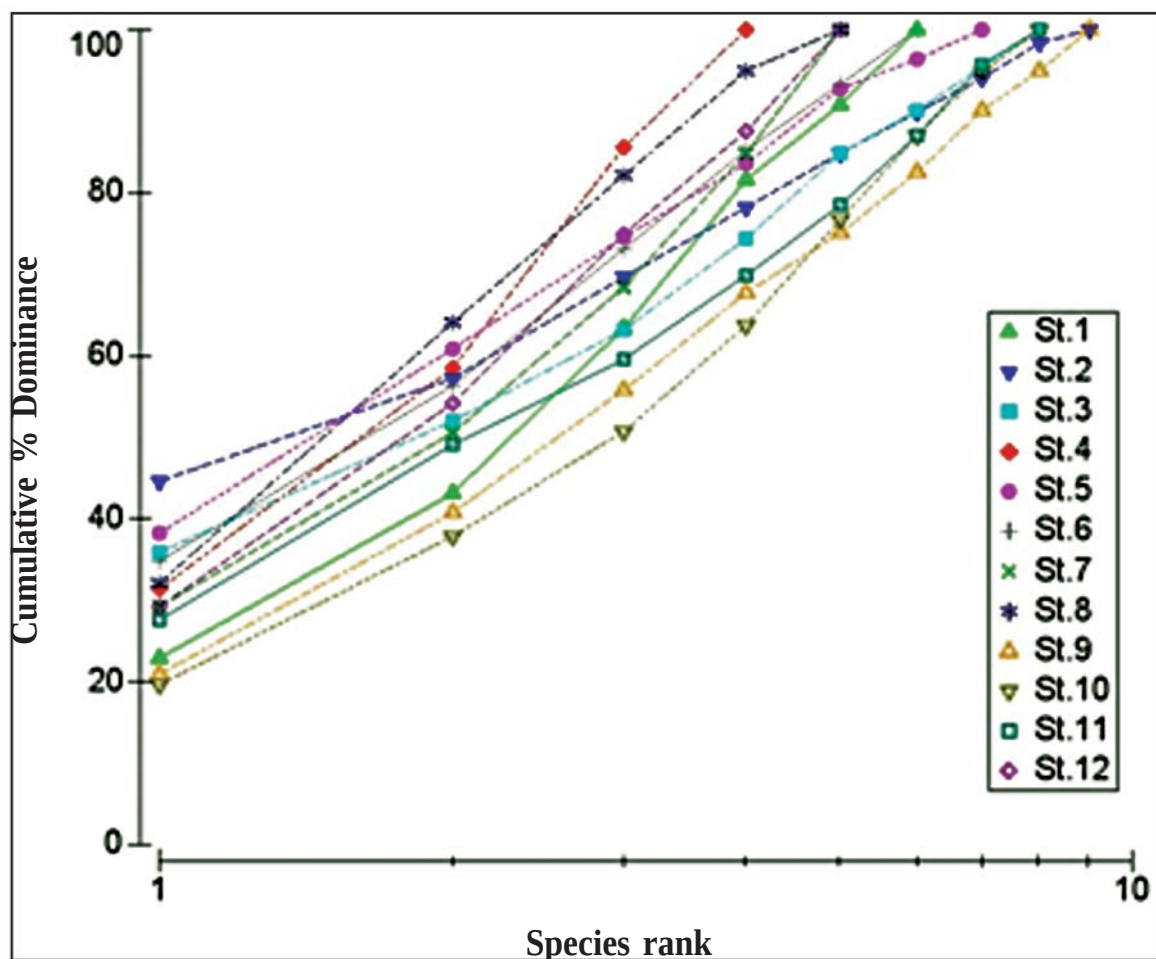


Fig. 4. k-dominance curves for harpacticoid copepods species at the 12 stations of Tamil Nadu coast.

Vertical distribution of harpacticoid copepods

The abundance of the harpacticoid copepods was maximum (130 ind. 10 cm⁻²; 12% of the total fauna) in the top portion 2-4 cm of the sandy sediment (Fig. 5a, b, c & 12). In muddy sediments, the density was highest (290 ind. 10 cm⁻²; 15% of the total abundance) in the top portion (0-2 cm) the sediment (Figs. 5d, e, f, g, h, j & k).

Different portion of sandy sediments showed the abundance of 12-128 ind. 10 cm⁻², 8-80 ind.

10 cm⁻² and 3-30 ind. 10 cm⁻² at 0-2 cm, 4-6 cm and 6-10 cm respectively. In muddy sediments, harpacticoid copepods varied from 12 to 185 ind. 10 cm⁻², 5 to 60 and 6 to 10 ind. 10 cm⁻² at 2-4 cm, 4-6 cm and 6-10 cm depth intervals respectively.

The harpacticoid copepods were totally absent at the depth of 10-15 cm depth interval in both the sediment types. In this study, abundance of harpacticoid copepods were decreasing with increasing depth (Fig. 5).

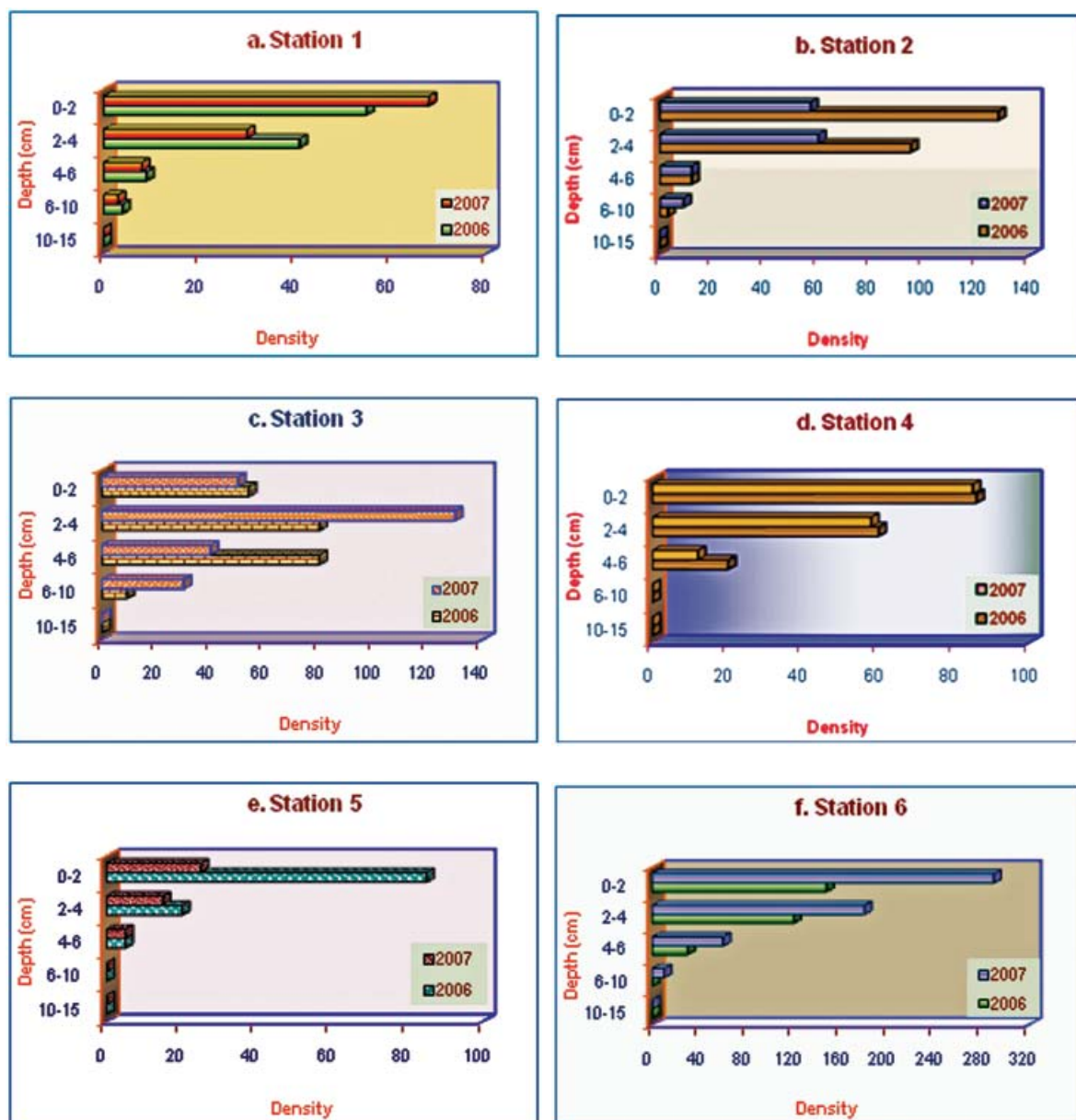


Fig. 5. Vertical distribution of harpacticoids of Tamil Nadu coast at stations 1-6.

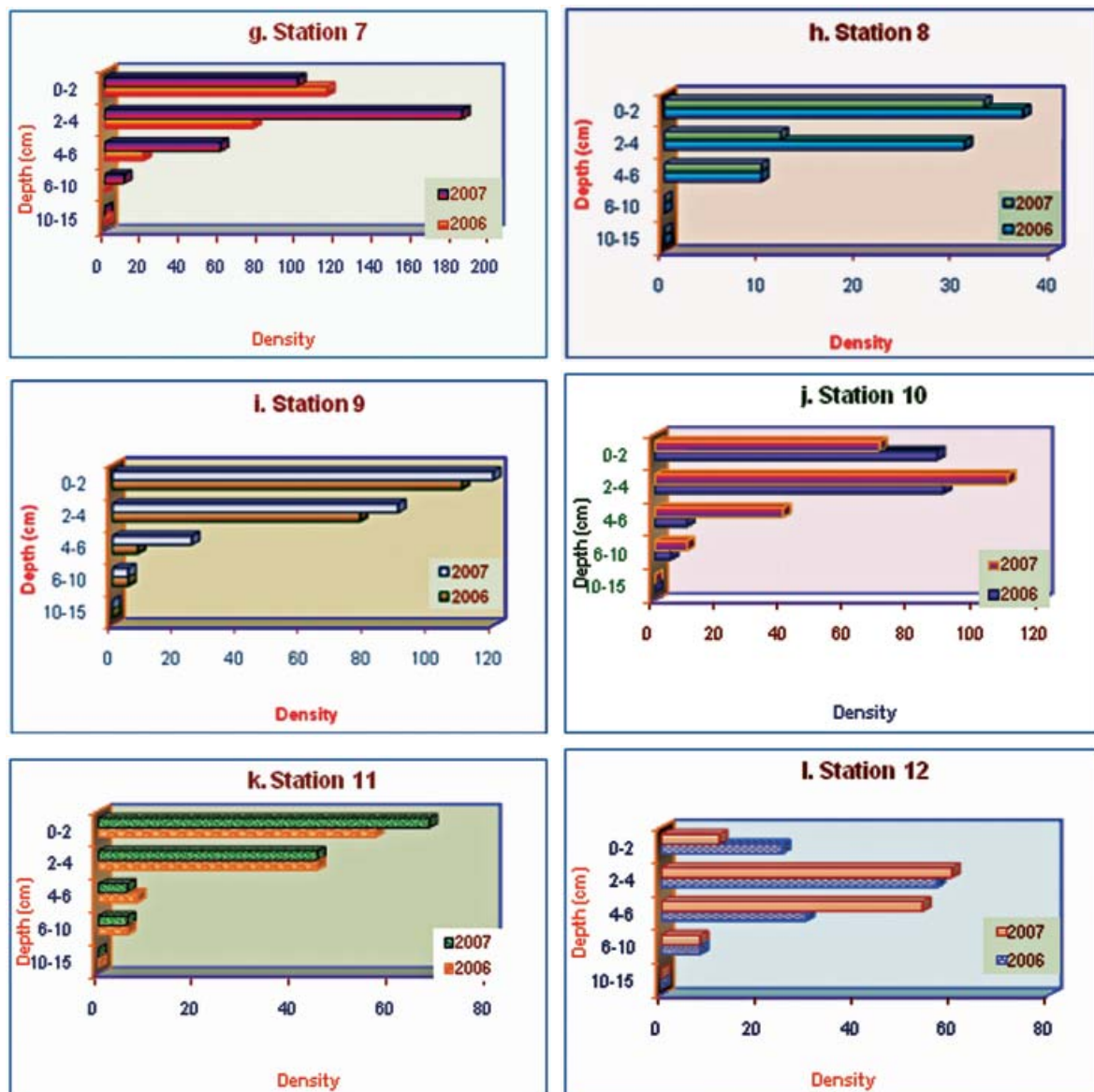


Fig. 5. Vertical distribution of harpacticoids of Tamil Nadu coast at stations 7-12.

DISCUSSION

Meiofauna densities in the seagrass bed were significantly related, with a time log, to change in bacterial standing stock, indicating that microbes may be an important resource (Danovaro, 1996). The increase of detritus, which provides the main food for the distribution and abundance of meiofauna, is suggested to be the reason for the high meiofauna densities observed in the seagrass bed.

Harpacticoid copepods ranked to be second. The highest diversity was observed in Mandapam,

which was more sandy in nature (Table, 13). The lowest was observed at Karaikal; it must be also stated that the sediment here was muddy. The abundance of the harpacticoid copepods was maximum (130 ind. 10 cm⁻²; 12% of the total fauna) in the top portion 2-4 cm of the sandy sediment. In muddy sediments, the density was highest (290 ind. 10 cm⁻²; 15% of the total abundance) in the top portion (0-2 cm).

Harpacticoid copepods were found as the most abundant meiofaunal taxa in both seagrass blades and canopy sediment or detritus (Hicks and Coull,

1983). This study in general, harpacticoid copepods were increased in coarser sand. However, a lower density of harpacticoid copepods was observed at Nagapattinam (station 5) and Tuticorin (station 8). It is situated near the harbour, which was considerably organically enriched due to harbour activities. The copepods are generally susceptible to pollution stress. Moreover, harpacticoids are more sensitive to pollutants than nematodes, which make them good indicators of pollution (Coull and Chandler, 1992, Mc.Lachlan and Brown, 2006).

SUMMARY

The present study has been undertaken to provide information on the species composition, community structure and vertical distribution of meiofauna and the taxonomy of the most dominant group i.e. nematodes on intertidal areas of Tamil Nadu coast, India. As a result of the present study it could be understood that, Harpacticoid copepods ranked to be second. In general, harpacticoid copepods were increased in coarser sand. However, a lower density of harpacticoid copepods was observed at Nagapattinam (station 5) and Tuticorin (station 8). It is situated near

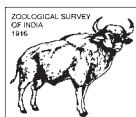
the harbour, which was considerably organically enriched due to harbour activities. The copepods are generally susceptible to pollution stress. Secondly, at stations 11 (Rameswaram) and 12 (Kanyakumari) were also lowest density of meiobenthic community. Probably due to that fact of human impact. Rameswaram and Kanyakumari stations are a favorite tourist spot of south India and attracts thousands of people every day. Because, the famous temple is situated in Rameswaram, it was highly disturbed by human interference. There are anthropogenic activities in the beaches causing disturbance which may be the possible reason for less diversity of meiofauna compared to protected and undisturbed sandy beaches. Organic enrichment has been seen to influence the density of harpacticoid copepods.

ACKNOWLEDGEMENTS

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REFERENCES

- Clarke, K.R and Warwick, R.M. 1994. Similarity-based testing for community pattern: The two-way layout with no replication. *Marine biology*. Berlin, Heidelberg, **118**: 167-176.
- Coull B.C, Chandler G.T. 1992. Pollution and meiofauna- field, laboratory, and mesocosm studies. *Oceanog. Mar. Biol. Ann. Rev.*, **30**: 191-271.
- Danovaro, R. 1996. Detritus-bacteria-meiofauna interactions in a seagrass bed *Posidonia oceanica* of the NW Mediterranean, *Marine Biology*, **127**(1), 1-13.
- Hicks, G.R.F. and B.C. Coull, 1983. The ecology of marine meiobenthic harpacticoid copepods. *Ocea. Mar. Biol. Ann. Rev.*, **21**: 67-175.
- Mc.Lachlan, A. and Brown, A.C. (2006) The ecology of sandy shores. Academic Press, Burlington, Massachusetts.



A CHECKLIST OF APHELINIDAE (HYMENOPTERA: CHALCIDOIDEA) OF INDIA

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INTRODUCTION

The family Aphelinidae is a small group of Chalcidoidea, containing 36 genera and more than thousand species globally and a major source of biocontrol agents of economically important pest species (Noyes, 2003). Generally, majority of the aphelinids are known as parasitoids of sternorrhynchous Homoptera. Species of the genera like *Encarsia* Foerster (Polaszek *et al.*, 2004), and *Eretmocerus* Haldeman (Rose and Zolnerowich, 1997) attack Aleyrodidae while the members of the genus *Aphelinus* Dalman attack mostly aphids (Hayat, 1998). Many genera develop by consuming scale- insects belonging to the families Coccidae, Diaspididae, Pseudococcidae, Acleridae, Cerococcidae, Asterolecaniidae, Margarodidae, Tachardiidae, Kermococcidae, Eriococcidae, Lecanodiaspididae, Kermococcidae, Eriococcidae, Lecanodiaspididae and Psyllidae either as endo or as ectoparasitoids (Viggiani, 1984, Polaszek, 1991 and Hayat, 1998).

The genus *Centrodora* Foerster attack eggs of orthopterous (tettigoniids) and homopterous (cercopids) insects. One exception is *C. speciosissima* Stanley that parasitises pupae of dipterous, chalcid and proctotrupid insects. *Centrodora darwini* (Girault) is an extremely polyphagous, facultative hyperparasitoid (Hayat, 1998). Members of the genus *Euryischia* are parasitoids of dipterous larvae/pupae, while species of the genera like *Ablerus* Howard,

Marietta Motschulsky and *Promuscidea* Girault are hyperparasitoids (Hayat, 1998). *Euryischomyia washingtoni* Girault is a parasitoid of mealybugs whereas *E. flavithorax* Girault & Dodd is a hyperparasitoid via chalcidoids and braconids (Carvar, 1995) and *Eutrichosomella blattophaga* Girault was reared from blattid ootheca (Girault, 1915). The males of a number species develop as hyperparasitoids of coccoids via their eulophid, aphelinid or encyrtid primary parasitoids. A number of aphelinids are internal parasitoids of the eggs of various Auchenorrhyncha, Reduvioidea, Lepidoptera or Orthoptera, whilst very few develop on larvae or pupae of Dryinidae (Hymenoptera) (Viggiani, 1984).

Hayat (1998) in his book on "Aphelinidae of India (Hymenoptera: Chalcidoidea) - A taxonomic revision" provided key to the twenty-one genera and 180 species of aphelinids occurring in India, and in fact he is the major contributor of aphelinid taxonomy in India. Subba Rao (1957, 1970, 1980 and 1984), Subba Rao and Rai (1969), De Bach and Rosen (1976), Rosen and De Bach (1977, 1979 and 1986), Rosen and Rose (1989), Mani (1989), Menakadevi and Manickavasagam (2011 and 2012) and Manickavasagam and Menakadevi (2012) were the other taxonomists who made contributions to the taxonomy of Indian aphelinids.

Hayat (2010, 2011a & b, 2012) published additional aphelinid papers on the genera like,

Ablerus, *Coccophagus* Westwood, *Centrodora*, *Encarsia* and *Proaphelinoides* Girault. All aphelinid taxonomy papers with reference to India were reviewed and compiled here as a Checklist which includes a total of 269 species under 24 genera upto December, 2013.

Order HYMENOPTERA

Superfamily CHALCIDOIDEA

Family APHELINIDAE

Genus ***Ablerus*** Howard, 1894

1. *Ablerus aleuroides* (Husain & Agarwal, 1982)
Distribution: Uttar Pradesh (Husain & Agarwal, 1982).
 2. *Ablerus aligarhensis* (Khan & Shafee, 1976)
Distribution: Uttar Pradesh (Khan & Shafee, 1976).
 3. *Ablerus aonidiellae* Hayat, 1974a
Distribution: Rajasthan (Hayat, 1974a); Uttar Pradesh (Hayat, 1998).
 4. *Ablerus bharathius* (Subba Rao, 1984)
Distribution: Andhra Pradesh, Karnataka, Tamil Nadu and Uttar Pradesh (Hayat, 1998).
 5. *Ablerus chionaspidis* (Howard, 1914)
Distribution: Karnataka, Tamil Nadu and Uttar Pradesh (Hayat, 1986).
 6. *Ablerus connectens* Silvestri, 1927
Distribution: Karnataka (Hayat & Anis, 2004); Tamil Nadu (Menakadevi & Manickavasagam, 2011).
 7. *Ablerus delhiensis* (Lal, 1938)
Distribution: Bihar, Haryana, Madhya Pradesh, Odisha and Uttar Pradesh (Hayat, 1998).
 8. *Ablerus gargarae* Hayat, 1998
Distribution: Tamil Nadu (Hayat, 1998).
 9. *Ablerus inquirenda* Silvestri, 1927
Distribution: Tamil Nadu (Hayat, 1998).
 10. *Ablerus perspeciosus* Girault, 1916
Distribution: Jammu & Kashmir and Uttar Pradesh (Hayat, 1998).
 11. *Ablerus williamsi* (Annecke & Insley, 1970)
Distribution: Assam, Odisha (Hayat & Khan, 2010); Tamil Nadu, Kerala (Menakadevi & Manickavasagam, 2011).
 12. *Ablerus xenex* Hayat, 2010
Distribution: Sikkim (Hayat & Khan, 2010).
- Genus ***Aphelinus*** Dalman, 1820
13. *Aphelinus abdominalis* (Dalman, 1820)
Distribution: Andhra Pradesh, Assam, Himachal Pradesh, Jammu & Kashmir, Karnataka, Kerala, Meghalaya, Punjab, Rajasthan, Tamil Nadu and West Bengal (Hayat, 1998).
 14. *Aphelinus accuminatus* Hayat, 1998
Distribution: Meghalaya (Hayat, 1998).
 15. *Aphelinus albipodus* Hayat & Fatima, 1992
Distribution: Andhra Pradesh, Jammu & Kashmir, Karnataka, Rajasthan and Tamil Nadu (Hayat & Fatima, 1992).
 16. *Aphelinus ancer* Hayat, 1990
Distribution: Karnataka (Hayat, 1990)
 17. *Aphelinus argiope* Walker, 1839
Distribution: Himachal Pradesh and Uttar Pradesh (Hayat, 1986).
 18. *Aphelinus asychis* Walker, 1839
Distribution: Himachal Pradesh, Jammu & Kashmir, Karnataka, Meghalaya, Uttar Pradesh and West Bengal (Hayat, 1986).
 19. *Aphelinus basilicus* Hayat, 1998
Distribution: Andhra Pradesh, Assam,

- Bihar, Goa, Daman & Diu and West Bengal (Hayat, 1998); Tamil Nadu (Menakadevi & Manickavasagam, 2011).
20. *Aphelinus desantisi* Hayat, 1972a
Distribution: Nagaland (Tripathi, 1995); Punjab (Hayat, 1972a); Karnataka, Rajasthan and Uttar Pradesh (Hayat, 1986); Tamil Nadu (Menakadevi & Manickavasagam, 2011).
21. *Aphelinus gossypii* Timberlake, 1924
Distribution: Bihar (Ahmad & Singh 1996); Himachal Pradesh (Thakur *et al.*, 1988); Jammu & Kashmir and Uttar Pradesh (Hayat, 1986).
22. *Aphelinus humilis* Mercet, 1927
Distribution: Uttar Pradesh and West Bengal (Hayat, 1986).
23. *Aphelinus lankaensis* Hayat, 1994
Distribution: Karnataka (Hayat, 1994).
24. *Aphelinus mali* (Haldeman, 1851)
Distribution: Andhra Pradesh, Himachal Pradesh, Jammu & Kashmir, Kerala and Tamil Nadu (Hayat, 1998).
25. *Aphelinus megadontus* Hayat, 1998
Distribution: Sikkim (Hayat, 1998).
26. *Aphelinus polaszeki* Hayat, 1998
Distribution: Himachal Pradesh (Hayat, 1998).
27. *Aphelinus semiflavus* Howard, 1908
Distribution: India (Hayat, 1998).
28. *Aphelinus sharpae* Hayat, 1998
Distribution: Assam and Meghalaya (Hayat, 1998).
- Genus **Aphytis** Howard, 1900
29. *Aphytis alami* Agarwal, 1964
Distribution: Uttar Pradesh (Agarwal, 1964).
30. *Aphytis aligarhensis* Hayat, 1998
Distribution: Uttar Pradesh (Hayat, 1998).
31. *Aphytis bangalorensis* Rosen & DeBach, 1986
Distribution: Karnataka (Rosen & DeBach, 1986).
32. *Aphytis chrysomphali* (Mercet, 1912)
Distribution: India (Hayat, 1986).
33. *Aphytis diaspidis* (Howard, 1881)
Distribution: Bihar, Jammu & Kashmir and Uttar Pradesh (Hayat, 1998).
34. *Aphytis florinae* Rosen & Rose, 1989
Distribution: Assam (Rosen & Rose, 1989).
35. *Aphytis fisheri* DeBach, 1959
Distribution: India (Hayat, 1986).
36. *Aphytis gordonii* DeBach & Rosen, 1976
Distribution: Karnataka (Hayat, 1998).
37. *Aphytis hispanicus* (Mercet, 1912)
Distribution: Assam and Uttar Pradesh (Hayat, 1998).
38. *Aphytis holoxanthus* DeBach, 1960
Distribution: Karnataka and Tamil Nadu (Hayat, 1986).
39. *Aphytis lepidosaphes* Compere, 1955
Distribution: India (Hayat, 1986).
40. *Aphytis linganensis* Compere, 1955
Distribution: Assam, Delhi, Karnataka, Kerala, Tamil Nadu and Uttar Pradesh (Hayat, 1998).
41. *Aphytis maculatus* (Shafee, 1970)
Distribution: Tamil Nadu (Hayat, 1986).
42. *Aphytis maculicornis* (Masi, 1911)
Distribution: India (Hayat, 1986).
43. *Aphytis manii* Hayat, 1998
Distribution: Karnataka (Hayat, 1998).

44. *Aphytis melinus* DeBach, 1959
Distribution: Delhi, Karnataka, Maharashtra, Pondicherry and Tamil Nadu (DeBach, 1959).
45. *Aphytis mytilaspidis* (Le Barron, 1870)
Distribution: India (Hayat, 1986).
46. *Aphytis paramaculicornis* DeBach & Rosen, 1976
Distribution: Jammu & Kashmir (Amin Masoodi & Trali, 1987).
47. *Aphytis peculiaris* (Girault, 1932)
Distribution: Bihar and Delhi (Hayat, 1998).
48. *Aphytis philippiensis* DeBach & Rosen, 1976
Distribution: Assam, Karnataka and Tamil Nadu (DeBach & Rosen, 1976, Fry, 1989, Hayat, 1986 and Rosen & DeBach, 1979).
49. *Aphytis proclia* (Walker, 1839)
Distribution: Himachal Pradesh (Hayat, 1998) and Jammu and Kashmir (Amin Masoodi & Trali, 1987).
50. *Aphytis sankarani* Rosen & DeBach, 1986
Distribution: Karnataka (Fry, 1989 & Rosen & DeBach, 1986).
51. *Aphytis theae* (Cameron, 1891)
Distribution: Assam and Himachal Pradesh (Hayat, 1998).
 Genus **Botryoideclava** Subba Rao, 1980
52. *Botryoideclava bharatiya* Subba Rao, 1980
Distribution: Maharashtra (Jadhav & Varma, 2001); Uttar Pradesh (Hayat, 1998); Andhra Pradesh (Manickavasagam & Menakadevi, 2012).
 Genus **Centrodora** Foerster, 1878
53. *Centrodora azimi* Hayat, 1973
Distribution: Andhra Pradesh (Hayat, 1986).
54. *Centrodora bahara* Hayat, 2010
Distribution: Uttar Pradesh (Hayat, 2010).
55. *Centrodora bifasciata* Hayat, 1988
Distribution: Assam (Hayat, 1988).
56. *Centrodora flemingiae* Hayat, 2012
Distribution: Jharkhand
57. *Centrodora ghorpadei* Hayat, 1998
Distribution: Karnataka (Hayat, 1998).
58. *Centrodora hamira* Hayat, 2010
Distribution: Himachal Pradesh and Odisha (Hayat, 2010).
59. *Centrodora hexatricha* Erdos & Novicky, 1953
Distribution: Assam (Hayat & Zeya 1993).
60. *Centrodora idioceri* Ferriere, 1931
Distribution: Assam, Bihar, Goa, Daman & Diu, Jammu & Kashmir, Tamil Nadu and Uttar Pradesh (Hayat, 1998).
61. *Centrodora lakma* Hayat, 2010
Distribution: Uttar Pradesh (Hayat, 2010).
62. *Centrodora lineascapa* Hayat, 1998
Distribution: Uttar Pradesh (Hayat, 1998), Kerala, Tamil Nadu (Menakadevi & Manickavasagam, 2011).
63. *Centrodora mala* Hayat, 2010
Distribution: Odisha (Hayat, 2010).
64. *Centrodora mandiana* Hayat, 2010
Distribution: Himachal Pradesh (Hayat, 2010).
65. *Centrodora oophaga* (Girault, 1917)
Distribution: Tamil Nadu (Hayat, 1998).
66. *Centrodora ossira* Hayat, 2010
Distribution: Odisha (Hayat, 2010).
67. *Centrodora pathania* Hayat, 2010
Distribution: Punjab (Hayat, 2010).

68. *Centrodora tetratricha* Hayat, 2010
Distribution: Uttar Pradesh (Hayat, 2010).
69. *Centrodora utara* Hayat, 2010
Distribution: Uttar Pradesh (Hayat, 2010).
Genus **Coccobius** Ratzeburg, 1852
70. *Coccobius amala* Hayat and Khan, 2012
Distribution: Uttar Pradesh (Hayat & Khan, 2012).
71. *Coccobius aligarhensis* (Hayat, 1974a)
Distribution: Uttar Pradesh (Hayat, 1998).
72. *Coccobius aspidiellae* Hayat 2010
Distribution: Kerala (Hayat & Khan, 2010).
73. *Coccobius assamensis* Hayat, 2010
Distribution: Assam (Hayat & Khan, 2010).
74. *Coccobius ceroplastidis* (Agarwal, 1964)
Distribution: Uttar Pradesh (Hayat, 1998).
75. *Coccobius comperei* (Hayat, 1971)
Distribution: Karnataka and Kerala (Hayat, 1998).
76. *Coccobius confusus* (Compere & Annecke, 1961)
Distribution: India (Hayat, 1985).
77. *Coccobius cosibus* Hayat, 2010
Distribution: Himachal Pradesh, Meghalaya and Odisha (Hayat & Khan, 2010), Tamil Nadu (Manickavasagan & Menakadevi, 2012).
78. *Coccobius debachi* (Compere & Annecke, 1961)
Distribution: India (Hayat, 1985).
79. *Coccobius flaviceps* (Girault & Dodd, 1915 in Girault, 1915)
Distribution: India (Hayat, 1971).
80. *Coccobius fulvus* (Compere & Annecke, 1961)
Distribution: Karnataka (Hayat, 1986) Maharashtra (Agarwal, 1964 & Shafee *et al.*, 1988).
81. *Coccobius himalayanus* Hayat, 2010 (in Hayat & Khan, 2010).
Distribution: Himachal Pradesh (Hayat & Khan, 2010).
82. *Coccobius himpradianus* Hayat, 2010 (in Hayat & Khan, 2010).
Distribution: Himachal Pradesh (Hayat & Khan, 2010).
83. *Coccobius mirus* Hayat, 1998
Distribution: Andhra Pradesh, Assam and Uttar Pradesh (Hayat, 1998), Tamil Nadu (Menakadevi & Manickavasagam, 2011).
84. *Coccobius phoebus* Hayat, 2010 (in Hayat & Khan, 2010)
Distribution: Himachal Pradesh, Karnataka, Odisha and Uttar Pradesh (Hayat & Khan, 2010).
85. *Coccobius reticulatus* (Compere & Annecke, 1961)
Distribution: Andhra Pradesh, Delhi, Karnataka, Kerala, Maharashtra and Uttar Pradesh (Hayat, 1998); Tamil Nadu (Menakadevi & Manickavasagam, 2011).
86. *Coccobius subflavus* (Annecke & Insley, 1970)
Distribution: India (Noyes, 2012).
87. *Coccobius udakamundus* Hayat, 1998
Distribution: Tamil Nadu (Hayat, 1998).
88. *Coccobius zalama* Hayat & Khan, 2012
Distribution: Uttar Pradesh
Genus **Coccophagoides** Girault, 1915
89. *Coccophagoides orientalis* (Agarwal, 1964)
Distribution: Bihar, Rajasthan, Uttar Pradesh (Hayat, 1998); Tamil Nadu (Menakadevi & Manickavasagam, 2012).

90. *Coccophagoides utilis* Doult, 1966
Distribution: Bihar (Hayat, 1998).
Genus ***Coccophagus*** Westwood, 1833a
91. *Coccophagus acanthosceles* Waterston, 1916
Distribution: Assam (Hayat, 1986).
92. *Coccophagus anthracinus* Compere, 1925
Distribution: Delhi (Hayat, 1986)
93. *Coccophagus assamensis* Hayat, 1993
Distribution: Assam (Hayat, 1993).
94. *Coccophagus atratus* Compere, 1926
Distribution: Delhi (Hayat, 1986).
95. *Coccophagus bivittatus* Compere, 1926
Distribution: Haryana, Rajasthan, Tamil Nadu, Uttar Pradesh (Hayat, 1998).
96. *Coccophagus bogoriensis* (Koningsberger, 1897)
Distribution: Andhra Pradesh, Assam, Karnataka, Kerala (Hayat, 1998).
97. *Coccophagus burksi* Hayat, 1971
Distribution: Puducherry (Hayat, 1998); Tamil Nadu (Menakadevi & Manickavasagam, 2011).
98. *Coccophagus candidus* Hayat, 1993
Distribution: Assam (Hayat, 1993).
99. *Coccophagus ceroplastae* (Howard, 1895)
Distribution: widely distributed recorded from several Indian states (Hayat, 1998), Meghalaya (Hayat & Khan, 2010).
100. *Coccophagus chloropulvinariae* Hayat, 1974b
Distribution: Assam (Hayat, 1993) Uttar Pradesh (Hayat, 1974b).
101. *Coccophagus clavatus* Husain & Agarwal, 1982
Distribution: Andhra Pradesh (Husain & Agarwal, 1982).
102. *Coccophagus copernicus* Husain & Agarwal, 1982
Distribution: Andhra Pradesh (Husain & Agarwal, 1982).
103. *Coccophagus cowperi* Girault, 1917
Distribution: Andhra Pradesh, Goa, Kerala, Karnataka, Maharashtra, Puducherry and Tamil Nadu (Hayat, 1998).
104. *Coccophagus dius* Hayat, 1998
Distribution: Karnataka (Hayat, 1998).
105. *Coccophagus flavicarpus* Husain & Agarwal, 1982
Distribution: Andhra Pradesh (Husain & Agarwal, 1982).
106. *Coccophagus flavifrons* Howard, 1885
Distribution: Delhi (Hayat, 1986).
107. *Coccophagus formicariae* Hayat, 1998
Distribution: Assam (Hayat, 1998).
108. *Coccophagus fumadus* Hayat, 2010 (in Hayat & Khan, 2010).
Distribution: Odisha (Hayat & Khan, 2010); Kerala (Menakadevi & Manickavasagam, 2011).
109. *Coccophagus gilvus* Hayat, 1971
Distribution: Goa (Hayat, 1998); Tamil Nadu (Menakadevi & Manickavasagam, 2011).
110. *Coccophagus indochraceus* Hayat, 1998
Distribution: Uttar Pradesh (Hayat, 1998).
111. *Coccophagus insignis* Hayat & Zeya, 1993
Distribution: Assam (Hayat & Zeya, 1993).
112. *Coccophagus longiclavatus* Shafee, 1972
Distribution: Assam, Bihar, Karnataka, Uttar Pradesh (Hayat, 1998).
113. *Coccophagus longicornis* Hayat, 1971
Distribution: Punjab (Hayat, 1998); Kerala (Menakadevi & Manickavasagam, 2011).

114. *Coccophagus longifasciatus* Howard, 1907
Distribution: Odisha (Hayat & Khan, 2010).
115. *Coccophagus longipedicellus* Shafee, 1972
Distribution: Andaman & Nicobar Islands, Karnataka (Hayat, 1998); Tamil Nadu (Menakadevi & Manickavasagam, 2011).
116. *Coccophagus lutescens* Compere, 1931
Distribution: Rajasthan (Hayat, 1998).
117. *Coccophagus lycimnia* (Walker, 1839)
Distribution: Karnataka (CIBC, 1976).
118. *Coccophagus mangiferae* (Dozier, 1932)
Distribution: Tamil Nadu, Uttar Pradesh (Hayat & Viggiani, 1984).
119. *Coccophagus meghaianus* Hayat, 2010 (in Hayat & Khan, 2010).
Distribution: Meghalaya (Hayat & Khan, 2010).
120. *Coccophagus narendrani* Hayat & Zeya, 1993
Distribution: Kerala (Hayat & Zeya, 1993).
121. *Coccophagus nigricarpus* Shafee, 1972
Distribution: Andhra Pradesh (Hayat, 1998).
122. *Coccophagus ochraceus* Howard, 1895
Distribution: Uttar Pradesh (Hayat, 1986).
123. *Coccophagus ophicus* Husain & Agarwal, 1982
Distribution: Andhra Pradesh (Husain & Agarwal, 1982).
124. *Coccophagus parlobatae* Hayat, 2007
Distribution: Karnataka (Hayat, 2007).
125. *Coccophagus perhispidus* Girault, 1926
Distribution: Delhi (Hayat, 1986).
126. *Coccophagus prinslooii* Hayat, 1998
Distribution: Karnataka (Hayat, 1998).
127. *Coccophagus pseudococci* Compere, 1933
Distribution: Andaman & Nicobar Islands, Bihar, Delhi, Goa, Himachal Pradesh, Karnataka, Maharashtra, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh (Hayat, 1998).
Distribution: Delhi (Hayat, 1986).
128. *Coccophagus samarae* Hayat, 1998
Distribution: Tamil Nadu (Hayat, 1998).
129. *Coccophagus sexvittatus* Hayat, 1974b
Distribution: Madhya Pradesh (Hayat, 1998).
130. *Coccophagus shafeei* Hayat, 1974b
Distribution: Goa, Karnataka (Hayat, 1998).
131. *Coccophagus shillongensis* Hayat & Singh, 1989
Distribution: Meghalaya (Hayat & Singh, 1989).
132. *Coccophagus silvestrii* Compere, 1931
Distribution: Uttar Pradesh (Hayat, 1998).
133. *Coccophagus subflavescens* Hayat, 1971
Distribution: Uttar Pradesh (Hayat, 1998).
134. *Coccophagus sudhiri* Hayat, 1993
Distribution: Assam (Hayat, 1993).
135. *Coccophagus tschirchii* Mahdihassan, 1923
Distribution: Assam, Bihar, Jammu & Kashmir, Karnataka, Punjab, West Bengal (Hayat, 1998).
136. *Coccophagus zebratus* Howard, 1907
Distribution: Karnataka (Hayat, 2012).
137. *Coccophagus zeyai* Hayat, 1998
Distribution: Tamil Nadu (Hayat, 1998).
Genus ***Diaspiniphagus*** Silvestri, 1927
138. *Diaspiniphagus decorus* Hayat, 2011a
Distribution: Uttar Pradesh (Hayat, 2011a).

- Genus ***Encarsia*** Foerster, 1878
139. *Encarsia acaudaleyrodis* Hayat, 1976
Distribution: Delhi, Rajasthan, Tamil Nadu (Hayat, 1976); Uttar Pradesh (Hayat, 2011b).
 140. *Encarsia albiscutellum* (Girault, 1913)
Distribution: Uttar Pradesh (Hayat, 2011b).
 141. *Encarsia aseta* Hayat & Polaszek, 1992
Distribution: Maharashtra (Hayat, 1998); Uttar Pradesh (Hayat, 2011b).
 142. *Encarsia asfar* Hayat, 2011b
Distribution: Uttar Pradesh (Hayat, 2011b).
 143. *Encarsia assamensis* Hayat, 2011b
Distribution: Assam (Hayat, 2011b).
 144. *Encarsia asterobemisiae* Viggiani and Mazzone, 1980
Distribution: Himachal Pradesh (Hayat, 2011b).
 145. *Encarsia aurantii* (Howard, 1894)
Distribution: Andhra Pradesh, Karnataka (Hayat, 1998), Tamil Nadu (Menakadevi & Manickavasagam, 2011).
 146. *Encarsia azimi* Hayat, 1986
Distribution: Himachal Pradesh, Punjab, Tamil Nadu, Uttar Pradesh, Odisha (Hayat, 1998); Meghalaya, Assam, Uttarkhand, Karnataka (Hayat, 2011b).
 147. *Encarsia bangalorensis* Hayat, 1989
Distribution: Karnataka (Hayat, 1998).
 148. *Encarsia bennetti* Hayat, 1984
Distribution: Maharashtra, Uttar Pradesh (Hayat, 1998).
 149. *Encarsia bimaculata* Heraty & Polaszek, 2000
Distribution: Assam, Karnataka, Maharashtra, Odisha and West Bengal (Hayat, 2011b).
 150. *Encarsia bolangeri* Hayat, 2011b
Distribution: Karnataka (Hayat, 2011b).
 151. *Encarsia borkusiensis* Hayat, 2011b
Distribution: Assam (Hayat, 2011b).
 152. *Encarsia boswelli* (Girault, 1915)
Distribution: Karnataka, Tamil Nadu (Polaszek & Hayat, 1992).
 153. *Encarsia brevicar* Hayat, 2011b
Distribution: Goa (Hayat, 2011b).
 154. *Encarsia brevivalvula* Hayat, 1989
Distribution: Uttar Pradesh (Hayat, 1998), Tamil Nadu (Menakadevi & Manickavasagam, 2011).
 155. *Encarsia brevivena* Hayat, 1989
Distribution: Karnataka (Hayat, 1989).
 156. *Encarsia brimblecombei* (Girault, 1933)
Distribution: Assam (Hayat, 1989).
 157. *Encarsia cibensis* Lopez-Avila, 1987
Distribution: India (Schmidt *et al.*, 2001).
 158. *Encarsia citrina* (Craw, 1891)
Distribution: Meghalaya, Karnataka (Hayat, 2011b).
 159. *Encarsia clypealis* (Silvestri, 1927)
Distribution: Andhra Pradesh, Assam, Karnataka, Maharashtra, Tamil Nadu, Uttar Pradesh (Hayat, 1998).
 160. *Encarsia coimbatorensis* Hayat, 1989
Distribution: Tamil Nadu (Hayat, 1998).
 161. *Encarsia confusa* Hayat, 1989
Distribution: Bihar and Uttar Pradesh (Hayat, 1998).
 162. *Encarsia colima* Myartseva, 2005
Distribution: Tamil Nadu (Menakadevi & Manickavasagam, 2011).
 163. *Encarsia davidi* Viggiani and Mazzone, 1980

- Distribution:* Rajasthan and Uttar Pradesh (Hayat, 2011b).
164. *Encarsia dialeurodis* Hayat, 1989
Distribution: Uttar Pradesh (Hayat, 1998).
165. *Encarsia diaspidicola* (Silvestri, 1909)
Distribution: Meghalaya (Hayat, 2011b).
166. *Encarsia dispersa* Polaszek, 2004 (In Polaszek *et al.*, 2004)
Distribution: Karnataka, Kerala and Lakshadweep Islands (Hayat, 2011b).
167. *Encarsia divergens* (Silvestri, 1926)
Distribution: Assam (Hayat, 1998).
168. *Encarsia duorunga* Hayat, 1989
Distribution: Uttar Pradesh (Hayat, 1998), Tamil Nadu (Menakadevi & Manickavasagam (2012); Assam, Meghalaya, Uttarakhand and West Bengal (Hayat, 2011b).
169. *Encarsia elegans* Masi, 1911
Distribution: Bihar, Delhi and Uttar Pradesh (Hayat, 1998); Assam, Himachal Pradesh, Meghalaya and Uttarakhand (Hayat, 2011a).
170. *Encarsia elongata* (Dozier, 1937)
Distribution: Assam (Hayat, 1998).
171. *Encarsia farmani* Hayat, 2011b
Distribution: Uttarakhand (Hayat, 2011b).
172. *Encarsia flavoscutellum* Zehntner, 1900
Distribution: Assam (Hayat, 1998).
173. *Encarsia guadeloupae* Viggiani, 1987
Distribution: Bangaluru (Antony *et al.*, 2006); Andhra Pradesh, Kerala (Hayat, 2011b); Tamil Nadu (Menakadevi & Manickavasagam, 2011).
174. *Encarsia gunturensis* (Azim & Shafee, 1980)
Distribution: Andhra Pradesh, Tamil Nadu and Uttar Pradesh (Hayat, 1998).
175. *Encarsia hitam* Hayat, 2011b
Distribution: Meghalaya, Uttarakhand, Uttar Pradesh (Hayat, 2011b); Tamil Nadu (Menakadevi & Manickavasagam, 2011).
176. *Encarsia hragila* Hayat, 2011b
Distribution: Uttar Pradesh (Hayat, 2011b).
177. *Encarsia inaron* (Walker, 1839)
Distribution: Karnataka, Uttar Pradesh (Hayat, 2011b).
178. *Encarsia indica* (Shafee, 1973)
Distribution: Puducherry (Hayat, 1998).
179. *Encarsia inida* Hayat, 2011b
Distribution: Sikkim (Hayat, 2011b).
180. *Encarsia interstrica* Huang & Polaszek, 1998
Distribution: West Bengal (Hayat, 2011b).
181. *Encarsia isaaci* Mani, 1941
Distribution: Andhra Pradesh, Odisha, Tamil Nadu and Uttar Pradesh (Hayat, 1998).
182. *Encarsia ixorae* Krishnan & Vasantharaj David, 1996
Distribution: Tamil Nadu (Hayat, 1998).
183. *Encarsia jowaiana* Hayat, 2011b
Distribution: Meghalaya (Hayat, 2011b).
184. *Encarsia khadijae* Hayat, 2011b
Distribution: Odisha, Uttarakhand, Uttar Pradesh (Hayat, 2011b).
185. *Encarsia lahorensis* (Howard, 1911)
Distribution: Bihar (Hayat, 1998).
186. *Encarsia levo* Hayat, 2006
Distribution: West Bengal (Hayat, 2006).
187. *Encarsia lipaleyrodia* Krishnan & Vasantharaj David, 1996
Distribution: Tamil Nadu (Krishnan & Vasantharaj David, 1996).

188. *Encarsia liliyingae* Viggiani and Ren
Distribution: Assam (Hayat, 1998).
189. *Encarsia longicauda* Hayat, 1989
Distribution: Andhra Pradesh, Rajasthan and Tamil Nadu (Hayat, 1998) Orissa (Hayat, 2011b).
190. *Encarsia longifasciata* Subba Rao, 1984
Distribution: Karnataka (Hayat, 1998).
191. *Encarsia lounsburyi* (Berlese and Paoli, 1916)
Distribution: Sikkim (Hayat, 2011b).
192. *Encarsia lutea* (Masi, 1909)
Distribution: Bihar and Uttar Pradesh (Hayat, 1998).
193. *Encarsia macroptera* Viggiani, 1985
Distribution: Maharashtra, Punjab and Uttar Pradesh (Hayat, 1998).
194. *Encarsia meghalayana* Hayat, 2011b
Distribution: Meghalaya (Hayat, 2011b).
195. *Encarsia merceti* Silvestri, 1926
Distribution: Assam, Delhi (Hayat, 1998).
196. *Encarsia muliyali* Mani, 1941
Distribution: Odisha, Uttar Pradesh (Hayat, 1998); Tamil Nadu (Menakadesvi & Manickavasagam, 2011).
197. *Encarsia nanjingensis* Huang and Polaszek, 1998
Distribution: Assam (Hayat, 1998).
198. *Encarsia narayanani* Agarwal, 1964
Distribution: Karnataka, Maharashtra, Odisha and Uttar Pradesh (Hayat, 1998).
199. *Encarsia norani* Hayat, 1989
Distribution: Uttar Pradesh (Hayat, 1998).
200. *Encarsia obtusiclava* Hayat, 1989
Distribution: Karnataka, Uttar Pradesh (Hayat, 1998); Tamil Nadu (Menakadevi & Manickavasagam, 2011).
201. *Encarsia occultans* Hayat, 1998
Distribution: Bihar, Odisha, Uttar Pradesh (Hayat, 1998).
202. *Encarsia orangae* Raina, Khurad & Rathod, 1996
Distribution: Maharashtra (Raina *et al.*, 1996).
203. *Encarsia ossira* Hayat, 2011b
Distribution: Odisha (Hayat, 2011b).
204. *Encarsia perflava* Hayat, 1989
Distribution: Uttar Pradesh (Hayat, 1998), Assam, Madhya Pradesh and Uttarakhand (Hayat, 2011b).
205. *Encarsia perniciosi* (Tower, 1913)
Distribution: Jammu & Kashmir, Himachal Pradesh, Punjab, Uttar Pradesh (Hayat, 1998).
206. *Encarsia perplexa* Huang & Polaszek, 1998
Distribution: Uttar Pradesh (Hayat, 2006).
207. *Encarsia pseudococci* (Agarwal, 1964)
Distribution: Uttar Pradesh (Agarwal, 1964).
208. *Encarsia punicae* Hayat, 1998
Distribution: Andhra Pradesh, Karnataka (Hayat, 1998); Uttar Pradesh (Hayat, 2011b).
209. *Encarsia pura* Hayat, 1998
Distribution: Maharashtra (Hayat, 1998).
210. *Encarsia reeda* Hayat, 2011b
Distribution: Assam, Meghalaya, Uttarakhand (Hayat, 2011b).
211. *Encarsia sankarani* Hayat, 1989
Distribution: Assam (Hayat, 1989).
212. *Encarsia septentrionalis* Hayat, 1989
Distribution: Bihar, Delhi, Uttar Pradesh (Hayat, 1989).

213. *Encarsia sikkimiana* Hayat, 2011a
Distribution: Sikkim (Hayat, 2011b).
214. *Encarsia smithi* (Silvestri, 1926)
Distribution: Bihar, Karnataka, Maharashtra (Hayat, 1998).
215. *Encarsia sophia* (Girault & Dodd, 1915) (in Girault, 1915).
Distribution: India.
216. *Encarsia strenua* (Silvestri, 1927)
Distribution: Uttar Pradesh and West Bengal (Noyes, 2012).
217. *Encarsia terebrator* (Shafee, 1974)
Distribution: Andhra Pradesh (Hayat, 1998).
218. *Encarsia tinctoriae* Krishnan & Vasantharaj David, 1996
Distribution: Tamil Nadu (Krishnan & Vasantharaj David, 1996).
219. *Encarsia tristis* (Zehntner, 1896)
Distribution: Bihar, Delhi, Karnataka, Maharashtra, Punjab, Tamil Nadu, Uttar Pradesh (Hayat, 1998).
220. *Encarsia trivittata* Hayat, 1989
Distribution: Uttar Pradesh (Hayat, 1989).
221. *Encarsia udaipuriensis* (Shafee, 1973)
Distribution: Bihar, Odisha, Rajasthan, Tamil Nadu and Uttar Pradesh (Hayat, 1998); Meghalaya (Hayat, 2011b).
 Genus **Eretmocer** Haldeman, 1850
222. *Eretmocer* *adustiscutum* Krishnan & Vasantharaj David, 1996
Distribution: Karnataka, Kerala, Maharashtra, Tamil Nadu and Uttar Pradesh (Krishnan & Vasantharaj David, 1996).
223. *Eretmocer* *bisetae* Hayat, 1998
Distribution: Uttar Pradesh (Hayat, 1998).
224. *Eretmocer* *breviclavus* Subba Rao, 1984
Distribution: Karnataka (Subba Rao, 1984).
225. *Eretmocer* *corni* Haldeman, 1850
Distribution: Maharashtra (Hayat, 1986).
226. *Eretmocer* *delhiensis* Mani, 1941
Distribution: Bihar, Delhi, Rajasthan and Uttar Pradesh (Hayat, 1998).
227. *Eretmocer* *dialeurolongae* Krishnan & Vasantharaj David, 1996
Distribution: Tamil Nadu (Krishnan & Vasantharaj David, 1996).
228. *Eretmocer* *flavus* Krishnan & Vasantharaj David, 1996
Distribution: Tamil Nadu (Krishnan & Vasantharaj David, 1996).
229. *Eretmocer* *gunturiensis* Hayat, 1972b
Distribution: Andhra Pradesh and Maharashtra (Hayat, 1998).
230. *Eretmocer* *haldemani* Howard, 1908
Distribution: Uttar Pradesh (Hayat, 1986).
231. *Eretmocer* *hayati* Zolnerowich & Rose, 1998
Distribution: India (Noyes, 2012).
232. *Eretmocer* *hydrabadensis* Husain & Agarwal, 1982
Distribution: Andhra Pradesh (Husain & Agarwal, 1982).
233. *Eretmocer* *indicus* Hayat, 1972
Distribution: Uttar Pradesh (Hayat, 1998).
234. *Eretmocer* *longiscapus* Hayat, 1998
Distribution: Uttar Pradesh (Hayat, 1998).
235. *Eretmocer* *mundus* Mercet, 1931
Distribution: Andhra Pradesh, Bihar, Maharashtra, Tamil Nadu, Uttar Pradesh (Hayat, 1998).
236. *Eretmocer* *paulistus* Hempel, 1904
Distribution: Uttar Pradesh (Hayat, 1986).

237. *Eretmocerus rajasthanicus* Hayat, 1976
Distribution: Rajasthan (Hayat, 1998); Tamil Nadu (Menakadevi & Manickavasagam, 2011).
238. *Eretmocerus sculpturatus* Hayat, 1998
Distribution: Bihar (Hayat, 1998).
239. *Eretmocerus serius* Silvestri, 1927
Distribution: Andhra Pradesh, Karnataka and Uttar Pradesh (Hayat, 1998).
240. *Eretmocerus trialeurodis* Hayat, 1998
Distribution: Tamil Nadu (Hayat, 1998).
 Genus **Eriaphytis** Hayat, 1972c
241. *Eriaphytis chackoi* Subba Rao, 1980
Distribution: Karnataka (Hayat, 1998).
242. *Eriaphytis orientalis* Hayat, 1972c
Distribution: Kerala, Rajasthan, Tamil Nadu and Uttar Pradesh (Hayat, 1998).
 Genus **Euryischia** Compere, 1928
243. *Euryischia indica* Mani & Kurian, 1953
Distribution: Andhra Pradesh, Bihar, Tamil Nadu, Uttar Pradesh (Hayat, 1998).
 Genus **Euryischomyia** Girault, 1914
244. *Euryischomyia washingtoni* Girault, 1914
Distribution: Andhra Pradesh, Karnataka and Tamil Nadu (Hayat, 1998).
 Genus **Eutrichosomella** Girault, 1915
245. *Eutrichosomella indica* Singh, 2010
Distribution: Western Ghats (Singh & Srinivasa, 2010).
246. *Eutrichosomella keralensis* Manickavasagam & Menakadevi, 2012
Distribution: Kerala (Manickavasagam & Menakadevi, 2012).
 Genus **Idiococcobius** Hayat, 2010
247. *Idiococcobius encarsoides* Hayat, 2010
Distribution: West Bengal (Hayat & Khan 2010)
- Genus **Marietta** Motschulsky, 1863
248. *Marietta carnesi* (Howard, 1910)
Distribution: Jammu & Kashmir, Uttar Pradesh (Hayat, 1998).
249. *Marietta leopardina* Motschulsky, 1863
Distribution: Throughout India including Andaman & Nicobar Islands (Hayat, 1998).
250. *Marietta picta* (Andre, 1878)
Distribution: Uttar Pradesh (Hayat, 1998).
 Genus **Marlattiella** Hayat, 1974a
251. *Marlattiella maculata* Hayat, 1974a
Distribution: Uttar Pradesh (Hayat, 1974a).
 Genus **Myiocnema** Ashmead, 1990
252. *Myiocnema comperei* Ashmead, 1900
Distribution: India (Thompson, 1955).
 Genus **Paraphytis** Compere, 1925
253. *Paraphytis maculatus* (Shafee, 1970)
Distribution: Tamil Nadu (Shafee, 1970).
254. *Paraphytis peculiaris* (Girault, 1932)
Distribution: Bihar and Delhi (Girault, 1932).
255. *Paraphytis transversa* (Huang, 1994)
Distribution: Kerala (Hayat, 2012).
 Genus **Proaphelinoides** Girault, 1917
256. *Proaphelinoides anomalus* Hayat, 1985
Distribution: Karnataka (Hayat, 1986).
257. *Proaphelinoides assamensis* Hayat, 2012
Distribution: Assam (Hayat 2012).
258. *Proaphelinoides chidambaramensis* Manickavasagam & Menakadevi, 2012 (in Menakadevi & Manickavasagam, 2012).
Distribution: Tamil Nadu (Menakadevi & Manickavasagam, 2012).
 Genus **Promuscidea** Girault, 1917
259. *Promuscidea unfasciiventris* Girault, 1917

- Distribution:* Andaman & Nicobar Islands, Andhra Pradesh, Assam, Bihar, Delhi, Jammu & Kashmir, Karnataka, Kerala, Madhya Pradesh, Odisha, Punjab, Tamil Nadu, Uttar Pradesh, West Bengal (Hayat, 1998).
- Genus ***Protaphelinus*** Mackauer, 1972a
260. *Protaphelinus nikolskajae* (Yasnosh, 1963)
- Distribution:* Himachal Pradesh, Jammu & Kashmir (Hayat, 1998).
- Genus ***Pteroptrix*** Westwood, 1833b
261. *Pteroptrix albifemur* (Girault, 1915)
- Distribution:* Karnataka (Hayat, 1998).
262. *Pteroptrix aster* Hayat, 2010
- Distribution:* Uttar Pradesh (Hayat & Khan, 2010).
263. *Pteroptrix bemisiae* Mani
- Distribution:* Bihar (Hayat, 1986).
264. *Pteroptrix chinensis* (Howard, 1907)
- Distribution:* Jammu & Kashmir (Hayat, 1998).
265. *Pteroptrix koebelei* (Howard, 1907)
- Distribution:* Karnataka (Hayat, 1998).
266. *Pteroptrix machiaveli* (Girault)
- Distribution:* Karnataka (Hayat, 1998); Uttar Pradesh, Odisha, Meghalaya, Assam (Hayat & Khan, 2010); Tamil Nadu (Menakadevi & Manickavasagam, 2011).
267. *Pteroptrix matpada* Hayat, 2010 (Hayat & Khan, 2010).
- Distribution:* Orissa (Hayat &Khan, 2010).
268. *Pteroprtix longiclavata* (Shafee, Siddiqui & Rizvi, 1988)
- Distribution:* Utttar Pradesh (Shafee, Siddiqui & Rizvi, 1988).
269. *Pteroptrix zoza* Hayat, 2010
- Distribution:* Uttar Pradesh (Hayat & Khan, 2010).

SUMMARY

A checklist of Indian aphelinids upto December, 2013 is compiled and presented that includes a total of 269 species under 24 genera.

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REFERENCES

- Agarwal, M.M. 1964. Studies of forms of Aphelinidae (Hymenoptera : Chalcidoidea) collected at Aligarh (India). II. *Proc. Ind. Acad. Sciences (B)*, **60**(5): 316.
- Ahmad, M.E. and Singh, R. 1996. Records of aphid parasitoids from the North Bihar and associations with their hosts and food plants. *J. Advan. Zoology*, **17**(1): 26-33.
- Amin Masoodi, M. and Trali, A.R. 1987. New record of scale insects (Diaspididae : Homoptera) from and aphelinid parasite (Hymenoptera) from Kashmir, India. *Entomon*, **12**(3): 227.
- Andre, M.E. 1878. Memoire pour server a histoire de la Trioza centranthi Vallot. *Ann. Soc. Ent., Franc*, **8**(5): 77-86.
- Annecke, D.P. and Insley, H.P. 1970. New and little-known species of *Azotus* Howard, *Ablerus* Howard and *Physcus* Howard (Hymenoptera, Aphelinidae) from Africa and Mauritius. *Bull. Entomol. Res.*, **60**(2): 244-246.

- Antony, B., Palaniswami, M.S., Kirk, A.A. and Henneberry, T. J. 2006. Aphelinid parasitoids of *Bemisia tabaci* (Gennadius) (Homoptera: Aleyrodidae) in India. *Entomon*, **31**: 217: 224.
- Ashmead, W.H. 1900. Description of a new genus in the Aphelinidae. *Canad. Entomol.*, **32**: 349.
- Azim, M.N. and Shafee, S.A. 1980. Indian species of the genus *Trichaporus* Foerster (Hymenoptera: Aphelinidae). *J. Bombay Nat. Hist. Soc.*, **76**(2): 337.
- Berlese, A, and Paoli, G. 1916. Un endofago esotico efficace contra il *Chrysomphalus dictyospermi*. *Morg. Redia*, **11**: 305-307.
- Cameron, P. 1891. Hymenopterological notices. *Memoirs & Proceedings of the Manchester Literary and Philosophical Society*, **4**(4):183.
- Carvar, M. 1995. *Euryischomyia* Girault (Hymenoptera: Chalcidoidea: Aphelinidae: Eriaporinae: Euryischiini). *J. Hym. Res.*, **4**: 64-76.
- CIBC, 1976. Report of work carried out during 1975. Pp. 49. Commonwealth Institute of Biological Control, Commonwealth Agricultural Bureaux, Slough, U.K.
- Compere, H. 1925. A new genus and species of Aphelinidae (Hymenoptera) from China. *Trans. Ameri. Entomol. Soc.*, **51**: 129-134.
- Compere, H. 1926. Descriptions of new coccid inhabiting chalcidoid parasites (Hymenoptera). *Univ. Califor. Publi. Entomo.*, **4**(1): 2.
- Compere, H. 1928. New coccid-inhabiting chalcidoid parasites from Sugonjaev. Subfamily. n. (Hymenoptera.Chalcidoidea. Tetracampidae) Africa and California. *Univ. Califor. Publi. Entomo.*, **4**: 209-230.
- Compere, H. 1931. A revision of the species of *Coccophagus*, a genus of hymenopterous, coccid-inhabiting parasites. *Proc. Unit. Sta. Nat. Muse.*, **78**(7): 67.
- Compere, H. 1933. The parasites of *Pseudococcus comstocki* Kuw. *Can. Entomol.*, **65**(11): 245.
- Compere, H. 1955. A systematic study of the genus *Aphytis* Howard (Hymenoptera, Aphelinidae) with descriptions of new species. *Univ. Califor. Publi. Entomo.*, **10**: 271-320.
- Compere, H. and Annecke, D.P. 1961. Descriptions of parasitic Hymenoptera and comments (Hymenoptera: Aphelinidae, Encyrtidae, Eulophidae). *J. Entomol. Soc. South. Africa*, **24**: 17-71.
- Craw, A. 1891. Internal parasites discovered in the San Gabriel Valley; recommendations and notes. *Bull. Califo. State Boa. Horti.*, **57**: 4.
- Dalman, J.W. 1820. Forsok till Uppställning af Insect-familjen Pteromalini, i synnerhet med afseen de på de i Sverige funne Arter. *Kungliga Svenska Vetenskapsakademiens Handlingar*, **41**(1): 181.
- DeBach, P. 1959. New species and strains of *Aphytis* (Hymenoptera, Eulophidae) parasitic on the California red scale, *Aonidiella aurantii* (Mask.), in the Oriental. *Ann. Entom. Soc Ame.*, **52**(4): 363.
- DeBach, P. 1960. The importance of taxonomy to biological control as illustrated by the cryptic history of *Aphytis holoxanthus* n.sp. (Hymenoptera: Aphelinidae), a parasite of *Chrysomphalus aonidum*, and *Aphytis coheni* n.sp., a parasite of *Aonidiella aurantii*. *Ann. Entom. Soc Ame.*, **53**(6): 704.

- DeBach, P. and Rosen, D. 1976. Twenty new species of *Aphytis* (Hymenoptera: Aphelinidae) with notes and new combinations. *Ann. Entom. Soc. Ame.*, **69**(3): 545.
- Doutt, R.L. 1966. A taxonomic analysis of parasitic Hymenoptera reared from *Parlatoria oleae* (Colvée). *Hilgardia*, **37**: 224.
- Dozier, H.L. 1932. Miscellaneous notes and descriptions of Chalcidoid parasites (Hymenoptera). *Procee. Entomol. Soci. Washington*, **35**: 85-100.
- Dozier, H.L. 1937. Descriptions of miscellaneous chalcidoid parasites from Puerto Rico (Hymenoptera). *J. Agri. Univer. Puer. Rico*, **21**(2): 128.
- ErDOS, and Novicky J. 1953. Additamenta ad cognitionem faunae Chalcidoidarum in Hungaria et regionibus finitimis. V. 11. Thysanidae, 12. Aphelinidae, 17. Tetracampidae, 18. Elasmidae. *Folia Entomologica Hungarica*, **6**: 180.
- Ferriere, C. 1931. New chalcidoid egg-parasites from South Asia. *Bull. Entom. Research*, **22**(2): 286.
- Foerster, A. 1878. Kleine monographien parasitischer Hymenoptera. *Verhandlungen der Naturhistorischen Vereins der Preussischen Rheinlande und Westfalens, Bonn*, **35**: 42-82.
- Fry, J. M. 1989. Natural enemy databank, 1987. A catalogue of natural enemies of arthropods derived from records in the CIBC Natural Enemy Databank. Pp. 58-59. CAB International, Wallingford, oxford, UK.
- Girault, A.A. 1913. Some chalcidoid Hymenoptera from North Queensland. *Arch, Naturg*, **76**: 70-90.
- Girault, A.A. 1914. The third genus of the family Elasmidae (Hymenoptera). *The Cana. Entomol.*, **46**: 285-286.
- Girault, A.A. 1915. Australian Hymenoptera Chalcidoidea III. Second Supplement. *Memo. Queens. Muse.*, **3**: 170-179.
- Girault, A.A. 1916. New miscellaneous chalcidoid Hymenoptera with notes on described species. *Ann. Entom. Soc. Ame.*, **9**(3): 292.
- Girault, A.A. 1917. Notes and descriptions of miscellaneous chalcid-flies (Hymenoptera). *Proc. Unit. Sta. Nat. Muse.*, **53**(2213): 445.
- Girault, A.A. 1922. New chalcid flies from eastern Australia (Hymenoptera, Chalcididae). *II. Insec. Insci. Mens.*, **10**: 101.
- Girault, A.A. 1923. Miscellaneous species of chalcid- flies from Australia (Hymenoptera, Chalcidoidea). *Insec. Insci. Menst.*, **9**: 188.
- Girault, A.A. 1926. New pests from Australia III. 2pp. private publication, Brisbane.
- Girault, A.A. 1932. *New lower Hymenoptera from Australia and India* pp.2 Brisbane, private publication.
- Girault, A.A. 1933. *Some beauties inhabitant not of commercial boudoirs but of natures bosom, notably new insects* pp. 4 Brisbane, private publication.
- Haldeman, S.S. 1851. Description of *Eriophilus mali* (Hymenoptera). *Pen. Farm Jour.*, **1**: 130-131.

- Hayat, M. 1971. Two new and known species of Aphelinidae (Hymenoptera: Chalcidoidea) from India. *Bull. Entom. Soc. India*, **12**(2): 118-120.
- Hayat, M. 1972a. The species of *Aphelinus* Dalman, 1820 (Hymenoptera: Aphelinidae) from India. *Entomophaga*, **17**(1): 52-56.
- Hayat, M. 1972b. The species of *Eretmocerus* Haldeman, 1850 (Hymenoptera: Aphelinidae) from India. *Entomophaga*, **17**(1): 99-106.
- Hayat, M. 1972c. A new aphelinid genus *Eriaphytis* (Hymenoptera: Chalcidoidea) reared from *Cerococus* spp. *Polskie Pismo Entomologiczne*, **423**: 151-156.
- Hayat, M. 1973. Two new Indian species of *Centrodora* Foerster, 1878 (Hymenoptera: Aphelinidae) parasitic in the eggs of membracids (Homoptera: Membracidae). *Entomophaga*, **18**(1): 41-44.
- Hayat, M. 1974a. Three new species of Aphelinidae (Hymenoptera: Chalcidoidea) parasitic on *Aonidiella orientalis* (Newst.) from India. *J. Bom. Nat. Hist.*, **71**(1): 64-71.
- Hayat, M. 1974b. On some Indian species of Aphelinidae, with a description of a new *Coccophagus* (Hymenoptera; Chalcidoidea). *J. Nat. Hist.*, 8 pp. 179-186.
- Hayat, M. 1976. Two new species of Aphelinidae parasitic on *Acaudaleyrodes rhachipora* from India. *Entomophaga*, **21**(2): 158-160.
- Hayat, M. 1984. *Encarsia bennetti* sp.n. (Hymenoptera: Aphelinidae) from India, associated with the citrus black fly *Aleurocanthus woglumi* (Homoptera: Aleyrodidae). *Bull. Entom. Res.*, **74**(3): 399-401.
- Hayat, M. 1985. Notes on some species of *Coccobius* and *Prophycus* (Hymenoptera: Aphelinidae), with special reference to Girault and Howard types. *Orien. Inse.*, **18**: 296.
- Hayat, M. 1986. Family Aphelinidae. (In: Subba Rao, B.R.; Hayat, M. (Eds) - The Chalcidoidea (Insecta: Hymenoptera) of India and the adjacent countries. Part II.) *Orien. Inse.*, **20**: 159.
- Hayat, M. 1988. Description of a new species of *Centrodora* Foerster and notes on the type of *Eretmocerus delhiensis* Mani (Hymenoptera: Chalcidoidea: Aphelinidae). *Entomon*, **13**: 128-131.
- Hayat, M. 1989. A revision of the species of *Encarsia* Foerster (Hymenoptera: Aphelinidae) from India and the adjacent countries. *Orien. Inse.*, **23**: 47.
- Hayat, M. 1990. Taxonomic studies on *Aphelinus* (Hymenoptera: Aphelinidae). 2. A new subgenus from India with comments on *Mesidia* and *Mesidiopsis*. *Orien. Inse.*, **24**: 253-254.
- Hayat, M. 1993. The *malthusi*-group of *Coccophagus* (Hymenoptera: Aphelinidae), with descriptions of three new species from India. *Orien. Inse.*, **27**: 178-179.
- Hayat, M. 1994. Taxonomic studies on *Aphelinus* (Hymenoptera: Aphelinidae). VI. Records of two known and descriptions of two new species from the Oriental region. *Entomon*, **19**(1, 2): 38.
- Hayat, M. 1998. Aphelinidae of India (Hymenoptera: Chalcidoidea): a taxonomic revision. *Mem. Entom., Inter.*, **13**: 127.
- Hayat, M. 2006. Description of a new species of *Encarsia* from India, with records of four other species (Hymenoptera: Aphelinidae). *Orien. Inse.*, **40**: 292-293.

- Hayat, M. 2007. Description of a new species of *Coccophagus* (Hymenoptera: Aphelinidae), parasitoid of *Paratachardina lobata* (Homoptera : Kerridae) from India. *Orien. Inse.*, **41**: 387-388.
- Hayat, M. 2010. Additions to the Aphelinidae of India (Hymenoptera : Chalcidoidea)–2, Genus *Centrodora* Foerster. *Orien. Inse.*, **44**: 57.
- Hayat, M. 2011a. On *Coccophagoides* Girault and *Diaspiniphagus* Silvestri (Hymenoptera: Chalcidoidea: Aphelinidae). *Zootaxa*, **3070**: 19-21.
- Hayat, M. 2011b. Additions to the Indian Aphelinidae (Hymenoptera : Chalcidoidea)- III: the genus *Encarsia* Foerster. *Orien. inse.*, **45**(2-3): 202-274.
- Hayat, M. 2012. Records and descriptions of some Aphelinidae (Hymenoptera: Chalcidoidea) from India. *Zootaxa*, **3521**: 39-50.
- Hayat, M. and Anis, S. B. 2004. Records of *Ablerus connectens* Silvestri (Hymenoptera : Aphelinidae) from India. *Bionotes*, **6**: 99.
- Hayat, M. and Fatima, K. 1992. Taxonomic studies on *Aphelinus* (Hymenoptera: Aphelinidae) 5. Description of new species and further records of *A. gossypii* with a new synonymy. *Entomon*, **17**(1/2): 103-106.
- Hayat, M. and Khan, 2010. Additions to the Aphelinidae of India (Hymenoptera – Chalcidoidea): 1. On species of *Ablerus* Howard, *Coccobius* Ratzeburg, *Coccophagus* Westwood, *Pteroptrix* Westwood, and *Idiococcobius* Hayat gen.nov. *Colemania*, **21**: 5-6.
- Hayat, M and Khan, 2012. Two new species of *Coccobius* Ratzeburg (Hymenoptera : Aphelinidae) from India. *Biosystematica*, **6**(1): 13-17.
- Hayat, M and Polaszek, A. 1992, *Encarsia aseta* new species (Hymenoptera; Aphelinidae) a parasitoid of *Dialeurolonga elongata* Dozier (Homoptera; Aleyrodidae) from India. *Orien. Inse.*, **26**: 107-109.
- Hayat, M. and Zeya, S. B. 1993. Records and descriptions of some Indian Aphelinidae (Hymenoptera: Chalcidoidea). *Hexapoda*, **5**(1): 58.
- Hayat, M. and Polaszek, A. 1992. *Encarsia aseta*, sp. nov. (Hymenoptera: Aphelinidae) a parasitoid of *Dialeuronga elongata* Dozier (Homoptera: Aleyrodidae). *Orie. Inse.*, **26**: 107-109.
- Hayat, M. and Singh, S. 1989. Description of a new *Coccophagus* of the *lycimnia*-group (Hymenoptera: Aphelinidae) from the Khasi hills, with some other species records from India. *Colemania*, **5**: 29-33.
- Hayat, M. and Viggiani, G, 1984. A preliminary catalogue of the Oriental Trichogrammatidea (Hym: Chalcidoidea). *Boll. del Labo. di Entom. Agr.Flip. Silv. Port.*, **41**: 27.
- Hempel, A. 1904. Notas sobre dois inimigos da laranjeira. *Boletim da Agricultura, Sao Paulo*, **1**(5): 19.
- Heraty, J.M. and Polaszek, A. 2000. Morphometric analysis and descriptions of selected species in the *Encarsia strenua* group (Hymenoptera: Aphelinidae). *J. Hym. Rese.*, **9**: 142-169.
- Howard, L.O. 1881. (In Comstock, J.H. - Report of the entomologist for 1880.) Report of the parasites of Coccidae in the collections of the U.S. Department of Agriculture Part III. *Report. United States Department of Agriculture. Washington. (Entomology)*, **1880**: 355.

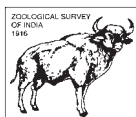
- Howard, L.O. 1885. Descriptions of North American Chalcididae from the collections of the U.S. Department of Agriculture and of Dr. C. V. Riley, with biological notes. (First paper). Together with a list of the described North American species of the family. *Bull. Unit Stat. Depar. Agricul. Bure. Entom.*, **5**: 25.
- Howard, L.O. 1894. The hymenopterous parasites of the California red scale. *Insect life*, **6**: 231.
- Howard, L.O. 1895. Two parasites of important scale-insects. *Insect Life*, **7**: 5-8.
- Howard, L.O. 1900. A new genus of Aphelininae from Chile. *Can. Entomol.*, **32**(6): 168.
- Howard, L.O. 1907. New genera and species of Aphelinidae with a revised table of genera. *United States Department of Agriculture Technical Series, Bureau of Entomology, United States Department of Agriculture*, **12**(4): 69-88.
- Howard, L.O. 1908. Upon the aphid feeding species of *Aphelinus*. *Entomological News*, **19**(8): 367.
- Howard, L.O. 1910. Two new aphelinine parasites of scale insects. *Entomological News*, **21**(4): 162.
- Howard, L.O. 1911. A note on the Indian enemies of *Aleyrodes citri* R. and H., with description of a new species of *Prospaltella*. *J. Econ. Entom.*, **4**: 132.
- Howard, L.O. 1914. Concerning some Aphelininae. *Proc. Entomol. Soc. Washi.*, **16**: 85.
- Huang, J. 1994. Systematic studies on Aphelinidae (Hymenoptera: Chalcidoidea) of China. 348 pp. Chongqing Publishing House, Chongqing.
- Huang, J. and Polaszek, 1998. A revision of Chinese species of *Encarsia* Foerster (Hymenoptera: Aphelinidae): parasitoids of whiteflies, scale insects and aphids (Hemiptera: Aleyrodidae, Diaspididae, Aphidoidea). *J. Nat. Hist.*, **32**: 1825-1966.
- Husain, T. and Agarwal, M.M. 1982. Studies on some aphelinid (Hymenoptera: Chalcidoidea) parasites of hemipterous insects of India. *J. Bom. Nat. Hist. Soc.*, **79**(1): 157-159.
- Jadhav, R.B. and Varma, A. 2001. Natural enemies of sugarcane scale insect and their seasonal activity in Ahmednagar district of Maharashtra. *Ind. J. Sugar. Tech.*, **16**(1): 123-126.
- Khan, M.Y. and Shafee, S.A. 1976. Indian species of the genus *Azotus* (Hymenoptera, Aphelinidae). *Geobios, Jodhpur*, **3**(5): 173.
- Koningberger, J.C. 1897. De dierkijke vijanden der koffiecituur op Java, deel 1. *Mededelingen uit 'S Lands Plantentuin*, **20**: 14-15.
- Krishnan, B. and Vasantharaj David, B. 1996. Records and descriptions of some aphelinid parasitoids of Aleyrodidae (Homoptera: Insecta) from India. *Jai Research Foundation*, Valvada, Gujarat, PP. 21-22.
- Lal, K.B. 1938. The first record of the eulophid genus *Azotus* from India (Chalcidoidea: Hymenoptera). *Rec. Ind. Mus.*, **40**: 2.
- Le Barron, W. 1870. The chalcideous parasite of the apple-tree bark-louse (*Chalcis* (*Aphelinus*) *mytilaspidis* n. sp.). *Ame. Entomo. Bota.*, **2**(12): 360-362.
- Lopez-Avila, A. 1987. Two new species of *Encarsia* Foerster (Hymenoptera: Aphelinidae) from Pakistan, associated with the cotton whitefly, *Bemisia tabaci* (Gennadius) (Hemiptera: Aleyrodidae). *Bull. Entomol. Rese.*, **77**(3): 427-429.

- Mackauer, M. 1972. The aphid-attacking genera of Aphelinidae (Hymenoptera), includes the descriptions of a new genus. *Can. Entomol.*, **104**: 1771-1779.
- Mahdihassan, S. 1923. Classification of lac insects from physiological stand point. *Journal of Scientific Association Maharajah's Coll, Vizianagaram*, **1**: 47-99.
- Mani, M.S. 1989. The fauna of India and adjacent countries: Chalcidoidea (Hym). Part 2: Families Signiphoridae, Aphelinidae, Elasmidae, Eurychiidae, Elachertidae, Entedonidae, Eulophidae, Tetrastichidae, Trichogrammatidae, Mymaridae, Supplement, and host-parasite index, Calcutta. *Zoological Survey of India*. 1069-1634 pp.
- Mani, M.S. 1941. Studies on Indian parasitic Hymenoptera I. *Ind. J. Entomo.*, **3**: 25-46.
- Mani, M.S. and Kurian, C. 1953. Descriptions and records of chalcids from India. *Ind. J. Entomo.*, **15**(1): 1-22.
- Manickavasagam, S. and Menakadevi, C. 2012. A new species of *Eutrichosomella* Girault (Chalcidoidea: Aphelinidae) from India, with Additional distribution records of Chalcids. *Madras. Agric. J.*, **99**: (10-12): 877-881.
- Masi, L. 1909. Contribuzioni alla conoscenza dei Chalcididi italiani. *Bollett. Del. Labora. Di. Zool. Generale e Agraria della R. Scuola Superiore d Agricolt. In Port.*, **4**: 3-37.
- Masi, L. 1911. Contribuzioni alla conoscenza dei Chalcididi Italiani (parte IV). *Bollettino del Laboratorio di Zoologia Generale e Agraria della R. Scuola Superiore d'Agricoltura, Portici*, **5**: 140-171.
- Menakadevi, C. and Manickavasagam, S. 2011. First report of *Encarsia colima* Myartseva from India and other distributional records of aphelinidae (Hymenoptera : Chalcidoidea) from the states of Kerala and Tamil Nadu, India. *Madras Agric. J.*, **98**(4-6): 182-186.
- Menakadevi, C. and Manickavasagam, S. 2012. A new species of *Proaphelinoides* Girault (Hymenoptera: Aphelinidae) with a key to world species and additional records from Tamil Nadu, India. *Zootaxa*, **3193**: 62-68.
- Mercet, R.G. 1912. Los enemigos de los parasites de las plantas. Trabajos del Museo de Ciencias Naturales, *Madrid*, **10**: 30.
- Mercet, R.G. 1912. Un parasito dell 'polloig'. *Boletin de la Real Sociedad Española de Historia Natural*, **12**: 135.
- Mercet, R.G. 1927. La fauna afelinina española. *Asoc. Esp. Progr. Cienc. Cádiz, Sección IV (Ciencias Nat.)* pp. 240.
- Mercet, R.G. 1931. Notas sobre Aphelinidos (Hym. Chalc.) 4a nota. *Eos. Revista Española de Entomologia. Madrid*, **7**: 395.
- Motschulsky, V. de 1863. Essai d'un catalogue des insectes de l'Ile Ceylon (Suite). *Bulleten' Moskovskogo Obshchestva Ispytateley Prirody (Otdel Biologicheskij)*, **36**(3): 51.
- Myartseva, S.N. 2005. Notes on the species of the genus *Encarsia* Foerster (Hymenoptera: Aphelinidae) introduced to Mexico for biological control of the blackfly *Aleurocanthus woglumi* Ashby (Homoptera: Aleyrodidae), with description of a new species. *Zoosystematica Rossica*, **14**(1): 148-150.

- Noyes, J.S, 2003. *Universal Chalcidoidea Database Website* [WWW. Document]. URL [www. nhm. ac.uk/ entomology/ chalcidoids/ index. html](http://www.nhm.ac.uk/entomology/chalcidoids/index.html) [December, 2013-updated].
- Polaszek, A. 1991. Egg parasitism in Aphelinidae (Hymenoptera: Chalcidoidea) with special reference to *Centrodora* and *Encarsia* species. *Bulle. Entomol. Rese.*, **81**: 97-106.
- Polaszek, A. and Hayat, M. 1992. A revision of the genera *Dirphys* Howard and *Encarsiella* Hayat (Hymenoptera: Aphelinidae). *Syst. Entomo.*, **17**: 193.
- Polaszek, A., S. Manzari. and D. Quicke. 2004. Morphological and molecular taxonomic analysis of the *Encarsia meritoria* species-complex (Hymenoptera, Aphelinidae), parasitoids of whiteflies (Hemiptera, Aleyrodidae) of economic importance. *Zoologica Scripta*, **33**: 403-421.
- Raina, S.K., Rathod, M.K., Khurad, A.M., Mategaonkar, D., Adolkar, V.V. and Rai, M.M. 1996. Survey and identification of citrus blackfly and its parasitoids in the Vidarbha region of Maharashtra (India). *Conservation of hymenopteran parasitoids for management of the citrus blackfly in oranges* pp.18-21 (Eds: Raina, S.K.; Overholt, W. A.) CSBR, Nagpur University, Nagpur, Maharashtra, India.
- Ratzeburg, J.T.C. 1852. *Die Ichneumoniden der Forstinsekten in entomologischer und forstlicher Beziehung*. Berlin, **3**: 195.
- Rosen, D. and De Bach, P. 1977. Resurrection of *Aphytis theae* (Hymenoptera: Aphelinidae), a parasite of tea scale, with notes on a new group of species. *The Florida Entomologist*, **60**: 1-10.
- Rosen, D. and De Bach, P. 1979. Species of *Aphytis* of the World (Hymenoptera: Aphelinidae), *Series Entomologica*, 17, Dr. W. Junk. KV. Publisher, The Hague.
- Rosen, D. and De Bach, P. 1986. Three new species of *Aphytis* (Hymenoptera: Aphelinidae), parasites of *Pseudaulacaspis* spp (Hymenoptera: Aphelinidae) in Indian and Australia. *Entomophaga*, **31**: 139-151.
- Rosen, D. and Rose, M. 1989. *Aphytis florinae* sp. nov. (Hymenoptera: Aphelinidae), a parasite of Tea scale, *Fiorinia theae* Green, from India. *Orie. Inse.*, **23**: 270-273.
- Rose, M. and Zolnerowich, G. 1997. *Eretmocerus* Haldeman (Hymenoptera: Aphelinidae) in the United States, with descriptions of new species attacking *Bemisia* (tabasi complex) (Homoptera: Aleyrodidae). *Procee. Entomol Soci. Washin.*, **99**(1): 1-27.
- Schmidt, S., Naumann, I.D. and De Barro, P. J. 2001. *Encarsia* species (Hymenoptera: Aphelinidae) of Australia and the Pacific islands attacking *Bemisia tabaci* and *Trieurodes Vaporariorum* (Hemiptera: Aleyrodidae)- a Pictorial key and descriptions of four new species. *Bull. Entomol. Rese.*, **91**: 377.
- Shafee, S.A. 1970. A new genus of Aphelinidae recorded from Ootacumund (India) (Hymenoptera). *Mushi*, **43**: 145-146.
- Shafee, S.A. 1972. Indian species of the genus *Coccophagus* Westwood (Hymenoptera: Aphelinidae). *Bull. Entomo. Soci. India*, **13**(1): 25.
- Shafee, S.A. 1973. Indian species of the genus *Prospaltella* Ashmead (Hymenoptera : Aphelinidae). *Entomophaga*, **18**: 251-258.
- Shafee, S.A. 1974. A new family of Chalcidoidea (Insecta: Hymenoptera) Euryischidae fam.n. *Current Science*, **43**(23): 768.

- Shafee, S.A., Azim, M.N. and Khan, M.Y. 1988. Taxonomic notes on some genera of Aphelinidae (Hymenoptera: Chalcidoidea). *Ind. J. Syst. Entomol.*, **2**(2): 27-30.
- Shafee, S.A, Siddiqui, J.M and Rizvi, S. 1988. Description of four new species of Aphelinidae (Hymenoptera) from India. *Ind. J. Sys. Ent.*, **5**(1): 6-7.
- Silvestri, F. 1909. Notizie e descrizioni preliminary di insetti parassiti della Diaspis pentagona. *Attidella Reale Accademia dei Lincei. Rendiconti. Roma. Classe Scienze, Matematiche e Naturali*, **18**(1): 564.
- Silvestri, F. 1926, Descrizione di tre specie di *Prospaltella* e di una di *Encarsia* (Hym. Chalcididae) parassite di *Aleurocanthus* (Aleyrodidae). *Eos. Revista Española di Entomologia. Madrid.* **2**: 179.
- Silvestri, F. 1927. Contribuzione alla conoscenza degli Aleyrodidae viventi su citrus in estremo oriente e dei loro parassiti. *Bollettino del Laboratorio di Zoologia Generale e Agraria della R. Istituto Superiore d'Agricoltura, Portici*, **21**: 28.
- Singh, S. and Srinivasa, B. 2010. Description of a new species of the genus *Eutrichosomella* Girault (Hymenoptera: Chalcidoidea: Aphelinidae) from the Western Ghats, India. *Ann. Entomo*, **28**(2): 1-5.
- Subba Rao, B.R. 1957. Some new records of Indian Hymenoptera. *Proc. Ind. Acade. Scie.*, **46**(B): 376-390.
- Subba Rao, B.R. 1970. *Eriaporus* a synonym of *Promuscidea* Girault, 1917 (Hymeoptera: Pteromalidae). *Ent Mon Mag*, **105**: 170-171.
- Subba Rao, B.R. 1980. *Botryoideclava bharatiya*, gen et sp nov and a new species of *Eriaphytis* Hayat from India (Hymenoptera: Aphelinidae). *Orie. Inse.*, **14**: 41-45.
- Subba Rao, B.R. 1984. Descriptions of new species of Oriental Mymaridae and Aphelinidae (Hymenoptera: Chalcidoidea). *Proc. Ind. Acad. Scie., (Animal Sciences)*, **93**: 261.
- Subba Rao, B.R and Rai, P.S. 1969. Studies on the Indian species of the genus *Coccophagus* Westwood, 1883. *Journal of Natural History*, **3**: 381-392.
- Thakur, J.N., Rawat, U.S. and Pawar, A.D. 1988. Survey for natural enemies of Pomegranate butterfly *Deudorix epijarbas* Moore in Himachal Pradesh, *J. Biol. control*, **2**: 1-2.
- Thompson, W.R. 1955. *A catalogue of the parasites and predators of insect pests. Section 2. Host parasite catalogue, Part 3. Hosts of the Hymenoptera (Calliceratid to Evaniid)*. pp.291 Commonwealth Agricultural Bureaux, The Commonwealth Institute of Biological Control, Ottawa, Ontario, Canada.
- Timberlake, P.H. 1924. Descriptions of new chalcid-flies from Hawaii and Mexico (Hymenoptera). *Proc. Hawa. Entomol. Soci.*, **5**: 408.
- Timberlake, P.H. 1941. Encyrtidae of the Marquesas and Society Islands (Hymenoptera : Chalcidoidea). *Occasional Papars of the Bernice Pauahi Bishop Museum*, **16**(9): 225.
- Tower, D.G. 1913. A new hymenopterous parasite on *Aspidiotus perniciosus* Comst. *Ann. Entomol. Soc. Amer.*, **6**(1): 125.
- Tripathi, G.M. 1995. Records of parasite and predator complex of sugarcane woolly aphid, *Ceratovacuna langera* Zehnt. In Nagaland. *Indian Sugar*, **44**(11): 839-841.

- Viggiani, G. 1984. Bionomics of the Aphelinidae. *Annual review of Entomology*, **29**: 257-276.
- Viggiani, G. 1985. Notes on a few Aphelinidae, with description of five new species of *Encarsia* Foerster (Hymenoptera, Chalcidoidea). *Boll. del Labo. di Entom. Agra. 'Fili. Silve.'*, *Por.*, **42**: 87.
- Viggiani, G. 1987. New species of *Encarsia* Förster (Hymenoptera: Aphelinidae), parasitoids of whiteflies. *Boll. del Labo. di Entom. Agra. 'Fili. Silve.'*, *Por.*, **44**: 35-37.
- Viggiani, G. and Mazzone, 1980. Le specie paleartiche di *Encarsia* del gruppo lutea Masi (Hym. Aphelinidae), con descrizione di due nuove specie. Ricerche sugli Hymenoptera Chalcidoidea. LXVIII.- *Boll. del Labor. di Zool. Gene. e Agra. della R. Istituto Supe. d' Agrico.*, *Por.*, **37**: 51-57.
- Walker, F. 1839. *Monographia Chalciditum*. **1**: 9 London.
- Waterson, J. 1916. Notes on Coccid infesting Chalcidoidea. *Bull. Entomol. Rese., London*, **7**: 137-144.
- Westwood, J.O. 1833a. On the probable number of insect species in the creation; together with descriptions of several minute Hymenoptera. *Mag. Nat. Hist.*, **6**: 122.
- Westwood, J.O. 1833b. Descriptions of several new British forms amongst the parasitic hymenopterous insects. *M. Phil. Magazine, London*, **3**(3): 342-344.
- Yasnosh, V.A. 1963. New species of the genus *Aphelinus* Dalm. (Hymenoptera, Chalcidoidea) in the fauna of the USSR. *Entomolo. Obozr.*, **42**(1): 181.
- Zehntner, L. 1896. De Plantenluizen van het suikerroet op Java. (I. *Aleurodes bergi* Signoret.) *Mededelingen van het Proefstation Oost-Java (Nieuwe Serie)*, **29**: 11.
- Zehntner, L. 1900. De Plantenluizen van het Suikerriet op Java. (X. *Ceratovacuna lanigera* Zehnt. de 'Witte Luis' der bladeren.) *Mededelingen van het Proefstation voor Suikerriet in West-Java. 'Kagok' Te Pekalongan*, **49**: 12.
- Zolnerowich, G. and Rose, M. 1998. *Eretmocerus* Haldeman (Hymenoptera: Aphelinidae) imported and released in the United States for control of (*Bemisia tabaci* complex) (Homoptera: Aleyrodidae). *Proceedings of the Entomological Society of Washington*, **100**(2): 310-323.



ON AN ACCOUNT OF REDUVIIDAE (HEMPITERA) FROM CHHATTISGARH, INDIA

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INTRODUCTION

The family Reduviidae is the largest family of predaceous terrestrial hemiptera and a few are blood suckers. Some of them are pathogenic and transmit various diseases to man and animals. Members of this family are commonly known as “Assassin bugs”. These are small to large, robust or elongated, somewhat flattened, smooth, hairy or spiny bugs, which may vary in size ranging from 2 to 40 mm.

This family is represented globally by more than 6878 species and subspecies under 981 genera belonging to 25 subfamilies (Henry, 2009). Of which 465 species under 144 genera belonging to 14 subfamilies (Ambrose, 2006) are recorded from India. Earlier 417 species under 133 genera belonging to 13 subfamilies are recorded from Indian region (Distant, 1904, 1910). Only 13 species under 10 genera of the family Reduviidae were known so far from Chhattisgarh (Biswas & Ghosh 1995, Chandra & Kushwaha, 2012). The present paper is the first consolidated account on the assassin bugs fauna of Chhattisgarh, which includes 32 species under 23 genera belonging to 7 subfamilies. Of these, 24 species belonging to 18 genera under 6 subfamilies marked with asterisks (*) constitute new record from the state. General characters of the group, keys to various taxa, diagnostic characters, synonymies, distribution in India and elsewhere under each species are also provided.

The classification of the family has been mainly adopted after Ambrose (2006). The work is based on the recent collections made by different survey parties of CAMPA Project.

SYSTEMATIC LIST

Suborder HETEROPTERA

Infraorder CIMICOMORPHA

Family REDUVIIDAE

Subfamily I. TRIBELOCEPHALINAE

Genus 1. *Tribelocephala* Stål, 1853

1. *Tribelocephala indica* (Walker, 1873)

Subfamily II. HARPACTORINAE

Genus 2. *Polididus* Stål, 1858

2. *Polididus armatissimus* Stål, 1859

Genus 3. *Sycanus* Amyot & Serville, 1843

*3. *Sycanus collaris* (Fabricius, 1785)

*4. *Sycanus croceovittatus* Dohrn., 1859

Genus 4. *Coranus* Curtis, 1833

*5. *Coranus siva* Kirkaldy, 1891

Genus 5. *Rihirbus* Stål, 1861

*6. *Rihirbus trochantericus* Stål, 1861

Genus 6. *Euagoras* Burmeister, 1835

7. *Euagoras plagiatus* (Burmeister, 1834)

Genus 7. *Rhynocoris* Kolenati, 1857

*8. *Rhynocoris fuscipes* (Fabricius, 1787)

*9. *Rhynocoris marginatus* (Fabricius, 1794)

- *10. *Rhynocoris squalus* (Distant, 1904)
 Genus 8. ***Sphedanolestes*** Stål, 1866
 *11. *Sphedanolestes variabilis* Distant, 1904
 Subfamily III. STENOPODAINAE
 Genus 9. ***Pygolampis*** Germar, 1817
 *12. *Pygolampis foeda* Stål, 1859
 13. *Pygolampis unicolor* Walker, 1873
 Genus 10. ***Sastrapada*** Amyot & Serville, 1843
 14. *Sastrapada baerensprungi* (Stål, 1859)
 Genus 11. ***Oncocephalus*** Klug, 1830
 *15. *Oncocephalus impudicus* Reuter, 1882
 *16. *Oncocephalus schioedtei* Reuter, 1882
 Subfamily IV. ECTRICHODIINAE
 Genus 12. ***Haematorrhophus*** Stål, 1874a
 *17. *Haematorrhophus tuberculatus* (Stål, 1874)
 Genus 13. ***Scadra*** Stål, 1859
 *18. *Scadra fuscicrus* Stål, 1859
 19. *Scadra annulipes* Reuter, 1881
 Genus 14. ***Ectrychotes*** Burmiester, 1835
 *20. *Ectrychotes atripennis* (Stål, 1866)
 21. *Ectrychotes dispar* Reuter, 1881
 Subfamily V. PEIRATINAE
 Genus 15. ***Sirthena*** Spinola, 1840
 *22. *Sirthena flavipes* (Stål, 1855)
 Genus 16. ***Catamiarus*** Amy. & Serville, 1843
 *23. *Catamiarus brevipennis* (Serville, 1831)
 Genus 17. ***Ectomocoris*** Mayr, 1865
 *24. *Ectomocoris simulans* Distant, 1919
 *25. *Ectomocoris cordiger* Stål, 1866
 Genus 18. ***Lestomerus*** Amyot & Serville, 1843
 *26. *Lestomerus sanctus* (Fabricius, 1787)
 Genus 19. ***Spilodermus*** Stål, 1868
 27. *Spilodermus quadrinotatus* (Fabricius, 1798)
 Genus 20. ***Cleptocoris*** Stål, 1866
 *28. *Cleptocoris lepturoides* (Wolff, 1804)
 29. *Cleptocoris atromaculatus* Stål, 1874
 Subfamily VI. SALYAVATINAE
 Genus 21. ***Lisarda*** Stål, 1859
 *30. *Lisarda annulosa* Stål, 1874

Subfamily VII. REDUVIINAE

- Genus 22. ***Gerbilius*** Distant, 1903
 *31. *Gerbilius ornatus* Distant, 1903
 Genus 23. ***Acanthaspis*** Amyot & Serville, 1843
 *32. *Acanthaspis quinquespinosa* (Fabricius, 1781)
 *33. *Acanthaspis siva* Distant, 1904
 34. *Acanthaspis sexguttata* (Fabricius, 1775)
 35. *Acanthaspis flavipes* Stål, 1855
 36. *Acanthaspis fulvipes* (Dallas, 1850)
 37. *Acanthaspis luteipes* Walker, 1873

SYSTEMATIC ACCOUNT

Key to the Subfamilies of the
Family REDUVIIDAE

1. Ocelli present.....2
- Ocelli absent TRIBELOCEPHALINAE
2. Hemelytra with a quadrangular areolet or cell at interior area of corium near base of membrane HARPACTORINAE
- Hemelytra without a quadrangular areolet or cell at interior area of corium near base of membrane 3
3. Hemelytra with a discoidal areolet or cell somewhat hexangular and touching base of membrane or largely triangular..... STENOPODANINAE
- Hemelytra without a discoidal areolet or cell.....4
4. Scutellum with its apex broad and 2 or 3 spined..... ECTRICHODIINAE
- Scutellum with its apex triangular or subtriangular 5
5. Pronotum constricted behind middle..... PEIRATINAE
- Pronotum constricted before or near middle 6
6. Anterior tarsi 2- jointed...SALYAVATINAE
- Anterior tarsi 3-jointed REDUVIINAE

Subfamily I. TRIBELOCEPHALINAE

Genus 1. **Tribelocephala** Stål, 18531853. *Tribelocephala* Stål, *Ofv. Vet.- Ak. Forh.*, p. 220.1. **Tribelocephala indica** (Walker, 1873)

(Plate I, Fig. 1)

1873. *Opisthoplatys indica* Walker, *Cat. Het.*, 8: 20.1904. *Tribelocephala indica*: Distant, *Fauna Brit. India, Rhynchota*, 2: 220.2006. *Tribelocephala indica* : Ambrose, *Zoos' Print Journ.*, 21(9): 27.

Material examined: 2 exs., Barnawapara, Dist. Raipur, 6.VII.2011, coll. Sunil and party; 2 exs., Barnawapara, Dist. Raipur, 16.VIII.2011, coll. Sunil and party; 1ex., Barnawapara, Dist. Raipur, 9.VII.2011, coll. Sunil and party; 1 ex., Barnawapara, Dist. Raipur, 18.VII.2011, coll. Sunil and party.

Diagnostic character: Body chocolate brownish in colour, densely tomentose; membranes with veins darker; rostrum, body beneath and legs pale; head little longer than pronotum which is moderately granulate; antennae with long hairs.

Length: 11-13 mm.

Distribution: India: Chhattisgarh (Raipur), North Bengal. *Elsewhere:* Sri Lanka.

Subfamily II. HARPACTORINAE

Key to the genera of the
Subfamily HARPACTORINAE

1. All femora spined**Polididus** Stål
 - All femora unarmed 2
2. Abdomen on each side much dilated.....
 -**Sycanus** Amyot. & Serville
 - Abdomen not dilated on each side 3
3. Antennae long, its first joint as long as or longer than head.....4
 - Antennae short, its first joint not longer than head..... **Coranus** Curtis
4. Anterior tibiae incurved and spined before apex.....**Rihirbus** Stål

- Anterior tibiae simple, not inwardly spined before apex 5

5. Head armed with a spine or tubercle behind the base of each antenna; lateral pronotal angle spinous
 -**Euagoras** Burmeister

- Head without a spine or tubercle behind the base of each antenna; lateral pronotal angle smooth.....6

6. Posterior lobe of pronotum not longitudinally impressed**Rhynocoris** Kolenati

- Posterior lobe of pronotum longitudinally impressed**Sphecanolestes** Stål

Genus 2. **Polididus** Stål, 18581858. *Polididus* Stål, *Ofv. Vet.-Ak. Forh.*, :448.2. **Polididus armatissimus** Stål, 1859

(Plate I, Fig. 2)

1859. *Polididus armatissimus* Stål, *Ofv. Vet.-Ak. Forh.*, : 376.1904. *Polididus armatissimus*: Distant, *Fauna Brit. India, Rhynchota*, 2: 386.2006. *Polididus armatissimus*: Ambrose, *Zoos' Print Journ.*, 21(9): 11

Material examined: 1 ex., Barnawapara, Dist. Raipur, 16.VIII.2011, coll. Sunil and party; 1 ex., Barnawapara, Dist. Raipur, 11.XI.2011, coll. Sunil and party; 1ex., Sankra R.H., Dist. Dhamtari, 18.X.2011, coll. Sunil and party.

Diagnostic character: Pale brownish yellow in colour; abdomen beneath with black fasciae on each side; sternum pilose; anterior pronotal angle with greyish narrow vittae; head with long spines at base of each antennae and with smaller discal spines; pronotum spinose, with two erect long spines on anterior lobe and long lateral spines on posterior lobe; femora and tibiae spinous.

Length : 10 mm.

Distribution: India : Chhattisgarh (Raipur, Dhamtari), Tamil Nadu, Maharashtra, West Bengal. *Elsewhere :* China, Japan, Sri Lanka.

Genus 3. **Sycanus** Amyot & Serville, 18431843. *Sycanus* Amy. & Serv., *Hem.*, 360.Key to the species of the
Genus **Sycanus** Amyot & Serville

1. Apical half of corium pale stramineous
.....*collaris* (Fabricius)
- Apical half of corium golden yellow.....
.....*croceovittatus* Dohrn.

3. **Sycanus collaris** (Fabricius, 1785)*
(Plate I, Fig. 3)1785. *Reduvius collaris* Fabricius, *Spec. Ins.*, 2: 380.1904. *Sycanus collaris*: Distant, *Fauna Brit. India, Rhynchota*, 2: 351.2006. *Sycanus collaris*: Ambrose, *Zoos' Print Journ.*, 21(9): 14.

Material examined: 1 ex., Barnawapara, Dist. Raipur, 1.VII.2011, coll. Dr. K. Chandra; 1 ex., Dondnala, Dist. Raipur, 10.VII.2011, coll. Sunil and party; 1 ex., Keduva, Dist. Raipur, 9.VI.2011, coll. Sunil and party; 3 exs., Devgaon, Dist. Raipur, 12.XI.2011, coll. Sunil and party.

Diagnostic character: Specimen black in colour; pronotum piceous; apical half of corium excluding apical angle and basal half of membrane reddish brown; membrane bronzy; antennae black, basal and subapical annulations to first joint, subbasal annulation to second joint and apex of rostrum reddish brown; head about as long as pronotum and scutellum together; first joint of antennae subequal to anterior femora; scutellar spine long, obliquely erect, apex bifid; abdomen strongly dilated on each side especially at third and fourth segments, posterior angles of second and third segments acute.

Length: 22-25 mm.

Distribution: India: Chhattisgarh (Raipur), Tamil Nadu, Assam, West Bengal, Meghalaya.
Elsewhere: China, Malaysia, Philippines, Sri Lanka, Thailand.

4. **Sycanus croceovittatus** Dohrn., 1859*
(Plate I, Fig. 4)1859. *Sycanus croceovittatus* Dohrn., *Stett. Ent. Zeit.*, 20: 97.1904. *Sycanus croceovittatus*: Distant, *Fauna Brit. India, Rhynchota*, 2: 352.2006. *Sycanus croceovittatus* Dohrn., Ambrose, *Zoos' Print Journ.*, 21(9): 14.

Material examined: 6 exs., Parbatiya, Dist. Raipur, 7.XI.2011, coll. Anil and party; 1 ex., Lalbandha pond, Dist. Raipur, 12.VII.2011, coll. Sunil and party.

Diagnostic character: Black in colour; posterior lobe of pronotum piceous; apical half of corium (excluding apical angle) and basal margin of membrane golden yellow in colour; second and third joints of rostrum pale reddish brown; head about as long as pronotum and scutellum together; antennae unicolourous, first joint equal to anterior femora; scutellar spine long, suberect, little obliquely curved bifid; abdominal margin strongly amplified and upwardly reflexed (especially 3rd and 4th segments), second, third, fourth and fifth segments with elevation, posterior angles of second and third segments acute.

Length: 22-25 mm.

Distribution: India: Chhattisgarh (Raipur).
Elsewhere: China, Malaysia, Myanmar.

Genus 4. **Coranus** Curtis, 18331833. *Coranus* Curtis, *Brit. Ent.*, 10: 453.5. **Coranus siva** Kirkaldy, 1891*
(Plate I, Fig. 5)1881. *Coranus spiniscutis* Reuter, *Act. Soc. Sc. Fenn.*, 12: 275.1904. *Coranus spiniscutis*: Distant, *Fauna Brit. India, Rhynchota*, 2: 381.2006. *Coranus siva*: Ambrose, *Zoos' Print Journ.*, 21(9): 7

Material examined: 1 ex., Barnawapara WLS, Dist. Raipur, 25.IX.2011, coll. Sunil and party; 1 ex., Anjani Beat, Dist. Surguja, 10.XI.2011, coll. Raha and party.

Diagnostic character: Body brownish yellow to dark brown covered with hairs; corium blackish brown membrane bronzy blackish brown; connexivum yellowish brown spotted with blackish

brown, abdomen beneath yellowish brown, its apex pitchy black; legs brownish yellow; bases and apices of tibiae, annulations to femora and apices of the tarsi pitchy black, extreme base of the tibiae with pale annulations.

Length: 9-10 mm.

Distribution: India: Chhattisgarh (Raipur, Surguja), Uttar Pradesh, Assam, Jharkhand, Meghalaya, West Bengal. *Elsewhere:* Myanmar.

Genus 5. **Rihirbus** Stål, 1861

1861. *Rihirbus* Stål, *Stett. Ent. Zeit.*, **22**: 129.

6. **Rihirbus trochantericus** Stål, 1861*
(Plate I, Fig. 6)

1861. *Rihirbus trochantericus* Stål, *Stett. Ent. Zeit.*, **22**: 132.

1904. *Rihirbus trochantericus*: Distant, *Fauna Brit. India, Rhynchota*, **2**: 378.

2006. *Rihirbus trochantericus*: Ambrose, *Zoos' Print Journ.*, **21**(9): 12.

Material examined: 1 ex., Dist. Kabirdham, 26. VIII. 2011, coll. Sunil and party.

Diagnostic character: Specimen sanguineous in colour; head excluding base and upper surface, antennae, rostrum, legs, lateral areas of meso and metasterna, transverse fasciae to abdomen black; intermediate and posterior femora with distinct yellowish brown annulations; head beneath, collar near middle, two basal tubercles on each side of anterior pronotal lobe, lateral and posterior margins of posterior pronotal lobe, apex of scutellum, intermediate spots behind middle of corium, trochanters, two annulations to anterior femora, sternum and abdomen pale reddish-testaceous.

Length: 18-24 mm.

Distribution: India: Chhattisgarh (Kabirdham), Meghalaya. *Elsewhere:* China, Myanmar, Sri Lanka, Philippines Islands.

Genus 6. **Euagorus** Burmeister, 1835

1835. *Euagorus* Burmeister, *Handb.* **2**: 226.

7. **Euagorus plagiatus** (Burmeister, 1834)
(Plate I, Fig. 7)

1834. *Zelus plagiatus* Burmeister, *Nov. Act. Ac. Nat. Cur.*, **16**(1): 303.

1904. *Euagorus plagiatus*: Distant, *Fauna Brit. India, Rhynchota*, **2**: 363.

2006. *Euagorus plagiatus*: Ambrose, *Zoos' Print Journ.*, **21**(9): 8.

Material examined: 1 ex., Jhirianala, Dist. Raipur, 25.VII.2011, coll. Sunil and party; 1ex., Naktipond, Dist. Raipur, 13.VII.2011, coll. Sunil and party; 1ex., Rampurnala, Dist. Raipur, 8.X.2011, coll. Sunil and party; 1ex., Barnawapara Dist. Raipur, 6.X.2011, coll. Sunil and party; 1ex., Chilpighati, Dist. Kabirdham, 26.VIII.2011, coll. Sunil and party; 4 exs., Jamunpani Dist. Kabirdham, 22.IX.2011, coll. Anil and party; 1ex., Stapdambur, Dist. Raipur, 7.VIII.2011, coll. Sunil and party; 1ex., Barnawapara, Dist. Raipur, 5.VIII.2011, coll. Sunil and party; 1ex., Damau Nala, Dist. Raipur, 7.X.2011, coll. Sunil and party.

Diagnostic character: Head, pronotum, scutellum reddish yellow with slight brownish tinge, hemelytron, sternum and a broad central spot to pronotum black; posterior spines to the pronotum curved and reflexed; first joint of antennae about as long as anterior femora or head, pronotum and scutellum together, rostrum reddish with its apex black.

Length: 13-14 mm.

Distribution: India: Chhattisgarh (Kabirdham, Raipur), Assam, Maharashtra, Tamil Nadu, Andaman Islands, Jammu & Kashmir, Kerala, West Bengal, Meghalaya. *Elsewhere:* Myanmar, China, Japan, Indonesia, Malaysia, Philippines, Singapore.

Genus 7. **Rhynocoris** Kolenati, 1857

1857. *Rhynocoris* Kolenati, *Fascia Bulletin Moscou*, **29**: 419-502.

Key to the species of the
Genus **Rhynocoris** Kolenati

1. Posterior lobe of pronotum rugosely granulate 2

- Posterior lobe of pronotum not, or very obscurely rugosely granulate
.....*fuscipes* (Fabr.)
- 2. Species sanguineous in colour; base of antennae sanguineous; disk of sternum, coxa, trochanters, anterior lobe of pronotum reddish-ochraceous; posterior lobe of pronotum rugose without any excavation.....
.....*marginatus* (Fabr.)
- Species black in colour; antennae black; disk of sternum, coxae, trochanters and pronotum rugulose with central excavation.....
.....*squalus* (Distant)

8. *Rhynocoris fuscipes* (Fabricius, 1787)*
(Plate I, Fig. 8)

1787. *Reduvius fuscipes* Fabricius, *Mant. Ins.*, 2 : 312.
1904. *Harpactor fuscipes*: Distant, *Fauna Brit. India, Rhynchota*, 2: 333.
1986. *Rhynocoris fuscipes*: Ambrose and Livingstone, *J. Bombay nat. Hist. Soc.*, **83**(1): 176.
2006. *Rhynocoris fuscipes*: Ambrose, *Zoos' Print Journ.*, **21**(9): 11.

Material examined: 1ex., GGNP, Rehand, Dist. Surguja 17.VIII.2011, coll. Angshuman; 1ex., Keduva, Dist. Raipur, 9.VII.2011, coll. Sunil and party; 1ex., Kundpani F., Dist. Kabirdham, 21.XI.2011, coll. Anil and party; 1ex., Sakri river, Dist. Kabirdham, 25.VIII.2011, coll. Sunil and party.; 1ex., Parbatiya WF, Dist. Raipur, 7.XI.2011, coll. Anil and party.; 1ex., Turturia forest, Dist. Raipur, 24.VII. 2011, coll. Sunil and party.

Diagnostic character: Body coral red; rostrum, antennae, anterior area of the posterior lobe of pronotum, disk of scutellum, an oblong spot between antennae, upper surface of postocular area, legs, two spots to pronotum, black; pronotum with the anterior lobe distinctly sculptured, posteriorly centrally a little impressed; membrane passing abdominal apex with its posterior margin pale fuliginous.

Length: 14-16 mm.

Distribution: India: Chhattisgarh (Kabirdham, Raipur, Surguja) Maharashtra, Tamil Nadu, West Bengal. *Elsewhere:* China, Sri Lanka.

9. *Rhynocoris marginatus* (Fabricius, 1794)*
(Plate I, Fig. 9)

1794. *Reduvius marginatus* Fabricius, *Ent. Syst.*, **4**: 196.
1904. *Harpactor marginatus*: Distant, *Fauna of Brit. India, Rhynchota*, **2**: 332.
2006. *Rhynocoris marginatus*: Ambrose, *Zoos' Print Journ.*, **21**(9): 11.
2010. *Rhynocoris marginatus*: Biswas and Bal, *Fauna of Uttarakhand, State Fauna Series*, **18**: 260.

Material examined: 1ex., Dongpahari, Dist. Raipur, 16.VII.2011, coll. Sunil and party; 1ex., Thadghat, Dist. Raipur, 9.VIII.2011, coll. Anil and party; 1ex., Devpur, Dist. Raipur, 1.VIII.2011, coll. Sunil and party.

Diagnostic character: Body blood reddish; scutellum, inner area of membrane, eyes, antennae, apical two thirds of tibiae, abdomen beneath violaceous black; pronotum with the anterior lobe sculptured, the posterior lobe wrinkled; first joint of antennae almost equal in length to anterior femora; corium wrinkled, the transverse cell near base of membrane with blood reddish margin; disc of sternum, coxae, trochanters and anterior lobe of pronotum reddish brownish yellow.

Length: 19.50-20 mm.

Distribution: India: Chhattisgarh (Raipur), Uttar Pradesh, Andhra Pradesh, Delhi, Uttarakhand. *Elsewhere:* China, Sri Lanka.

10. *Rhynocoris squalus* (Distant, 1904)*
(Plate II, Fig 10)

1904. *Harpactor squalus* Distant, *Fauna Brit. India, Rhynchota*, **2**: 333.
2006. *Rhynocoris squalus*: Ambrose, *Zoos' Print Journ.*, **21**(9): 12.

Material examined: 1ex., Ramgarh, Dist. Korea, 2.VIII.2011., coll. Angshuman and party; 1ex., nr. Sakri river, Dist. Kawardha, 25.VIII.2011, coll. Sunil and party; 2exs., nr. Polak river, Dist. Kabirdham, 28.VIII.2011, coll. Sunil and party;

1ex., Sarodadar, Dist. Kabirdham, 27.VIII.2011, coll. Sunil and party; 2exs., Balsarand Dist. Kabirdham, 1.IX.2011, coll. Sunil and party; 1ex., Moharli, Dist. Surguja, 16.VIII.2011, coll. Angshuman and party.

Diagnostic character: Species black in colour; corium, sternum, legs pitchy black; posterior lobe of pronotum and corium coarsely rugosely granulate; anterior pronotal lobe sculptured with two small distinct tubercles and centrally excavated posteriorly; head with anteocular and postocular area equal in length; first joint of antennae almost as long as anterior femora.

Length: 21 mm.

Distribution: India: Chhattisgarh (Kabirdham, Kawardha, Korea, Surguja), Sikkim.

Genus 8. *Sphedanolestes* Stål, 1866

1866. *Sphedanolestes* Stål, *Ofv. Vet. Ak. Forh.*: 284 & 288.

11. *Sphedanolestes variabilis* Distant, 1904*
(Plate II, Fig. 11)

1904. *Sphedanolestes variabilis* Distant, *Fauna Brit. India, Rhynchota*, 2: 342.

2006. *Sphedanolestes variabilis*: Ambrose, *Zoos' Print Journ.*, 21(9): 13.

Material examined: 1ex., Sarodadar, Dist. Kabirdham, 27.VIII.2011, coll. Sunil and party; 1ex., Lalbandhanala, Dist. Raipur, 15.VII.2011, coll. Sunil and party; 1ex., Thadghat, Dist. Raipur, 9.VIII.2011, coll. Anil and party.

Diagnostic character: Brownish yellow in colour; head above and lateral areas behind eyes, anterior lobe of pronotum, scutellum (excluding apex), spots to connexivum above and beneath, anterior area of prosternum, meso and meta sterna and coxa black; antennae, rostrum, legs pale reddish brown; apex of rostrum, basal, central and broad apical annulations to femora, bases and apices of tibiae, and tarsi black in colour; first joint of rostrum slightly longer than anteocular area of head which is as long as postocular area; head as long as pronotum; both lobes of pronotum sulcately impressed; first joint of antennae little shorter than anterior femora.

Length: 7-8 mm.

Var. a. Posterior lobe of pronotum more or less infuscated; legs wholly black.

Var. b. Resembling var. a, but with the pronotum black, a small central brownish yellow spot on posterior lobe.

Distribution: India: Chhattisgarh (Kabirdham, Raipur), Tamil Nadu.

Subfamily III. STENOPODAINAE

Key to the genera of the Subfamily STENOPODAINAE

1. First joint of rostrum longer than two apical joints together.....*Pygolampis* Germ.
- First joint of rostrum not longer than two apical joints together..... 2
2. Anterior femora with two series of small spines beneath*Sastrapada* Amy. & Serv.
- Anterior femora with a single series of small spines beneath *Oncocephalus* Klug

Genus 9. *Pygolampis* Germ., 1817

1817. *Pygolampis* Germ., *Faun. Ins. Eur.*, p. 8.

Key to the species of the Genus *Pygolampis* Germ.,

1. Mesosternum with two central piceous vittae; pronotum with longitudinal sulcation which is wider behind*foeda* Stål
- A broad central fasciae extending through meso, metasterna and abdomen beneath; anterior lobe of pronotum sulcate where as posterior lobe is with four discal carina *unicolor* Walker

12. *Pygolampis foeda* Stål, 1859*
(Plate II, Fig. 12)

1859. *Pygolampis foeda* Stål, *Ofv. Vet.-Ak. Forh.*, p. 379.

1904. *Pygolampis foeda*: Distant, *Fauna Brit. India, Rhynchota*, 2: 223.

2006. *Pygolampis foeda*: Ambrose, *Zoos' Print Journ.*, 21(9): 25.

Material examined: 1ex., Jagdalpur FRH,

Dist Jagdalpur, 14.VII.2011, coll. R.P. Gupta and party; 1ex., Bridulaw colony, Dist Jagdalpur, 16.VII.2011, coll. R.P. Gupta and party; 1ex., Barnawapara, Dist Raipur, 9.VII.2011, coll. Sunil and party.

Diagnostic character: Specimen brownish ochraceous in colour; femora thickened towards apex, anterior and intermediate tibiae annulated with dark brown markings; mesosternum with two central pitchy black vittae; first joint of antennae longer than head; basal joint of antennae, femora and posterior tibiae, mottled with dark brown; pronotum with a longitudinal sulcation which is wider behind.

Length: 12.5-16 mm.

Distribution: India: Chhattisgarh (Jagdalpur, Raipur), Tamil Nadu. *Elsewhere:* Australia, China, Fiji, Malaysia, Myanmar, Philippines, Sri Lanka.

13. *Pygolampis unicolor* Walker, 1873
(Plate II, Fig. 13)

1873. *Pygolampis unicolor* Walker, *Cat. Het.*, 8: 36.

1904. *Pygolampis unicolor*: Distant, *Fauna Brit. India, Rhynchota*, 2: 223.

2006. *Pygolampis unicolor*: Ambrose, *Zoos' Print Journ.*, 21(9): 25.

Material examined: 1ex., Bijapur, Dist. Bastar, 4.II.1990, coll. R. K. Ghosh

Diagnostic character: Head a little shorter than pronotum; anteocular portion faintly longitudinally ridged; postocular portion obsoletely sulcate; anterior lobe of pronotum sulcate, posterior lobe with four discal carina.

Length: 13.5-14.5 mm.

Distribution: India: Chhattisgarh (Bastar), West Bengal.

Genus 10. *Sastrapada* Amyot & Serville, 1843

1843. *Sastrapada* Amy. & Serv., *Hem.*, p. 388.

14. *Sastrapada baerensprungi* (Stål, 1859)
(Plate II, Fig. 14)

1859. *Harpagochara baerensprungi* Stål, *Ofv. Vet. Ak. Forh.*, 381.

1904. *Sastrapada baerensprungi*: Distant, *Fauna Brit. India, Rhynchota*, 2: 224.

2006. *Sastrapada baerensprungi*: Ambrose, *Zoos' Print Journ.*, 21(9): 25.

Material examined: 1ex., Bar forest, Dist Raipur, 25.IX.2011, coll. Sunil and party; 1ex., Barnawapara, Dist Raipur, 24.VIII.2011, coll. Sunil and party; 1ex., Chilpi RH, Dist Kabirdham, 1. IX. 2011, coll. Sunil and party.

Diagnostic character: Body pale brownish yellow; a discoidal spot to hemelytra and lateral abdominal margin black; head little shorter than pronotum; hemelytra shorter than abdomen; anterior coxae, apex and sometime sub basal annulations to anterior tibiae, disk of the sternum, lateral areas of head pitchy black.

Length: 14-18 mm.

Distribution: India: Chhattisgarh (Kabirdham, Raipur), Sikkim, West Bengal. *Elsewhere:* Algeria, Australia, Ethiopia, Greece, Israel, Italy, Morocco, Switzerland, Tunisia.

Genus 11. *Oncocephalus* Klug, 1830

1830. *Oncocephalus* Klug, *Symb. Phys.*, 2^e.

Key to the species of the
Genus *Oncocephalus* Klug

1. Anteocular portion of head longer, but not twice the length of postocular are a
.....*impudicus* Reuter
- Anteocular portion of head twice the length of postocular area.....*schioedtei* Reuter

15. *Oncocephalus impudicus* Reuter, 1882*
(Plate II, Fig. 15)

1882. *Oncocephalus impudicus* Reut., *Act. Soc. Sc. Fenn.*, 12: 715.

1904. *Oncocephalus impudicus*: Distant, *Fauna Brit. India, Rhynchota*, 2: 229.

2006. *Oncocephalus impudicus*: Ambrose, *Zoos' Print Journ.*, 21(9): 25.

Material examined: 1ex., Barnawapara, Dist. Raipur, 7.VII.2011, coll. Sunil and party; 1ex., Latadadar, Dist. Raipur, 23.IX.2011, coll. Sunil

and party. 1ex., Barnawapara, Dist. Raipur, 9.VIII.2011, coll. Anil; 1ex., Charalda vil Dist. Raipur, 19.VII.2011, coll. Sunil and party; 1ex., Barnawapara, Dist. Raipur, 8.IX.2011, coll. Sunil and party.; 1ex., Sankra RH, Dist. Dhamtari, 12.X.2011, coll. Sunil and party.; 1ex., Dist. Jagdalpur, 28. VII.2011, coll. R. P. Gupta and party; 1ex., Dist. Jagdalpur, 27. VII.2011, coll. R.P. Gupta and party; 1ex., Barnawapara Dist. Raipur, 19.IX.2011, coll. Sunil and party.

Diagnostic character: Specimen yellowish brown in colour; eyes black; antennae, legs, abdomen beneath brownish yellow in colour; three fasciae on anterior lobe of pronotum and lateral margins dark brown; a central spot to clavus, cellular area of corium, a small spot behind it, long irregular spot on membrane reddish brown; head beneath, sternum, anterior and posterior femora, apices of intermediate tibiae, three annulations to tibiae, lateral area and apex of abdomen dark brown; apex of first antennal joint dark brown, third joint black; apical spine to scutellum long and acute; first and second joint of rostrum subequal.

Length: 12-13 mm.

Distribution: India: Chhattisgarh (Dhamtari, Jagdalpur, Raipur), West Bengal. *Elsewhere:* China, Indonesia, Sri Lanka, Philippines, Myanmar.

16. ***Oncocephalus schioedtei*** Reuter, 1882*
(Plate II, Fig. 16)

1882. *Oncocephalus schioedtei* Reut., Act. Soc. Sc. Fenn., 12: 702.

1904. *Oncocephalus schioedtei* : Distant, Fauna Brit. India, Rhynchota, 2: 232.

2006. *Oncocephalus schioedtei* : Ambrose, Zoos' Print Journ., 21(9): 25.

Material examined: 3ex., Durg, Dist. Rajnand gaon, 24.VIII.2011, coll. Sunil and party.

Diagnostic character: Yellowish brown in colour; basal joint of antennae biannulated with dark brown; head with a black spot on disk behind eyes, the lateral areas dark brown; pronotum with

two central longitudinal lines which are fused on anterior lobe and two obscure waved lines on each lateral areas and lateral margins dark brown; scutellum dark brown with central transverse band yellowish brown; corium with a posterior subclaval elongate spot, a cellular subquadrate spot near inner angle, a very small spot between them, with grayish margin; second joint excluding base and remaining joints of rostrum, lateral areas of meso and metasterna, apices of intermediate and posterior femora, longitudinal lines on undersurface of anterior femora, basal, subbasal annulations to intermediate and posterior tibiae and their apices dark brown; 1st joint of antennae as long as head; lateral angles of pronotum acutely pointed.

Length: 16-21 mm.

Distribution: India: Chhattisgarh (Rajnand gaon), West Bengal, Tamil Nadu. *Elsewhere:* Myanmar.

Subfamily IV. ECTRICHODIINAE

Key to the genera of the
Subfamily ECTRICHODIINAE

1. Antennae with eight joints..... 2
- Antennae with six joints.....
..... *Haematorrhophus* Stål
2. Scutellum with two apical spinous angulations..... *Scadra* Stål
- Scutellum with three apical spinous angulations, the middle one minute.....
..... *Ectrychotes* Burm.

Genus 12. ***Haematorrhophus*** Stål, 1874a

1874a. *Haematorrhophus* Stål, Kongliga Svenska Vetenskaps Akademiens Handlingar, 4 :3-7.

17. ***Haematorrhophus tuberculatus***

(Stål, 1874)*

(Plate II, Fig. 17)

1874. *Physorhynchus tuberculatus* Stål, En. Hem., 4: 49.

1904. *Physorhynchus tuberculatus*: Distant, Fauna Brit. India, Rhynchota, 2: 320.

2006. *Haematorrhophus tuberculatus*: Ambrose, Zoos' Print Journ., 21(9): 3.

Material examined: 1ex., Devgaon, Dist. Raipur, 5.VIII.2011, coll. Sunil and party; 1ex., Darbha, Dist. Jagdalpur, 16.VIII.2011, coll. R.P. Gupta and party.

Diagnostic character: Specimen shining black in colour; lateral margins of connexivum reddish; hemelytra abbreviated, practically absent; apices of tibiae and tarsi clothed with yellowish brown hairs; anterior lobe of pronotum longer than posterior lobe; first and second joint of antennae sub-equal in length.

Length: 28-35 mm.

Distribution: India: Chhattisgarh (Jagdalpur, Raipur), Assam, Meghalaya, Nagaland. *Elsewhere:* Sri Lanka, Myanmar.

Genus 13. **Scadra** Stål, 1859.

1859. *Scadra* Stål, *Ofv. Vet. -Ak. Forh.*: 176 & 182.

Key to the species of the Genus **Scadra** Stål

1. Neither antennae nor tibiae annulated
..... *fuscicrus* Stål
- Both antennae and tibiae annulated
..... *annulipes* Reuter

18. **Scadra fuscicrus** Stål, 1859*

(Plate II, Fig. 18)

1859. *Scadra fuscicrus* Stål, *Ofv. Vet. -Ak. Forh.*: 183.

1904. *Scadra fuscicrus*: Distant, *Fauna of Brit. India, Rhynchota*, 2: 308.

1999. *Scadra fuscicrus*: Biswas et. al., *Fauna of Meghalaya, State Fauna Series*, 4(Part 4): 304.

2007. *Scadra fuscicrus*: Biswas et. al., *Fauna of Andhra Pradesh, State Fauna Series*, 5(Part 3): 340.

Material examined: 2exs., Sankra, Dist. Dhamtari, 21.X.2011, coll. Sunil and party; 1ex., Barnawapara, Dist. Raipur, 10.XI.2011, coll. Sunil and party; 1ex., Barnawapara, Dist. Raipur, 28.IX.2011, coll. Sunil and party; 2exs., Hardifor, Dist. Raipur, 4.X.2011, coll. Sunil and party; 1ex., Sankra, Dist. Dhamtari, 22.X.2011, coll. Sunil and party.

Diagnostic character: Body rufous-testaceous; a large spot on interior area of corium, membrane,

three segmental spots to the ventral segments and the tibiae black; tarsi yellowish brown, apical joint dark brown; posterior lobe of pronotum with two black spots.

Length: 10.5-13.5 mm.

Distribution: India: Chhattisgarh (Dhamtari and Raipur), Meghalaya, Andhra Pradesh. *Elsewhere:* Sri Lanka.

19. **Scadra annulipes** Reuter, 1881

(Plate III, Fig. 19)

1881. *Scadra annulipes* Reuter, *Act. Soc. Sc. Fenn.*, 12: 309.

1904. *Scadra annulipes*: Distant, *Fauna of Brit. India, Rhynchota*, 2: 310.

2006. *Scadra annulipes*: Ambrose, *Zoos' Print Journ.*, 21(9): 4.

Material examined: 2exs., Barnawapara camp., Dist. Raipur, 3.VII.2011, Dr. Kailash Chandra and party.

Diagnostic character: Body flavous-testaceous; antennae, a spot on each side of posterior pronotal lobe, a triangular spot on interior area of corium, membrane, abdomen above, last ventral segment, ventral series of round spots, three annulations to tibiae, apices of tarsi black; third joint of antennae with subapical white annulations; connexivum not spotted.

Length: 13.5 mm.

Distribution: India: Chhattisgarh (Raipur), West Bengal, Tamil Nadu, Kerala.

Genus 14. **Ectrychotes** Burmiester, 1835

1835. *Ectrychotes* Burm. *Handb.*, 2 : 237.

Key to the species of the
Genus **Ectrychotes** Burmiester

1. Pronotum unicolourous *atripennis* (Stål)
- Pronotum not unicolourous *dispar* Reuter

20. **Ectrychotes atripennis** (Stål, 1866)*

(Plate III, Fig. 20)

1866. *Larymna atripennis* Stål, *Ofv. Vet. -Ak. Forh.*, p. 302.

1904. *Ectrychotes atripennis*: Distant, *Fauna Brit. India, Rhynchota*, 2: 317.

2006. *Ectrychotes atripennis*: Ambrose, *Zoos' Print Journ.*, 21(9): 1.

Material examined: 1ex., Naktipond, Dist. Raipur, 13.VII.2011, coll. Sunil and party

Diagnostic character: Species coral red in colour, shining. Antennae dark brown at apex; hemelytra excluding base and marginal line from base to middle, three large lateral segmental spots to sternum, lateral fasciae to abdomen black.

Length: 11-12 mm.

Distribution: India: Chhattisgarh (Raipur), Tamil Nadu. *Elsewhere*: Myanmar, Indonesia, Malaysia.

21. *Ectrychotes dispar* Reuter, 1881
(Plate III Fig. 21)

1881. *Ectrychotes dispar* Reuter, *Act. Soc. Sc. Fenn.*, 12: 304.

1904. *Ectrychotes dispar*: Distant, *Fauna of Brit. India, Rhynchota*, 2: 315.

2006. *Ectrychotes dispar*: Ambrose, *Zoos' Print Journ.*, 21(9): 2.

Material examined: 5exs., Barnawapara camp., Dist. Raipur, 1.VII.2011, Dr. Kailash Chandra and party.

Diagnostic character: Species violet in colour, antennae and hemelytra piceous; lateral areas of posterior lobe of pronotum, scutellum, base of clavus, corium, lateral margins of corium, connexivum, apices of coxae, trochanters, basal half of posterior femora, bases of tarsi and abdomen beneath, violaceous.

Length: 12-14 mm.

Distribution: India: Chhattisgarh (Raipur), West Bengal, Maharashtra, Bangalore, Tamil Nadu.

Subfamily V. PEIRATINAE

Key to the genera of the Subfamily **Peiratinae**

1. Head of moderate length; antennae inserted near or not remote from eyes; intermediate tibiae generally provided with a spongy furrow 2

- Head long, porrect; antennae inserted remotely from eyes; intermediate tibiae without a spongy furrow *Sirthena* Spinola
- 2. Pronotum smooth, or with posterior lobe finely granulate 3
- Pronotum tuberculously granulate *Catamiarus* Amy. & Serv.
- 3. Spongy furrow occupying more than half of anterior tibiae *Ectomocoris* Mayr.
- Spongy furrow occupying less or not more than half of anterior tibiae 4
- 4. Anterior femora not spinose beneath 5
- Anterior femora spinose beneath *Lestomerus* Amy. & Serv.
- 5. Second joint of antennae as long as pronotum *Spilodermus* Stål
- Second joint of antennae about as long as anterior lobe of pronotum *Cleptocoris* Stål

Genus 15. *Sirthena* Spinola, 1840

1840. *Sirthena* Spinola, *Spin. Ess. Hem.*, p. 100.

22. *Sirthena flavipes* (Stål, 1855)*
(Plate III, Fig. 22)

1855. *Rasahus flavipes* Stål, *Ofv. Vet.-Ak. Forh.*, p. 187.

1904. *Sirthena flavipes*: Distant, *Fauna Brit. India, Rhynchota*, 2: 303.

2006. *Sirthena flavipes*: Ambrose, *Zoos' Print Journ.*, 21(9): 18.

Material examined: 1ex., Barnawapara, Dist. Raipur, 28.IX.2011, coll. Sunil and party.

Diagnostic character: Black in colour; anterior lobe of pronotum, disk of abdomen beneath reddish brown; first joint of antennae, base of second and third excluding base, base and apex of clavus, base and a subclaval apical spot to corium, apex of membrane, rostrum, legs, spots to connexivum above and beneath and a large lateral, basal and apical abdominal spot yellowish brown; antennae pilose, first joint not reaching apex of head, second about as long as anteocular portion of head.

Length: 19-21 mm.

Distribution: India: Chhattisgarh (Raipur), Assam, Nagaland, Tamil Nadu. *Elsewhere:* China, Hong Kong, Indonesia, Japan, Philippines, Sri Lanka.

Genus 16. ***Catamiarus*** Amyot & Serville, 1843

1843. *Catamiarus* Amyot & Serville, *Hem.*, 323.

23. ***Catamiarus brevipennis*** (Serville, 1831)*
(Plate III, Fig. 23)

1831. *Pirates brevipennis* Serv., *Ann. Sc. Nat.*, 23: 217.

1904. *Catamiarus brevipennis*: Distant, *Fauna Brit. India, Rhynchota*, 2: 302.

2006. *Catamiarus brevipennis*: Ambrose, *Zoos' Print Journ.*, 21(9): 15.

Material examined: 1ex., Korea, 3.VII.2011, coll. Angshuman and party; 1ex., Surguja, 16.VIII.2011, coll. Angshuman and party.

Diagnostic character: Body black; a large rounded spot adjoining to the apex of the clavus and a very large discal spot to membrane brownish yellow; antennae hairy; head with the lateral margin hirsute; legs and margins of the body with long hair or hirsute.

Length: 20-26 mm.

Distribution: India: Chhattisgarh (Surguja), Uttaranchal, Rajasthan, Tamil Nadu, Karnataka.

Genus 17. ***Ectomocoris*** Mayr, 1865

1865. *Ectomocoris* Mayr, *Verh. Z.-b. Ges. Wien.*, p. 438.

Key to the species of the
Genus ***Ectomocoris*** Mayr

1. Hemelytra abbreviated *simulans* Distant
- Hemeltra fully developed *cordiger* Stål

24. ***Ectomocoris simulans*** Distant, 1919*
(Plate III, Fig. 24)

1919. *Ectomocoris simulans* Distant, *Ann. Mag. Nat. Hist.*, 3: 466-469.

2006. *Ectomocoris simulans* : Ambrose, *Zoos' Print Journ.*, 21(9): 17.

Material examined: 1ex., Bar forest, Dist. Raipur, 6.VIII.2011, Sunil and party; 1ex., Devgaon, Dist. Raipur, 5.VIII.2011, Sunil and party.

Diagnostic character: Specimen black in colour; head moderately long, anteocular longer than postocular area, impressed transversely between eyes; antennae brownish yellow, first joint shorter than head, second and third joints almost equal in size; rostrum brownish yellow, stout, second joint longest; pronotum elongate, anterior lobe more than twice the length of posterior lobe; hemelytra excluding base and spot at apex, yellowish and only reaching base of first abdominal segment; apex of scutellum acute; abdomen moderately dilated; legs brownish yellow, anterior femora strongly, intermediate femora moderately incrassated, anterior tibiae almost as long as femora and provided with a spongy furrow occupying three-fourths of their under surface, tarsi three-jointed.

Length : 15-16 mm.

Distribution: Known from India including Chhattisgarh (Raipur).

25. ***Ectomocoris cordiger*** Stål, 1866*
(Plate III, Fig. 25)

1866. *Ectomocoris cordiger* Stål, *Ofv. Vet.-Ak. Forh.*, p. 256.

1904. *Ectomocoris cordiger*: Distant, *Fauna Brit. India, Rhynchota*, 2: 295.

2006. *Ectomocoris cordiger*: Ambrose, *Zoos' Print Journ.*, 21(9): 16.

Material examined: 1ex., Chilpi R.H, Dist. Kawardha., 31.VIII.2011, coll. Sunil and party.

Diagnostic character: Black, opaque; pronotum and scutellum olivaceous black; antennae, greater part of second and third joints of rostrum, small spots to connexivum above and beneath, legs, yellowish brown in colour; apical half of clavus confluent with somewhat similar sized spot on corium, small spot on outer area of basal cell to membrane, brownish yellow; legs and antennae hairy.

Length : 12-15 mm.

Distribution: India: Chhattisgarh (Kawardha), West Bengal, Maharashtra, Tamil Nadu, Kerala. *Elsewhere*: Sri Lanka, New Guinea, Iran, Iraq, United Arab Emirates.

Genus 18. ***Lestomerus*** Amyot & Serville, 1843

1843. *Lestomerus* Amyot & Serville, *Hem.*, p. 322.

26. ***Lestomerus sanctus*** (Fabricius, 1787)*
(Plate III, Fig. 26)

1787. *Reduvius sanctus* Fabricius, *Mant.*, 2, p. 310.

1904. *Pirates sanctus*: Distant, *Fauna Brit. India, Rhynchota*, 2: 298.

2006. *Lestomerus sanctus*: Ambrose, *Zoos' Print Journ.*, 21(9): 17.

Material examined : 1ex., Barnawapara, Dist Raipur, 12.VII.2011, coll. Sunil and party; 1ex., Barnawapara, Dist Raipur, 18.IX.2011, coll. Sunil and party; 1ex., Barnawapara, Dist Raipur, 9.IX.2011, coll. Sunil and party.

Diagnostic character: Body brownish yellow in colour; eyes, narrow lateral margins and a central longitudinal fascia to anterior pronotal lobe, anterior marginal area of posterior pronotal lobe, hemelytra, transverse spots to connexivum above and beneath, lateral areas of prosternum, meso and metasterna, segmental fasciae and apex to abdomen, anterior femora beneath, apex of femora and tibiae, black; second joint of antennae almost as long as pronotum; anterior pronotal lobe with a sulcation, merged in a foveate spot near base; anterior and intermediate femora spinose beneath.

Length: 14.5-15 mm.

Distribution: India: Chhattisgarh (Raipur), North Bengal, Tamil Nadu, Punjab. *Elsewhere*: Sri Lanka, Myanmar.

Genus 19. ***Spilodermus*** Stål, 1868

1868. *Spilodermus* Stål, *Hem.*, 1: 122.

27. ***Spilodermus quadrinotatus***
(Fabricius, 1798)
(Plate III, Fig. 27)

1798. *Reduvius quadrinotatus* Fabricius, *Ent. Syst. Suppl.*, p. 544.

1904. *Pirates quadrinotatus*: Distant, *Fauna Brit. India, Rhynchota*, 2: 300.

2006. *Spilodermus quadrinotatus*: Ambrose, *Zoos' Print Journ.*, 21(9): 18.

Material examined: 1ex., Barnawapara, Dist Raipur, 16.VIII.2011, coll. Sunil and party.

Diagnostic character: Black, legs with greyish hairy; posterior lobe of pronotum, scutellum, clavus, corium, posterior margin of prosternum, cinnamon- brown; posterior inner area of corium black; membrane with one anterior another posterior spots and a line on basal margin white; spots to connexivum above and beneath, apices of coxae, bases of intermediate and posterior femora brownish yellow; second joint of antennae as long as pronotum.

Length: 9-10.5 mm.

Distribution: India: Chhattisgarh (Raipur), Tamil Nadu. *Elsewhere*: Sri Lanka, Bangladesh.

Genus 20. ***Cleptocoris*** Stål, 1866

1866. *Cleptocoris* Stål, *Ofv. Vet.-Ak. Forh.*, p. 262.

Key to the species of the
Genus ***Cleptocoris*** Stål

1. Membrane fuscous, unicolorous.....
.....*lepturoides* (Wolff.)
- Membrane spotted with black.....
.....*atromaculatus* Stål

28. ***Cleptocoris lepturoides*** Wolff., 1804*
(Plate IV, Fig. 28)

1804. *Reduvius lepturoides* Wolff, *Ik.*, 4: 165.

1904. *Pirates lepturoides* : Distant, *Fauna Brit. India, Rhynchota*, 2: 301.

2006. *Cleptocoris lepturoides* : Ambrose, *Zoos' Print Journ.*, 21(9): 15.

Material examined: 1ex., Moharli, Dist Surguja, 16.VIII.2011, coll. Angshuman and party.

Diagnostic character: Black; corium brownish yellow in colour, a small spot at inner angle at base of membrane, the membrane, brownish yellow; connexivum above and beneath spotted with yellowish brown; anterior pronotal lobe centrally impressed; anterior femora unarmed beneath.

Length : 9-10.5 mm.

Distribution: India: Chhattisgarh (Surguja), Maharashtra. *Elsewhere*: Sri Lanka, Myanmar, Indonesia.

29. *Cleptocoris atromaculatus* Stål, 1870

(Plate IV, Fig. 29)

1870. *Cleptocoris atromaculatus* Stål, *Ofv. Vet.-Ak. Forh.*, p. 692.

1904. *Pirates atromaculatus*: Distant, *Fauna Brit. India, Rhynchota*, 2: 301.

2006. *Cleptocoris atromaculatus*: Ambrose, *Zoos' Print Journ.*, 21(9): 15.

Material examined: 1ex., Kutru, Dist. Bastar, 2.II.1990, coll. R.K. Ghosh; 1ex., Kerpe, 20 km N.W. of Kutru, Dist. Bastar, 31. I.1990, Coll. R.K. Ghosh.

Diagnostic character: Black; posterior lobe of pronotum, scutellum, clavus, corium and posterior lateral margin of pro-sternum cinnamon brown; antennae pilose, second joint about as long as pronotum.

Length : 12 mm.

Distribution: India: Chhattisgarh (Bastar), Assam, Meghalaya, Nagaland, *Elsewhere*: Sri Lanka, Myanmar, Indonesia, China, Hong Kong, Japan and Philippines.

Subfamily VI. SALYAVATINAE

Genus 21. *Lisarda* Stål, 1859

1859. *Lisarda* Stål, *Ofv. Vet.-Ak. Forh.*, p. 192.

30. *Lisarda annulosa* Stål, 1874*

(Plate IV, Fig. 30)

1874. *Lisarda annulosa* Stål, *En. Hem.*, 4, p. 83.

1904. *Lisarda annulosa*, Distant, *Fauna Brit. India, Rhynchota*, 2: 237.

2006. *Lisarda annulosa*: Ambrose, *Zoos' Print Journ.*, 21(9): 23.

Material examined: 1ex., Sonnat, Dist Korea, 1.VIII.2011, coll. Sunil and party; 1ex., Lalbandhapond Dist Raipur, 14.VII.2011, coll. Sunil and party.

Diagnostic character: Species brownish-yellow in colour; base and annulations to second joint of antennae, mottlings to hemelytra and abdomen, connexivum and legs brownish yellow; subocellate spots to connexivum, head beneath, sternum, a broad fasciae on each side of abdomen joining a spot on apical segment and a few smaller linear central spots dark reddish brown; tibiae and femora annulated with brownish yellow; femora with a spine on apex, anterior femora with a medial spine, spine to scutellum short and obtuse.

Length : 11 mm.

Distribution: India: Chhattisgarh (Korea and Raipur), Tamil Nadu. *Elsewhere*: China, Myanmar, Sri Lanka

Subfamily VII. REDUVIINAE

Key to the genera of the
Subfamily REDUVIINAE

1. Eyes and ocelli large or very prominent; eyes extending transversely quite across the lateral areas of the head; pronotum broadly longitudinally impressed or sulcate.....
.....*Gerbelius* Distant
- Eyes and ocelli small or mediocre; eyes never extending transversely across the lateral areas of the head; pronotum is not broadly longitudinally impressed or sulcate.....
.....*Acanthaspis* Amy. & Serv.

Genus 22. *Gerbelius* Distant, 1903

1903. *Gerbelius* Distant, *Ann. Soc. Ent. Belg.*, p. 59.

31. *Gerbelius ornatus* Distant, 1903*

(Plate IV, Fig. 31)

1903. *Gerbelius ornatus* Distant, *Ann. Soc. Ent. Belg.*, p. 59.

1904. *Gerbelius ornatus*: Distant, *Fauna Brit. India, Rhynchota*, 2: 254.

2006. *Gerbelius ornatus*: Ambrose, *Zoos' Print Journ.*, 21(9): 21.

Material examined: 1ex., Latadadar, Dist Raipur, 9.X.2011, coll. Sunil and party.

Diagnostic character: Species brownish black

in colour; femora pale brownish, their bases, the tibiae, tarsi, antennae, rostrum, a large spot occupying claval apices, adjacent area of corium, apical angle of corium, a small adjacent spot on membrane, apex of scutellum pale yellowish brown; femora spined beneath; connexivum with pale narrow incisural spots.

Length: 8.5-10 mm.

Distribution: India: Chhattisgarh (Raipur), Maharashtra. *Elsewhere*: Sri Lanka.

Genus 23. *Acanthaspis* Amyot & Serv., 1843

Key to the species of the

Genus *Acanthaspis* Amyot & Serv.

1. Posterior lobe of pronotum either with discal spines or with tubercles 2
 - Posterior lobe of pronotum discally unarmed 3
2. Posterior lobe of pronotum with two short but prominent discal tubercles 4
 - Posterior lobe of pronotum with two long discal spines..... *quinquespinosa* (Fabricius)
3. Pronotum unicolorous, unspotted; legs unicolorous *siva* Distant
 - Pronotum dark with pale spots and markings; legs annulate *sexguttata* (Fabricius)
4. Pronotum unicolorous, unspotted 5
 - Pronotum palely marked or spotted *flavipes* Stål
5. Piceous in colour; central disc of abdomen reddish brown; first joint of rostrum distinctly longer than second *fulvipes* (Dallas)
 - Purplish-brown in colour; abdomen beneath yellowish brown; first joint of rostrum shorter than second *luteipes* Walker

32. *Acanthaspis quinquespinosa* (Fabr., 1781)*
(Plate IV, Fig. 32)

1781. *Reduvius quinquespinosa* Fabr., *Spec. Ins.*, 2: p. 382.

1904. *Acanthaspis quinquespinosa*: Distant, *Fauna Brit. India, Rhynchota*, 2: 257.

2006. *Acanthaspis quinquespinosa*: Ambrose, *Zoos' Print Journ.*, 21(9): 20.

2007. *Acanthaspis quinquespinosa*: Biswas and Bal, *Fauna of Andhra Pradesh, State Fauna Series*, 5(Part-3): 342.

Material examined: 1ex., Barnawapara, Dist Raipur, 11.VII.2011, coll. Sunil and party; 1ex., Raipur, Dist Raipur, 10.VII.2011, coll. Anil and party; 1ex., Raipur, Dist Raipur, 10.VII.2011, coll. Anil and party.

Diagnostic character: Body black; two lateral and two discal spines to pronotum; a transverse discal spot to corium and spot to connexivum above and beneath luteous; anterior lobe of pronotum strongly sculptured, posterior lobe rugose with a long lateral spine on each side and with two shorter erect discal spines between them; scutellar spine long, obliquely ascending.

Length: 15.5-19 mm.

Distribution: India: Chhattisgarh (Raipur), Assam, Madhya Pradesh, Tamil Nadu, Maharashtra, Meghalaya and West Bengal. *Elsewhere*: China, Sri Lanka, Myanmar.

33. *Acanthaspis siva* Distant, 1904*
(Plate IV, Fig. 33)

1904. *Acanthaspis siva* Distant, *Fauna Brit. India, Rhynchota*, 2: 265.

2006. *Acanthaspis siva*: Ambrose, *Zoos' Print Journ.*, 21(9): 20.

Material examined: 1ex., Kabirdham, 1.X.2011, coll. Sunil and party.

Diagnostic character: Body black and rugulose; corium with basal and sub basal angular creamy spot; connexivum spotted pale ochraceous; antennae basal joint black and remaining joints brown in colour; pronotum posterior lobe rugulose and centrally sulcate; scutellar spine ascendant obliquely, apex of membrane creamy white.

Length: 18 mm.

Distribution: India: Chhattisgarh (Kabirdham), Madhya Pradesh, North and Central India and Tamil Nadu. *Elsewhere*: Sri Lanka.

34. *Acanthaspis sexguttata* (Fabricius, 1775)
(Plate IV, Fig. 34)

1775. *Reduvius sexguttata* Fabricius, *Syst. Ent.*, p. 832.
1904. *Acanthaspis sexguttata*: Distant, *Fauna Brit. India, Rhynchota*, 2: 270
2003. *Acanthaspis sexguttata*: Biswas and Bal, *Fauna of Sikkim, State Fauna Series*, 9(Part-2): 529.
2006. *Acanthaspis sexguttata*: Ambrose, *Zoos' Print Joun.*, 21(9): 20.

Material examined: 1 ex., AABR, Bilaspur, Chhaparwa FRH, 4.VI.08, coll. Y.N. Gupta and party.

Diagnostic character: Posterior pronotal lobe transversely rugulose with four flavous brownish yellow spots; anterior lobe distinctly sculptured, corium with sub basal and a larger about rounded subapical spot and large apical spot to membrane greyish flavescent, femora annulated near apex and the tibiae biannulate; scuteller spine obliquely ascendant.

Length: 16-20 mm.

Distribution: India: Chhattisgarh (Bilaspur), Andhra Pradesh, Sikkim, Karnataka, Tamil Nadu and West Bengal.

35. *Acanthaspis flavipes* Stål, 1855
(Plate IV, Fig. 35)

1855. *Acanthaspis flavipes* Stål, *Ofv. Vet.-Ak. Forh.*, p. 187.
1904. *Acanthaspis flavipes*: Distant, *Fauna Brit. India, Rhynchota*, 2: 262.
2006. *Acanthaspis flavipes*: Ambrose, *Zoos' Print Joun.*, 21(9): 19.

Material examined: 1ex., Barnawapara, Dist Raipur, 12.VII.2011, coll. Sunil and party.; 1ex., Devpur, Dist Raipur, 1.VIII.2011, coll. Sunil and party.

Diagnostic character: Body brown; large transverse spot to the middle of corium, spot to connexivum; rostrum, legs, apex of scutellar spine luteous; pronotum with anterior lobe strongly sculptured, lateral angle spinously produced; scutellar spine obliquely ascendant.

Length: 15.5-16 mm.

Distribution: India: Chhattisgarh (Raipur), Madhya Pradesh, Maharashtra, Punjab, Tamil Nadu and West Bengal.

36. *Acanthaspis fulvipes* (Dallas, 1850)
(Plate IV, Fig. 36)

1850. *Platymeris fulvipes* Dallas, *Tr. Ent. Soc.*, p. 6.
1904. *Acanthaspis fulvipes*: Distant, *Fauna Brit. India, Rhynchota*, 2: 259.
2006. *Acanthaspis fulvipes*: Ambrose, *Zoos' Print Joun.*, 21(9): 19.

Material examined: 1ex., Jagdalpur, Dist. Jagdalpur, 16.VIII.2011, coll. R.P. Gupta.

Diagnostic character: Pronotum with anterior lobe moderately sculptured and deeply centrally foveate on posterior margin; posterior lobe rugulose, its lateral angles acutely spinous, scutellar spine long, obliquely ascendant; antennae, rostrum, legs and central disk of abdomen reddish brown; a large spot behind middle of corium and spot to connexivum above and beneath ochraceous.

Length: 25-26 mm.

Distribution: India: Chhattisgarh (Jagdalpur), Assam, Madhya Pradesh, West Bengal and Sikkim. Elsewhere: Bhutan.

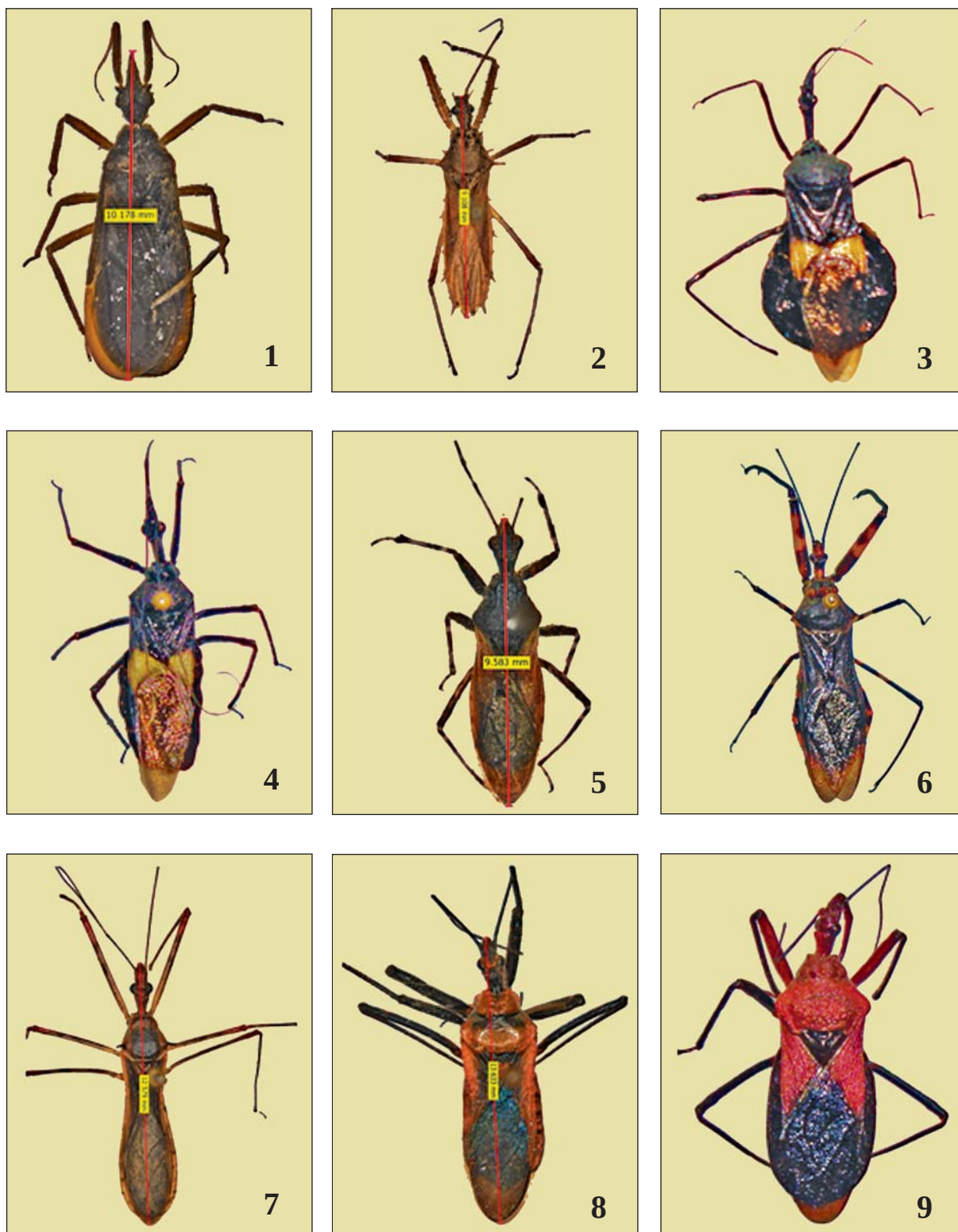
37. *Acanthaspis luteipes* Walk., 1873
(Plate IV, Fig. 37)

1873. *Acanthaspis luteipes* Walk., *Cat. Het.*, 7, p. 175.
1904. *Acanthaspis luteipes* Distant, *Fauna Brit. India, Rhynchota*, 2: 260.
2006. *Acanthaspis luteipes*: Ambrose, *Zoos' Print Joun.*, 21(9): 19.
2007. *Acanthaspis luteipes*: Biswas and Bal, *Fauna of Andhra Pradesh, State Fauna Series*, 5(Part-3): 342.

Material examined: 1ex., Jhirianala; Dist. Raipur, 25.VII.2011, coll. Sunil and party; 1ex., Barnawapara, Dist Raipur, 28.IX.2011, coll. Sunil and party; 1ex., Barnawapara, Dist Raipur, 4. VIII.2011, coll. Sunil and party.

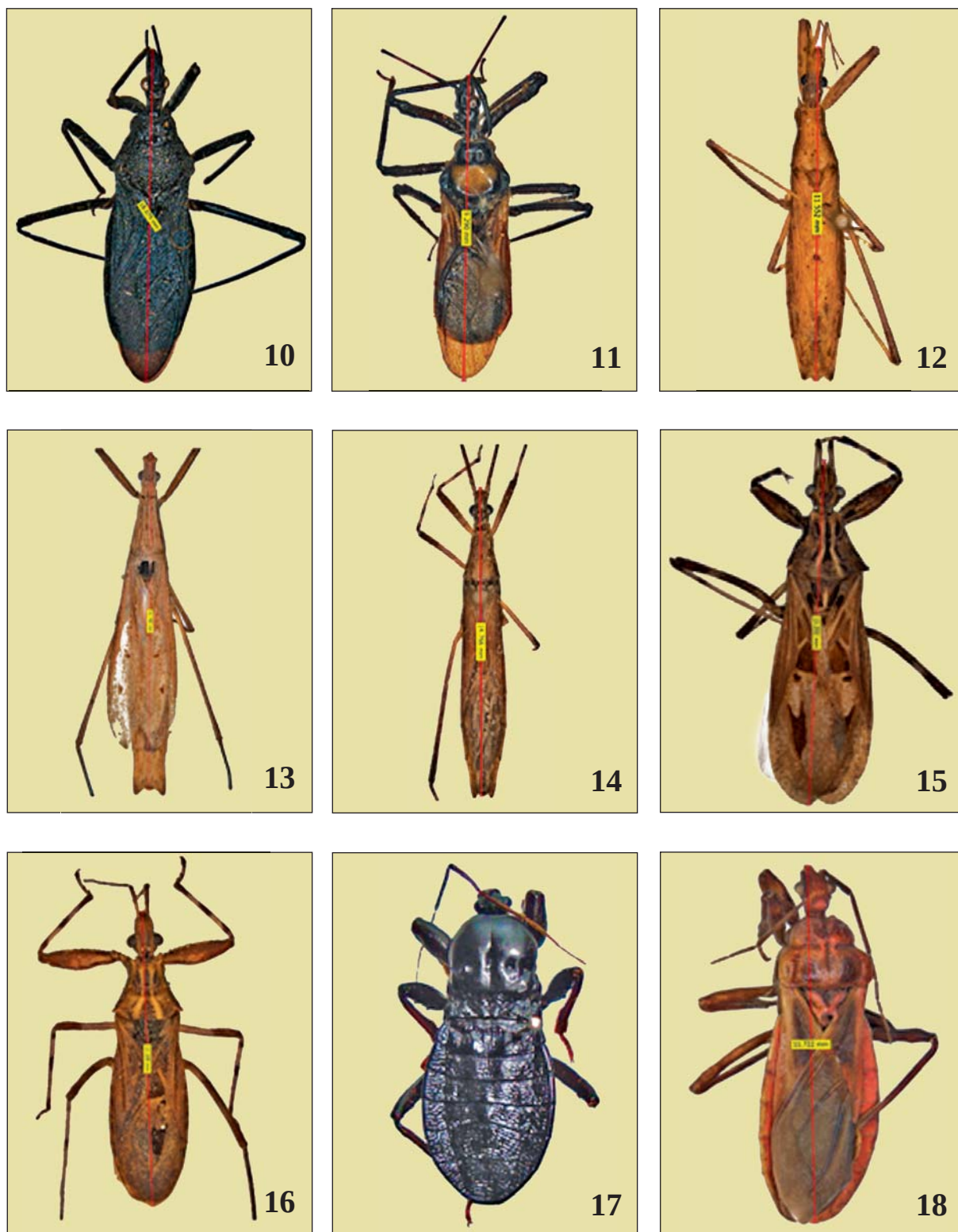
Diagnostic character: Body purplish brown;

PLATE I



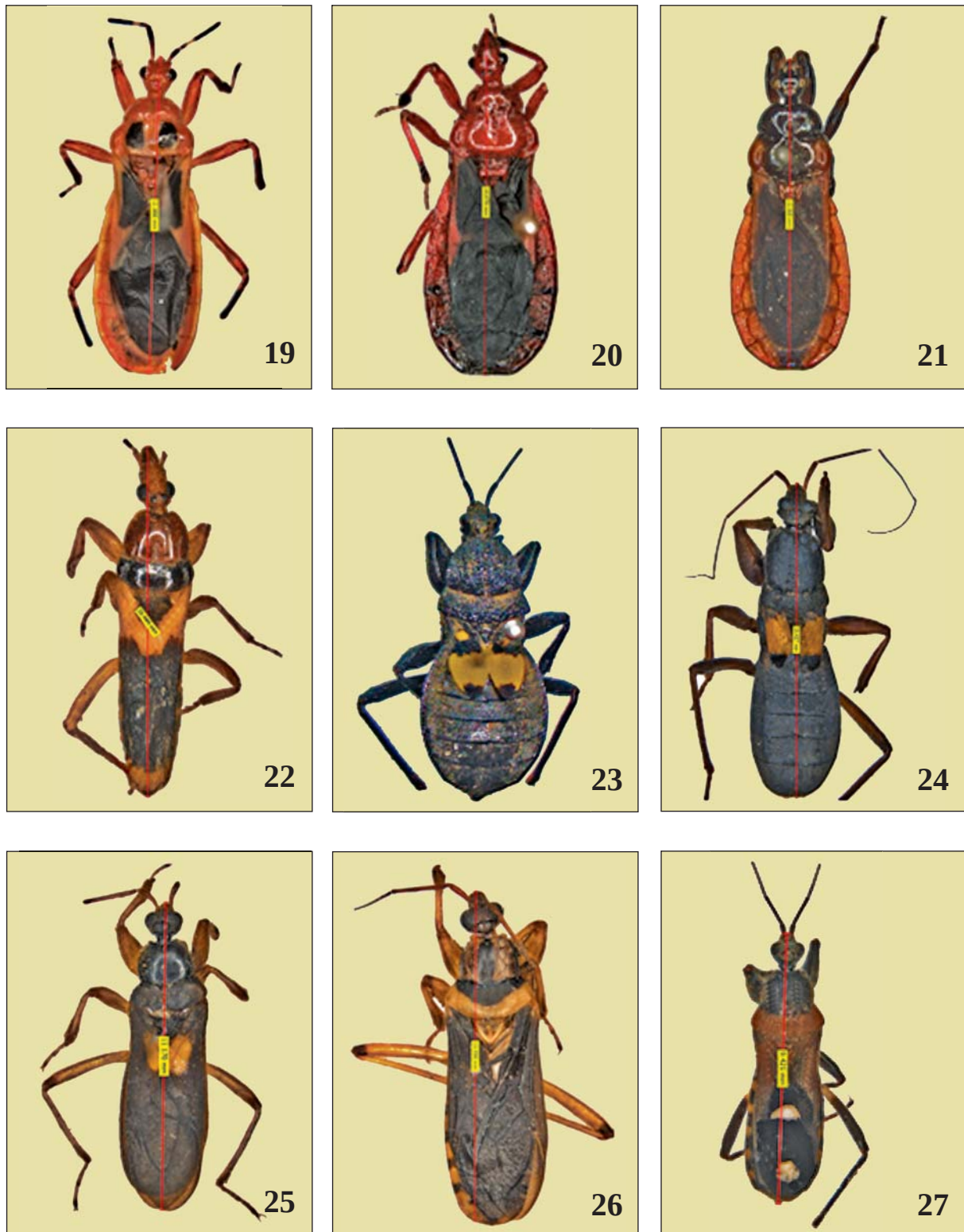
Figs. 1-9. 1. *Tribelocephala indica* Walker, 2. *Polididus armatissimus* Stål, 3. *Sycanus collaris* (Fabricius), 4. *Sycanus croceovittatus* Dohrn, 5. *Coranus siva* Kirkaldy, 6. *Rihirbus trochantericus* Stål, 7. *Euogoras plagiatus* (Burmiester), 8. *Rhynocoris fuscipes* (Fabricius), 9. *Rhynocoris marginatus* (Fabricius)

PLATE II



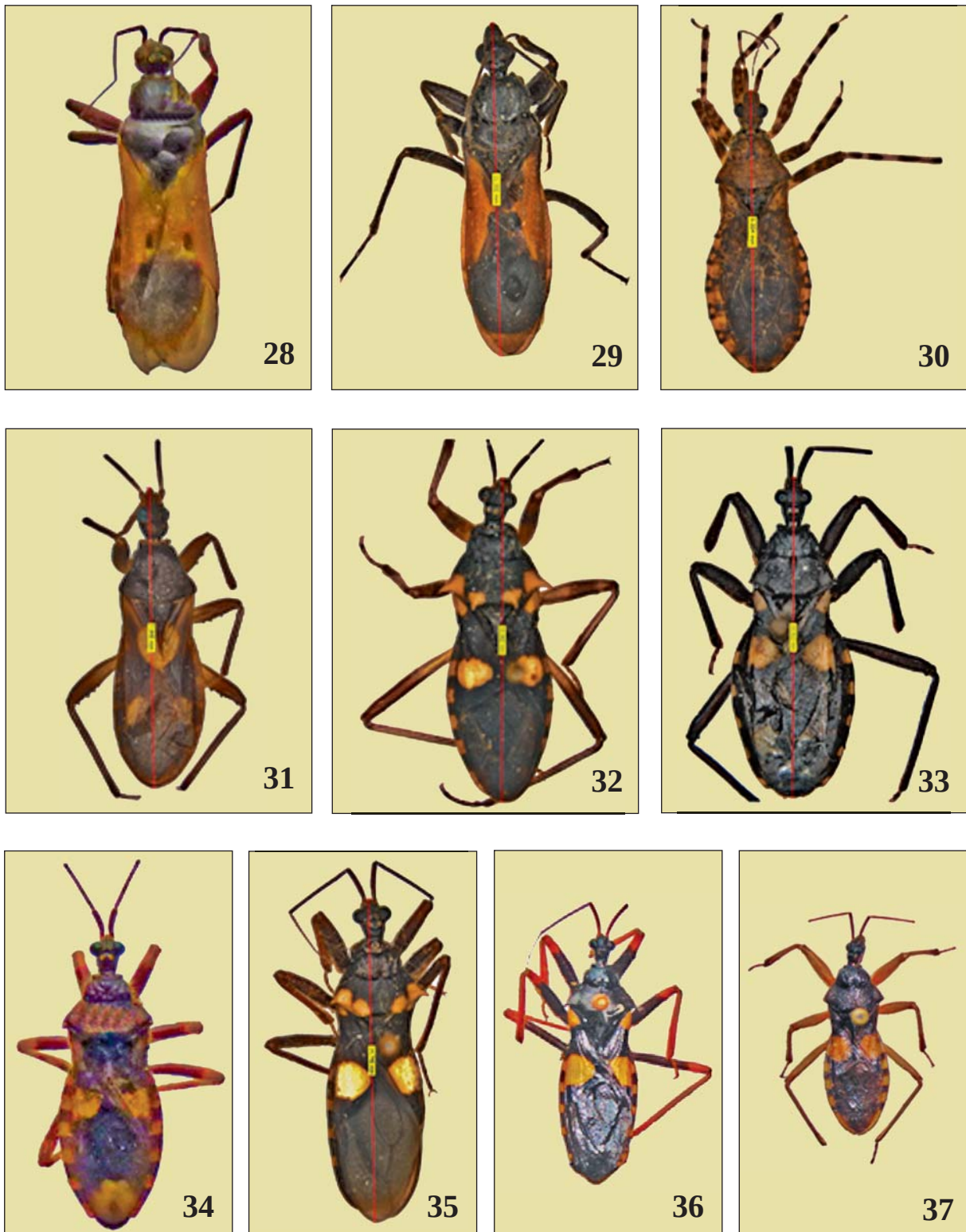
Figs. 10-18. 10. *Rhynocoris Squalus* (Distant), 11. *Sphedanolestes variabilis* Distant, 12. *Pygolampis foeda* Stål, 13. *Pygolampis unicolor* Walker, 14. *Sastrapada baerensprungi* (Stål), 15. *Oncocephalus impudicus* Reuter, 16. *Oncocephalus schioedtei* Reuter, 17. *Haematorrhophus tuberculatum* (Stål), 18. *Scadra fuscicrus* Stål.

PLATE III



Figs. 19-27. 19. *Scadra annulipes* Reuter, 20. *Ectrychotes atripennis* Stål, 21. *Ectrychotes dispar* Reuter, 22. *Sirthenaea flavipes* (Stål), 23. *Catamarius brevipennis* (Serville), 24. *Ectomocoris simulans* Distant, 25. *Ectomocoris cordiger* Stål, 26. *Lestomerus sancturs* (Fabricius), 27. *Spilodermus quadrinotatus* (Fabricius).

PLATE IV



Figs. 28-37. 28. *Cleptocoris lepuroides* (Wolff), 29. *Cleptocoris atromaculatus* Stål, 30. *Lisarda annulosa* Stål, 31. *Gerbeliu ornatus* Distant, 32. *Acanthaspis quinquespina* (Fabricius), 33. *Acanthaspis siva* Distant, 34. *Acanthaspis sexguttata* (Fabricius), 35. *Acanthaspis flavipes* Stål, 36. *Acanthaspis fulvipes* (Dallas), 37. *Acanthaspis luteipes* Walker.

head with a spot on each side of ocelli and a distinct, longitudinal incision between eyes; pronotum with anterior lobe moderately sculptured and centrally sulcate; a large moderately sculptured and centrally sulcate, posterior lobe obsoletely rugulose, lateral angles subacutely prominent; a large spot to connexivum above and beneath, coxae trochanters and legs pale ochraceous.

Length: 17-18 mm.

Distribution: India: Chhattisgarh (Raipur), Andhra Pradesh, West Bengal, Sikkim, Tripura, Nicobar Islands.

from the state of Chhattisgarh, of which 24 species belonging to 18 genera under 6 subfamilies constitute new record to the State. Relevant literature references, diagnosis of each species, keys to various taxa, distribution of each species in various districts of Chhattisgarh and other states, have been incorporated. The record of these species will provide the information on predacious species diversity of the family Reduviidae of the state. It is also expected that the further study of unexplored area may yield many more species.

SUMMARY

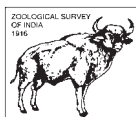
This paper deals with 32 species of Reduviid bugs belonging to 23 genera under 7 subfamilies

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REFERENCES

- Ambrose, D.P., 2006. A Checklist of Indian Assassin bugs (Insecta: Hemiptera: Reduviidae) with taxonomic status, distribution and diagnostic morphological characteristics. *Zoos' Print Journal*, **21**(9): 2388-2406.
- Biswas, B. and L.K. Ghosh, 1995. *Fauna of Indravati Tiger Reserve, Conservation Area Series*, **6**: 19-29.
- Chandra, K, Kushwaha, S. 2012. Studies on the Hemiptera Fauna of Barnawapara Wildlife Sanctuary, Chhattisgarh, India, *DCSI*, **7**: 101-108.
- Distant, W.L., 1904. *The Fauna of British India including Ceylon and Burma, Rhynchota*, **2**: 198-389.
- Distant, W.L., 1910. *The Fauna of British India including Ceylon and Burma. Rhynchota*, **5**: 169-217.
- Henry, T.J. 2009. Biodiversity of Heteroptera in *Insect Biodiversity Science and Society* Edt. By Robert, G. Footitt and Piter, H. Adler: 224-263.



SYSTEMATIC STUDIES ON ODONATA (INSECTA) OF SOUTHERN WESTERN GHATS

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INTRODUCTION

Odonata are one of the ancient orders of Insects that appeared during the Permian period, about 250 million years ago. There are fossil records of dragonflies much before the advent of dinosaurs. Some of the fossil Dragonflies have wingspans of 60 cm. Modern odonates are smaller, but have changed structurally very little since ancient times. They are among the most beautiful and amazing insects flying today.

The Odonates are distributed in all geographical realms, but their greatest numbers and diversity occur in the tropics. About 5740 species of Odonata are reported from the world over (Schorr *et al.*, 2009). Dragonflies and damselflies are attached to their aquatic habitats. Some of the odonates are very specific on their habitat, especially the montane species. They are occupying diverse freshwater habitats including streams, rivers, lakes, ponds, swamps, bogs etc. Since the distribution of odonate larvae depend on many ecological factors such as the pH and temperature of water, type of the water body, as well as the quantity and type of aquatic vegetation, they qualify as good bioindicators of a healthy riverine system (Subramanian, 2005)

Order Odonata comprising dragonflies (Suborder: Anisoptera) and damselflies (Suborder: Zygoptera) are well-established groups. The third suborder, Anisozygoptera superficially resembles the Anisoptera, but several characters are intermediate between the Zygoptera and Anisoptera. Anisozygoptera is represented only

by one species (*Epiophlebia laidlawi* Tillyard) in India, which is near threatened category. Our knowledge on the Indian odonata is mainly based upon the works of Fraser (1933, 1934 and 1936) who provided taxonomic descriptions of all the 536 species and subspecies known till then from "British India including Burma and Ceylon". Incorporating recent studies, Subramanian (2009) published a checklist of Odonata, which comprised of 470 species and subspecies in 139 genera and 19 families of odonata known from India. A perusal of literature (Fraser, 1931 and 1933-1936; Peters, 1981; Rao and Lahiri, 1982; Mathavan and Miller, 1989; Radhakrishnan, 1997; Emiliyamma and Radhakrishnan, 2000 and 2002; Asiathambi and Manickavasagam, 2002; Emiliyamma *et al.*, 2005; Emiliyamma, 2005, Jafer *et al.*, 2002; Jafer and Soniya, 2004, Jafer *et al.*, 2005; Mitra, 2002, 2003 and 2006; Kandibane *et al.*, (2005; Prasad and Kulkarni 2000; Subramanian and Sivaramakrishnan. 2002, Subramanian 2007 and 2009) revealed that 470 taxa of odonates occur in India, of which 169 species and subspecies under 82 genera and 14 families are known from southern Western Ghats.

There are different opinions in considering the areas under southern Western Ghats. In one document it is considered that the areas from Kanyakumari to Coorg (Subramanian, 2002) and in another one, it is considered as from Goa to Kanyakumari (Santhoshkumar, online publication). In the present document, the odonata fauna known from Kanyakumari to Coorg areas are included (Map-1)

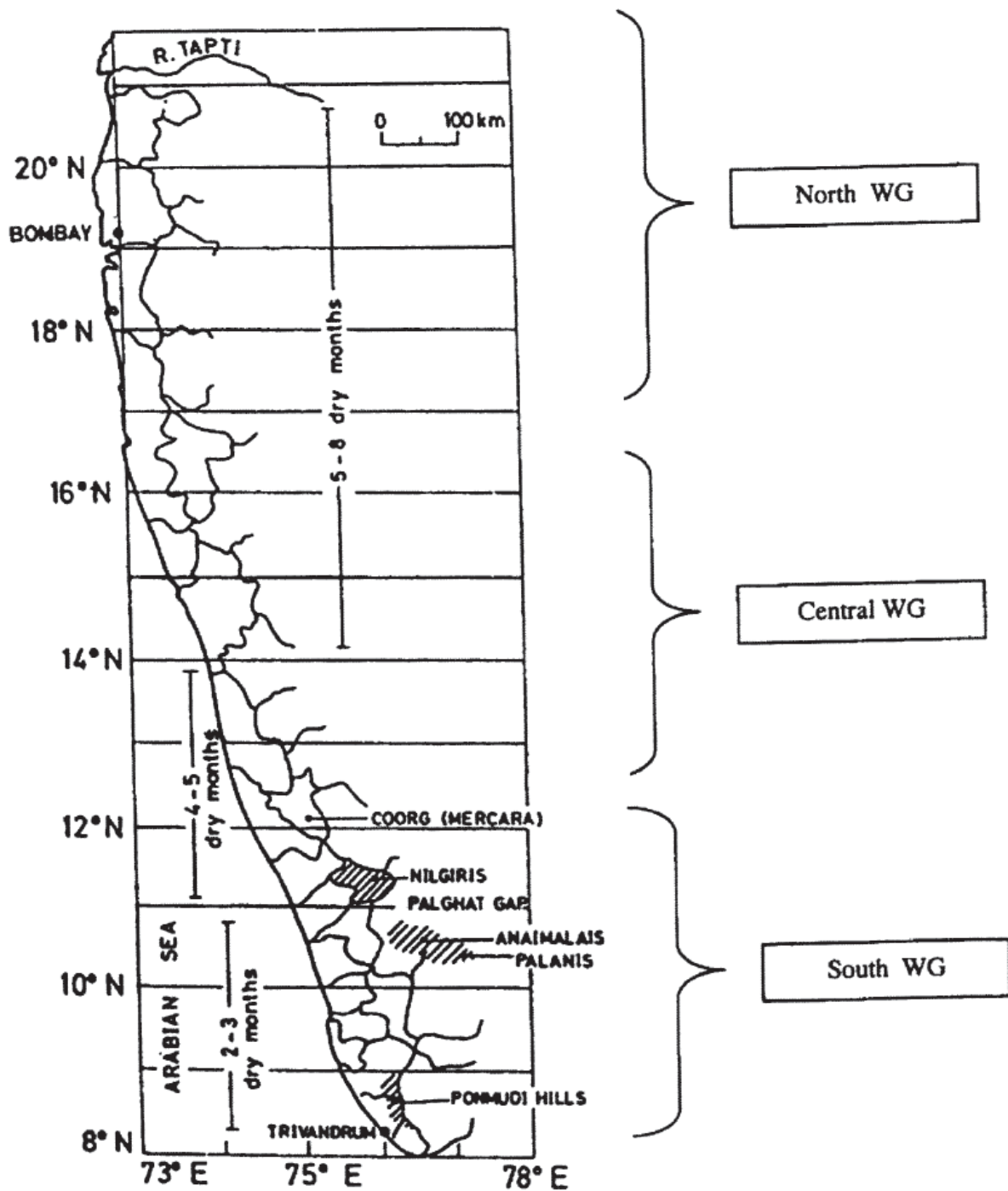


Fig. 1. Map showing northern, central and southern of Western Ghats (after Daniels, 1992)

The physiography of the Western Ghats is characterized by the mountainous high ranges and isolated small hills with lush green vegetation, valleys and meadows interspersed with varied inland water bodies such as rivers, reservoirs, lakes, tanks, pools, ditches etc. (Radhakrishnan and

Emiliyamma, 2004) offer diverse aquatic habitats for odonates. There are 178 species of Odonata with 68 endemics are known from Western Ghats (Subramanian, 2006). The present study involved 169 species of Odonata from southern Western Ghats with 66 endemic species. Previous studies

revealed that species richness and endemism are highest in southern Western Ghats (Subramanian, op.cit.) than Central and North parts. The present study also proved the earlier reports.

Checklist of Odonata (Insecta) of southern Western Ghats

Order ODONATA

Suborder ANISOPTERA

Family AESHNIDAE

1. *Anaciaeschna donaldi* Fraser, 1922
2. *Anaciaeschna jaspidea* (Burmeister, 1839)
3. *Anax guttatus* (Burmeister, 1839)
4. *Anax immaculifrons* Rambur, 1842
5. *Anax indicus* Lieftinck, 1942
6. *Anax parthenope* (Selys, 1839)
7. *Gynacantha bayadera* Selys, 1891
8. *Gynacantha dravida* Lieftinck, 1960
9. *Hemianax ephippiger* (Burmeister, 1839)

Family CHLOROGOMPHIDAE

10. *Chlorogomphus campioni* (Fraser, 1924)
11. *Chlorogomphus xanthoptera* (Fraser, 1919)

Family CORDULIIDAE

12. *Hemicordulia asiatica* Selys, 1878
13. *Idionyx corona* Fraser, 1921
14. *Idionyx corona burliyaensis* Fraser, 1928
15. *Idionyx galeata* Fraser, 1924
16. *Idionyx minima* Fraser, 1931
17. *Idionyx nadganiensis* Fraser, 1924
18. *Idionyx nilgiriensis* (Fraser, 1918)
19. *Idionyx periyashola* Fraser, 1939
20. *Idionyx rhinoceroideus* Fraser, 1934
21. *Idionyx saffronata* Fraser, 1924
22. *Idionyx travancorensis* Fraser, 1931
23. *Macromidia donaldi* (Fraser, 1924)

Family GOMPHIDAE

24. *Acrogomphus fraseri* Laidlaw, 1925
25. *Asiagomphus nilgircus* (Laidlaw, 1922)
26. *Burmagomphus cauvericus* Fraser, 1926

27. *Burmagomphus laidlawi* Fraser, 1924
 28. *Burmagomphus pyramidalis* Laidlaw, 1922
 29. *Cyclogomphus heterostylus* Selys, 1854
 30. *Davidioides martini* Fraser, 1924
 31. *Gomphidia fletcheri* Fraser, 1923
 32. *Gomphidia kodaguensis* Fraser, 1923
 33. *Heliogomphus kalarensis* Fraser, 1934
 34. *Heliogomphus promelas* (Selys, 1873)
 35. *Ictinogomphus rapax* (Rambur, 1842)
 36. *Macrogomphus wynaadicus* Fraser, 1924
 37. *Megalogomphus hannyngtoni* (Fraser, 1923)
 38. *Megalogomphus superbus* Fraser, 1931
 39. *Merogomphus longistigma* (Fraser, 1922)
 40. *Merogomphus longistigma tamaracherriensis* Fraser, 1931
 41. *Microgomphus souteri* Fraser, 1924
 42. *Onychogomphus acinaces* (Laidlaw, 1922)
 43. *Onychogomphus malabarensis* (Fraser, 1924)
 44. *Onychogomphus nilgiriensis* (Fraser, 1922)
 45. *Onychogomphus nilgiriensis annaimallaicus* Fraser, 1934
 46. *Onychogomphus striatus* Fraser, 1924
 47. *Paragomphus lineatus* (Selys, 1850)
- Family LIBELLULIDAE
48. *Acisoma panorpoides* Rambur, 1842
 49. *Aethriamanta brevipennis* (Rambur, 1842)
 50. *Brachydiplax chalybea* Brauer, 1868
 51. *Brachydiplax sobrina* (Rambur, 1842)
 52. *Brachythemis contaminata* (Fabricius, 1793)
 53. *Bradinopyga geminata* (Rambur, 1842)
 54. *Cratilla lineata* Foerster, 1903
 55. *Crocothemis servilia* (Drury, 1770)
 56. *Diplacodes lefebveri* (Rambur, 1842)
 57. *Diplacodes nebulosa* (Fabricius, 1793)
 58. *Diplacodes trivialis* (Rambur, 1842)

59. *Epithemis mariae* (Laidlaw, 1915)
 60. *Hydrobasileus croceus* (Brauer, 1867)
 61. *Hylaeothemis indica* Fraser, 1946
 62. *Indothemis carnatica* (Fabricius, 1798)
 63. *Lathrecista asiatica* (Fabricius, 1798)
 64. *Lyriotheemis acigastrea* (Selys, 1878)
 65. *Neurothemis fulvia* (Drury, 1773)
 66. *Neurothemis intermedia* (Rambur, 1842)
 67. *Neurothemis intermedia atlanta* Ris, 1919
 68. *Neurothemis tullia* (Drury, 1773)
 69. *Onychothemis testacea ceylanica* Ris, 1912
 70. *Orthetrum chrysis* Selys, 1891
 71. *Orthetrum glaucum* (Brauer, 1865)
 72. *Orthetrum luzonicum* (Brauer, 1868)
 73. *Orthetrum pruinsum neglectum* (Rambur, 1842)
 74. *Orthetrum sabina* (Drury, 1770)
 75. *Orthetrum taeniolatum* (Schneider, 1845)
 76. *Orthetrum triangulare* (Selys, 1878)
 77. *Palpopleura sexmaculata* (Fabricius, 1787)
 78. *Pantala flavescens* (Fabricius, 1798)
 79. *Potamarcha congener* (Rambur, 1842)
 80. *Rhodothemis rufa* (Rambur, 1842)
 81. *Rhyothemis triangularis* Kirby, 1889
 82. *Rhyothemis variegata* (Linnaeus, 1763)
 83. *Sympetrum fonscolombei* (Selys, 1840)
 84. *Tetrathemis platyptera* Selys, 1878
 85. *Tholymis tillarga* (Fabricius, 1798)
 86. *Tramea basilaris burmeisteri* Kirby, 1889
 87. *Tramea limbata similata* (Rambur, 1842)
 88. *Trithemis aurora* (Burmeister, 1839)
 89. *Trithemis festiva* (Rambur, 1842)
 90. *Trithemis kirbyi* Selys, 1891
 91. *Trithemis pallidinervis* Kirby, 1889
 92. *Urothemis signata* (Rambur, 1842)
 93. *Zygonyx iris malabarica* Fraser, 1926
 94. *Zygonyx torrida* (Kirby, 1889)
 95. *Zyxomma petiolatum* Rambur, 1842
- Family MACROMIIDAE
 96. *Epophthalmia frontalis binocellata* (Fraser, 1924)
 97. *Epophthalmia vittata* Burmeister, 1839
 98. *Macromia annaimallaiensis* Fraser, 1931
 99. *Macromia bellicosa* Fraser, 1924
 100. *Macromia cingulata* Rambur, 1842
 101. *Macromia ellisoni* Fraser, 1924
 102. *Macromia flavocolorata* Fraser, 1922
 103. *Macromia ida* Fraser, 1924
 104. *Macromia indica* Fraser, 1924
 105. *Macromia irata* Fraser, 1924
- Suborder ZYGOPTERA
 Family CALOPTERYGIDAE
 106. *Neurobasis chinensis* (Linnaeus, 1758)
 107. *Vestalis apicalis* Selys, 1873
 108. *Vestalis gracilis* (Rambur, 1842)
 109. *Vestalis submontana* (Fraser, 1934)
- Family CHLOROCYPHIDAE
 110. *Calocypha laidlawi* (Fraser, 1924)
 111. *Libellago lineata indica* (Fraser, 1928)
 112. *Rhinocypha bisignata* Hagen in Selys, 1853
- Family COENAGRIONIDAE
 113. *Aciagrion hisopa* (Selys, 1876)
 114. *Aciagrion occidentale* Laidlaw, 1919
 115. *Agriocnemis keralensis* Peters, 1981
 116. *Agriocnemis pieris* Laidlaw, 1919
 117. *Agriocnemis pygmaea* (Rambur, 1842)
 118. *Agriocnemis splendidissima* Laidlaw, 1919
 119. *Archibasis oscillans* (Selys, 1877)
 120. *Ceriagrion cerinorubellum* (Brauer, 1865)
 121. *Ceriagrion coromandelianum* (Fabricius, 1798)
 122. *Ceriagrion olivaceum* Laidlaw, 1914
 123. *Ceriagrion rubiae* Laidlaw, 1916
 124. *Ischnura aurora* (Brauer, 1865)
 125. *Ischnura senegalensis* (Rambur, 1842)

126. *Mortonagrion varralli* Fraser, 1920
127. *Onychargia atrocyana* Selys, 1865
128. *Paracercion calamorum* (Ris, 1916)
129. *Pseudagrion decorum* (Rambur, 1842)
130. *Pseudagrion indicum* Fraser, 1924
131. *Pseudagrion malabaricum* Fraser, 1924
132. *Pseudagrion microcephalum* (Rambur, 1842)
133. *Pseudagrion rubriceps* Selys, 1876

Family EUPHAEIDAE

134. *Dysphaea ethela* Fraser, 1924
135. *Euphaea cardinalis* (Fraser, 1924)
136. *Euphaea dispar* (Rambur, 1842)
137. *Euphaea fraseri* (Laidlaw, 1920)

Family LESTIDAE

138. *Indolestes gracilis birmanus* (Selys, 1891)
139. *Indolestes pulcherrimus* Fraser, 1924
140. *Lestes dorothea* Fraser, 1924
141. *Lestes elatus* Hagen in Selys, 1862
142. *Lestes malabarica* Fraser, 1929
143. *Lestes patricia* Fraser, 1924
144. *Lestes praemorsus* Hagen in Selys, 1862
145. *Lestes viridulus* Rambur, 1842

Family PLATYCNEMIDIDAE

146. *Copera marginipes* (Rambur, 1842)
147. *Copera vittata deccanensis* Laidlaw, 1917

Family PLATYSTICTIDAE

148. *Platysticta deccanensis* Laidlaw, 1915
149. *Protosticta antelopoides* Fraser, 1931
150. *Protosticta davenporti* Fraser, 1931
151. *Protosticta gravelyi* Laidlaw, 1915
152. *Protosticta hearseyi* Fraser, 1922
153. *Protosticta mortoni* Fraser, 1924
154. *Protosticta rufostigma* Kimmins, 1958
155. *Protosticta sanguinostigma* Fraser, 1922

Family PROTONEURIDAE

156. *Caconeura gomphoides* (Rambur, 1842)
157. *Caconeura ramburi* (Fraser, 1922)
158. *Caconeura risi* (Fraser, 1931)

159. *Caconeura t-coerulea* (Fraser, 1933)
160. *Disparoneura apicalis* (Fraser, 1924)
161. *Disparoneura quadrimaculata* (Rambur, 1842)
162. *Elattoneura souteri* (Fraser, 1924)
163. *Elattoneura tetrica* (Laidlaw, 1917)
164. *Esme cyaneovittata* Fraser, 1922
165. *Esme longistyla* Fraser, 1931
166. *Esme mudiensis* Fraser, 1931
167. *Melanoneura bilineata* Fraser, 1922
168. *Phylloneura westermanni* (Selys, 1860)
169. *Prodasineura verticalis annandalei* (Fraser, 1921)

SYSTEMATIC ACCOUNT

***Anaciaeschna donaldi* Fraser, 1922**

1897. *Aeschna martin* Selys, *Ann. Soc. Ent. Belg.*, Vol. 16, pp. 88, 89; Fraser, 1936, *Fauna Brit. India Odon.*, 3: 152-154.
1926. *Anaciaeschna donaldi* (female) Fraser, *J. Bombay nat. Hist. Soc.* Vol. 1, no. 2, p. 81.

***Anaciaeschna jaspidea* (Burmeister, 1839)**

1839. *Aeschna jaspidea* Burmeister, *Handb. Ent.*, 2: 840.
1890. *Anaciaeschna jaspidea* Kirby, *Cat. Odon.* p. 86; Martin, 1908, *Cat. Coll. Selys (Aeschnines)*, fasc., 17: 30-31; Fraser, 1936, *Fauna Brit. India Odon.*, 3: 152-154.

***Anax guttatus* (Burmeister, 1839)**

1839. *Aeshna guttata* Burmeister, *Handb. Ent.*, 2: 840.
1842. *Anax magnus* Rambur, *Ins. Nevrop.* p. 188; Brauer, 1866, *Reise d. Novara, Neur.*, p. 62.
1867. *Anax guttatus* Hagen, *Verh. zool.- bot. Ges. Eien*, 16: 39; Kirby, 1890, *Cat. Odon.* p. 84; Martin, 1908, *Cat. Coll. Selys, fasc.*, 18: 23; Fraser, 1936, *Fauna Brit. India Odon.*, 3: 140-142.

***Anax immaculifrons* Rambur, 1842**

1842. *Anax immaculifrons* Rambur, *Ins. Nevrop.* p. 189; Kirby, 1890, *Cat. Odon.*, P. 84; Fraser, 1933, *J. Bombay Nat. Hist. Soc.* Vol. 36, p. 465; Fraser, 1936, *Fauna Brit. India Odon.*, 3: 145-146.

***Anax indicus* Lieftinck, 1942**

1942. *Anax indicus*, Lieftinck, *Treubia*, 18(3): 441-607.

Anax parthenope (Selys, 1839)

1839. *Aeshna* (*Anax*)*parthenope* Selys, *Bull. Acad. Belg.* (2), vol. **6**, p. 389
1840. *Anax parthenope* Selys, *Mon. Lib. Eur.*, P. 119.
1921. *Anax parthenope parthenope* Fraser, *J. Bombay nat. Hist. Soc. Vol.*, **28**, p. 110, 119-121.
1936. *Anax parthenope*, Fraser, *Fauna Brit. India Odon.*, **3**: 140-142.

Gynacantha bayadera Selys, 1891

1891. *Gynacantha bayadera* Selys, *Ann. Mus. Civ. Genova*, vol., **30**, p. 47; Fraser, 1936, *Fauna Brit. India Odon.*, **3**: 103-104.

Material examined: 1male, 2-iii-2009, Lalbaghkathri (Bhadra WLS, Karnataka), Coll. K. G. Emiliyamma.

Gynacantha dravida Liefstinck, 1960

1882. *Gynacantha hyalina* Selys, *An. Soc. Espan. Hist. Nat.*, **11**: 19; Karsch, 1891, *Ent. Nachr.*, **17**: 228; Kruger, 1898, *Stett. Ent. Zeit.*, **59**: 275; Fraser, 1936, *Fauna Brit. India Odon.*, **3**: 97-100.
1960. *Gynacantha dravida* Liefstinck, *Mem. Soc. ent. ital.*, **38**: 252-253.

Material examined: 1 male, 29-i-2003, Ponnani (Malappuram Dt.), 2 males, 3-xi-2001, Kadalundi (Kozhikode Dt.); 2 males, 3 females, 25-iv-1999, Kadalundi (Kozhikode Dt.), Coll. K. G. Emiliyamma; 1 male, 1 female, 7-xii-1998, Chevayur (Kozhikode Dt.); 2 males, 1 female, 19-ii-2002, Chevayur (Kozhikode Dt.), Coll. C. Radhakrishnan.

Hemianax ephippiger (Burmeister, 1839)

1839. *Aeschna ephippiger* Burmeister, *Handb. Ent. Band*, **2**: 840; Calvert, 1898, *Trans. Amer. Ent. Soc.*, **25**: 55.
1867. *Anax ephippiger* Hagen, *Verh. zool.- bot. Ges. Wien*, **17**: 31.
1890. *Hemianax ephippiger* Kirby, *Cat. Odon.*, p. 85; Karsch, 1891, *Ent. Nachr.*, **17**: 278; Fraser, 1936, *Fauna Brit. India Odon.*, **3**: 147-149.
1921. *Anax* (*Hemianax*) *ephippiger* Laidlaw, *Rec. Indian Mus.*, **22**: 87.

Family CHLOROGOMPHIDAE

Chlorogomphus campioni (Fraser, 1924)

1924. *Orogomphus campioni* Fraser, *Rec. Indian Mus.*, **26**: 427, 467-469.
1931. *Chlorogomphus campioni* Fraser, *Rec. Indian Mus.* **33**: 447, 457; Fraser, 1936, *Fauna Brit. India Odon.* **3**: 9-13.

Material examined: 1 male, 21-iii-1995, Pakshipadalam (Wayanad), Coll. P.M. Sureshan.

Chlorogomphus xanthoptera (Fraser, 1919)

1919. *Orogomphus xanthoptera* Fraser, *J. Bombay nat. Hist. Soc.*, **26**: 874-875.
1924. *Chlorogomphus xanthoptera* Fraser, *Rec. Indian Mus.* **26**: 427, 469; Fraser, 1936, *Fauna Brit. India Odon.*, **3**: 8-9.

Family CORDULIIDAE

Hemicordulia asiatica Selys, 1878

1878. *Hemicordulia asiatica* Selys, *Bull. Acad. Belg.*, (2) **45**: 186; Kirby, 1890, *Cat. Odon.*, p. 47; Martin, 1906, *Cat. Coll. Selys* (Cordulinos), *fasc.*, **17**: 13; Fraser, 1936, *Fauna Brit. India Odon.*, **3**: 213-215.

Idionyx corona Fraser, 1921

1921. *Idionyx corona* Fraser, *J. Bombay nat. Hist. Soc. Vol.*, **28**, pp. 690-691;
1936. *Idionyx corona* Fraser, *Fauna Brit. India Odon.*, **3**: 229-230.

Idionyx corona burliyaensis Fraser, 1928

1922. *Idionyx corona* race *nilgiriensis* Fraser, *Mem. Dept. Agric. India, Ent.*, **7**(7): 65-66.
1924. *Idionyx corona burliyaensis* Fraser, *Rec. Indian Mus.*, **26**: 461-462.
1936. *Idionyx burliyaensis* Fraser, *Fauna Brit. India Odon.*, **3**: 227-229.

Material examined: 1 female, 4-vi-2003, Thusharagiri (Kozhikode), Coll. Md. Jafer Palot.

Idionyx galeata Fraser, 1924

1924. *Idionyx galeata* Fraser, *Rec. Indian Mus.*, **26**: 517, 519.
1936. *Idionyx galeata* Fraser, *Fauna Brit. India Odon.*, **3**: 226-227.

***Idionyx minima* Fraser, 1931**

1931. *Idionyx minima* Fraser, *Rec. Indian Mus.*, **33**: 447, 453-455; id., 1934, *J. Bombay nat. Hist. Soc.*, **37**: 558, 562.
1936. *Idionyx minima* Fraser, *Fauna Brit. India Odon.*, **3**: 225-226.

***Idionyx nadganiensis* Fraser, 1924**

1924. *Idionyx nadganiensis* Fraser, *Rec. Indian Mus.*, **26**: pp. 427, 460; *J. Bombay nat. Hist. Soc.*, **37**: 559, 570 (1934)
1936. *Idionyx nadganiensis* Fraser, *Fauna Brit. India Odon.*, **3**: 238-239

***Idionyx nilgiriensis* (Fraser, 1918)**

1924. *Idionyx nilgiriensis* Fraser, *Rec. Indian Mus.*, **26**: pp. 460-461.

***Idionyx periyashola* Fraser, 1939**

1939. *Idionyx periyashola* Fraser, *Proc. R. ent. Soc. London (B)*: **8**: 93-94.

***Idionyx rhinoceroideis* Fraser, 1934**

1934. *Idionyx rhinoceroideis* Fraser, *J. Bombay nat. Hist. Soc.*, **37**: 559, 565.
1936. *Idionyx rhinoceroideis* Fraser, *Fauna Brit. India Odon.*, **3**: 230-231.

***Idionyx saffronata* Fraser, 1924**

1924. *Idionyx saffronata* Fraser, *Rec. Indian Mus.*, **26**: 427, 458-460.
1936. *Idionyx saffronata* Fraser, *Fauna Brit. India Odon.*, **3**: 222-223.

Material examined: 1 female, 27-v-2003, Thusharagiri (Kozhikode Dt.), Coll. C. Radhakrishnan; 1 male, 10-v-2005, Vannathimala (Wayanad Dt.), Coll. K. G. Emiliyamma.

***Idionyx travancorensis* Fraser, 1931**

1931. *Idionyx travancorensis* Fraser, *Rec. Indian Mus.*, **33**: 447, 455-456.
1936. *Idionyx travancorensis* Fraser, *Fauna Brit. India Odon.*, **3**: 223-225.

Material examined: 2 males, 4-vi-2003, Thusharagiri (Kozhikode Dt.), Coll. Md. Jafer Palot.

***Macromidia donaldi* (Fraser, 1924)**

1924. *Indomacromia donaldi* Fraser, *Rec. Indian Mus.*, **26**: 515-516.

1931. *Macromidia donaldi* Fraser, *Rec. Indian Mus.*, **33**: 447, 456; Needham, 1932, *Rec. Indian Mus.*, **34**: 210; Fraser, 1936, *Fauna Brit. India Odon.*, **3**: 206-208.

Family GOMPHIDAE***Acrogomphus fraseri* Laidlaw, 1925**

1925. *Acrogomphus fraseri* Laidlaw, *Proc. Zool. Soc. Lond.* pp. 441-443; Fraser, 1926, *J. Bombay nat. Hist. Soc.*, **31**: 740-741; Needham, 1932, *Rec. Indian Mus.*, **34**: 217-218; Fraser, 1934, *Fauna Brit. India Odon.*, **2**: 337-339.

***Asiagomphus nilgircus* (Laidlaw, 1922)**

1922. *Gomphus nilgircus* Laidlaw, *Rec. Ind. Mus. Vol.*, **24**, pp. 371, 397-398, fig. 16; Fraser, 1934, *Fauna Brit. India Odon.*, **2**: 202-204.

***Burmagomphus cauvericus* Fraser, 1926**

1926. *Burmagomphus cauvericus* Fraser, *J. Bombay nat. Hist. Soc.*, Vol. **31**, p. 413, pl.1, fig.6; Fraser, 1934, *Fauna Brit. India Odon.*, **2**: 222-223.

***Burmagomphus laidlawi* Fraser, 1924**

1922. *Gomphus* sp. Fraser, *Rec. Ind. Mus. Vol.*, **24**, pp. 419.
1924. *Burmagomphus laidlawi* Fraser, *Rec. Ind. Mus. Vol.* **26**, pp. 427, 475-476; Fraser, 1934, *Fauna Brit. India Odon.*, **2**: 220-222.

***Burmagomphus pyramidalis* Laidlaw, 1922**

1922. *Burmagomphus pyramidalis* Laidlaw, *Rec. Indian Mus.*, **24**: 371, 399-401; Fraser, 1923, *J. Bombay nat. Hist. Soc.*, **29**: 62, 33; Fraser, 1934, *Fauna Brit. India Odon.*, **2**: 213-215.
1991. *Burmagomphus pyramidalis pyramidalis* Tsuda, *A distributional list of world Odonata 1991*, p. 92.

***Cyclogomphus heterostylus* Selys, 1854**

1854. *Cyclogomphus heterostylus* Selys, *Bull. Acad. Belg. Vol.*, **21**, pl. 2, p. 62.
1857. *Cyclogomphus heterostylus* Selys, *Mon. Gomph. P.* 106; Fraser, 1934, *Fauna Brit. India Odon.*, **2**: 182-183.

Material examined: 1 male, 5-iv-1998, Thenmalai urukunnu (Thiruvananthapuram Dt.), Coll. P. T. Cherian; 1 male, 9-v-2008, Neyyar Wildlife Sanctuary (Thiruvananthapuram Dt.), Coll. Md. Jafer Palot.

***Davidioides martini* Fraser, 1924**

1924. *Davidioides martini* Fraser, *Rec. Ind. Mus. Vol.*, **26**, pp. 427, 472-473, fig. 2; Fraser, 1934, *Fauna Brit. India Odon.*, **2**: 227-228

***Gomphidia fletcheri* Fraser, 1923**

1923. *Gomphidia fletcheri* Fraser, *J. Bombay nat. Hist. Soc.*, vol. **24**, pp. 669-670, pl. 2, fig. 2; Fraser, 1934, *Fauna Brit. India Odon.*, **2**: 386-387

***Gomphidia kodaguensis* Fraser, 1923**

1923. *Gomphidia kodaguensis* Fraser, *J. Bombay nat. Hist. Soc.*, **29**: 671-672; id., 1924, *Rec. Indian Mus.*, **26**: 427, 470; Laidlaw, 1930, *Trans. Ent. Soc. Lond.*, **78**: 179; Fraser, 1931, *Rec. Indian Mus.*, **33**: 447; Fraser, 1934, *Fauna Brit. India Odon.*, **2**: 389-391.

***Heliogomphus kalarensis* Fraser, 1934**

1933. *Heliogomphus kalarensis* Fraser (nom.nud.), *Ceylon J. Sci. B*, vol. **18**, p. 29, fig. 4; Fraser, 1934, *Fauna Brit. India Odon.*, **2**: 329-330.

***Heliogomphus promelas* (Selys, 1873)**

1923. *Gomphus promelas* Selys, 1873, *Bull. Acad. Belg.*, **36**: 498; Fraser, *J. Bombay nat. Hist. Soc.*, **29**: 62, 330.
1925. *Heliogomphus promelas* Fraser, *J. Bombay nat. Hist. Soc.*, **30**: 848-849; Laidlaw, 1930, *Trans. Ent. Soc. Lond.*, **78**: 182; Fraser, 1934, *Fauna Brit. India Odon.*, **2**: 327-329.

***Ictinogomphus rapax* (Rambur, 1842)**

1842. *Diastatomma rapax* Rambur, *Ins. Nevrop.* p. 169.
1854. *Ictinus rapax* Selys, *Bull. Acad. Belg.*, **21**(2): 90; Fraser, 1934, *Fauna Brit. India Odon.*, **2**: 373-376; Kirby, 1890, *Cat. Odon.*, p. 77; Martin, 1904, *Mision Pavie Indo- China*, p. 217.
1983. *Ictinogomphus rapax*, Mitra, *En. Mon. Mag.*, **119**: 30.

Material examined: 1 male, 25-x-2002, Kadalundi (Kozhikode Dt.), Coll. K. G. Emiliyamma; 3 males, 27-x-2000, Kanjirappally (Kottayam Dt.), Coll. P.M. Sureshan; 1 male, 1-ix-2001, Madayipara (Kannur Dt.); 1 male, 22-x-2001, Kannavam R. F., (Kannur Dt.), Coll. Md. Jaffer Palot; 1 male, 12-ix-2001, Malampuzha (Palakkad Dt.), Coll. Dinesan Cheruvat; 1 male, 8-x-1995, Asurankundu (Thrissur Dt.), Coll. K. C. Gopi; 1 female, 11-v-2002, Vallamkulam (Pathanamthitta Dt.), Coll. Ashok Kumar.

***Macrogomphus wynaadicus* Fraser, 1924**

1924. *Macrogomphus wynaadicus* Fraser, *Rec. Ind. Mus.*, **26**: 471-472; Fraser, 1934, *Fauna Brit. India Odon.*, **2**: 344-345.

***Megalogomphus hannynghoni* (Fraser, 1923)**

1923. *Heterogomphus hannynghoni* Fraser, *J. Bombay nat. Hist. Soc.*, **29**: 674-676.
1924. *Megalogomphus hannynghoni* Fraser, *Rec. Indian Mus.*, **26**: 428, 478-479; Fraser, 1934, *Fauna Brit. India Odon.*, **2**: 296-298.

***Megalogomphus superbus* Fraser, 1931**

1931. *Megalogomphus superbus* Fraser, *Rec. Indian Mus.*, **33**: 448, 460-463, figs. 3 & 4; Needham, 1932, *Rec. Indian Mus.*, **34**: 222; Fraser, 1934, *Fauna Brit. India Odon.*, **2**: 300-302.

***Merogomphus longistigma* (Fraser, 1922)**

1922. *Indogomphus longistigma* Fraser, *Rec. Indian Mus.*, **24**: 422 & 424; *Merogomphus longistigma* Laidlaw, 1930, *Trans. Ent. Soc. Lond.*, **78**: 185; Fraser, 1931, *Rec. Indian Mus.*, **33**: 448 & 460.
1934. *Merogomphus longistigma longistigma* Fraser, *Fauna Brit. India Odon.*, **2**: 311-313.

***Merogomphus longistigma tamaracherriensis* Fraser, 1931**

1931. *Merogomphus longistigma tamaracherriensis* race or sp.? Fraser, *Rec. Indian Mus.*, **33**: 460; Fraser, 1934, *Fauna Brit. India Odon.*, **2**: 313.

***Microgomphus souteri* Fraser, 1924**

1924. *Microgomphus torquatus souteri* Fraser, *Rec. Indian Mus.*, **26**: 427 & 474 *Microgomphus souteri* Fraser, 1925, *J. Bombay nat. Hist. Soc.*, **30**: 853-854; Laidlaw, 1930, *Trans. Ent. Soc. Lond.*, **78**: 182; Fraser, 1934, *Fauna Brit. India Odon.*, **2**: 355-356.

Material examined: 1 male, 6-vi-2010, Aralam Wildlife Sanctuary (Kannur Dt.), Coll. Md. Jafer Palot.

***Onychogomphus acinaces* (Laidlaw, 1922)**

1922. *Onychogomphus acinaces* Laidlaw, *Rec. Indian Mus.*, **24**: 407-408.
1924. *Lamellogomphus acinaces* Fraser, *J. Bombay nat. Hist. Soc.*, **29**: 988-990; Fraser, 1934, *Fauna Brit. India Odon.*, **2**: 280-282.

***Onychogomphus malabarensis* (Fraser, 1924)**

1922. *Onychogomphus bifaceps* Fraser (nec Selys), *Rec. Indian Mus.*, **24**: 424-425.
1924. *Lamellogomphus malabarensis* Fraser, *J. Bombay nat. Hist. Soc.*, **29**: 990-991; Laidlaw, 1930, *Trans. Ent. Soc. Lond.*, **78**: 193; Needham, 1932, *Rec. Indian Mus.*, **34**: 224.

1934. *Lamelligomphus malabarensis* Fraser, *Fauna Brit. India Odon.*, 2: 279-280.

***Onychogomphus nilgiriensis* (Fraser, 1922)**

1922. *Onychogomphus bifaceps nilgiriensis* Fraser, *Rec. Indian Mus.* 24: 425-426.
1924. *Lamelligomphus nilgiriensis* Fraser, *J. Bombay nat. Hist. Soc.*, 29: 986-988; Fraser, 1934, *Fauna Brit India Odon.*, 2: 276-279.

Onychogomphus nilgiriensis annaimallaicus

Fraser, 1934

1934. *Onychogomphus nilgiriensis annaimallaicus*, new race? Fraser, *Fauna Brit. India Odon.*, 2: 279.

***Onychogomphus striatus* Fraser, 1924**

1922. *Onychogomphus bistrigatus* Fraser, *Rec. Ind. Mus. Vol.*, 24, p. 424.
1924. *Onychogomphus striatus* Fraser, *J. Bombay Nat. Hist. Soc. Vol.*, 29, p. 1000, fig. 2; Fraser, 1934, *Fauna Brit. India Odon.*, 2: 249-250

***Paragomphus lineatus* (Selys, 1850)**

1850. *Gomphus lineatus* Selys, *Rev. Odon.* p. 386.
1854. *Onychogomphus lineatus* Selys, *Bull. Acad. Belg.*, 21: 36; Williamson, 1907, *Proc. U. S. Nat. Mus.*, 33: 309-310.
1924. *Mesogomphus lineatus* Fraser, *Rec. Indian Mus.*, 26: 427 & 477; Fraser, 1934, *Fauna, Brit. India Odon.*, 2: 230-234.

Material examined: 1 male, 7-xii-2004, Kinalur estate (Kozhikode Dt.), Coll. K. C. Gopi.; 1 male, 15-xi-2006, Madla (Bhadra WLS, Karnataka), Coll. K. G. Emiliyamma.

Family LIBELLULIDAE

***Acisoma panorpoides* Rambur, 1842**

1842. *Acisoma panorpoides* Rambur, *Ins. Nevrop.* P. 28; Lietinck, 1954, *Treubia*, 22 (suppl.): 146.
1911. *Acisoma panorpoides panorpoides* Ris, *Cat. Coll. Selys Lib.*, 12: 456 ; Fraser, 1936, *Fauna Brit. India Odon.*, 3: 330-331.

Material examined: 1 male, 1 female, 30-xii-1998, Chalamattom (Kottayam Dt.); 2 males, 3 females, 27-x-2004, Kadalundi (Kozhikode Dt.), 1 male, 9-v-2005, Pookode lake (Wayanad Dt.), Coll. K. G. Emiliyamma; 1 male, 18-xii-1998, Kanniparamba (Kozhikode Dt.), Coll. P. M.

Sureshan; 1 male, 2-x-2001, Kuniyan (Kasaragod Dt.), Coll. Md. Jafer Palot.

***Aethriamanta brevipennis* (Rambur, 1842)**

1842. *Libellula brevipennis* Rambur, *Ins. Nevrop.* p.114.
1889. *Aethriamanta brevipennis* Kirby, *Trans. Zool. Soc. Lond.*, 12: 283; Tsuda, 1991, *A distributional list of World Odonata*, 1991, p. 144.
1936. *Aethriamanta brevipennis brevipennis* Fraser, *Fauna Brit. India Odon.*, 3: 445-447.

Material examined: 1 male, 1 female, 20-x-2003; 1 male, 27-x-2004, Kadalundi (Kozhikode Dt.), Coll. K. G. Emiliyamma; 4 males, 1 female, 23-ii-2000, Parumala/Mannar (Alappuzha Dt.), Coll. K. C. Gopi; 1 male, 15-ix-2001, Kasaragod, Coll. Md. Jafer Palot.

***Brachydiplax chalybea* Brauer, 1868**

1868. *Brachydiplax chalybea* Brauer, *Verh. zool.- bot. Ges. Wien*, 18: 173, 725; Fraser, 1936, *Fauna Brit. India Odon.*, 3: 328-329.
1954. *Brachydiplax chalybea chalybea* Lieftinck, *Treubia*, 22 (suppl.): 143.

Material examined: 1 male, 25-viii-2003, Kadalundi (Kozhikode Dt.), Coll. K. G. Emiliyamma.

***Brachydiplax sobrina* (Rambur, 1842)**

1842. *Libellula sobrina* Rambur, *Ins. Nevrop.* p. 114.
1893. *Brachydiplax sobrina* Kirby, *J. Linn. Soc. Zool.*, 24: 551; Fraser, 1936, *Fauna Brit. India Odon.*, 3: 325-327.

Material examined: 1 male, 1 female, 10-vi-2001, Chemballikundu (Kannur Dt.); 1 female, 20-vii-2004, Madayipara (Kannur Dt.) Coll. Md. Jafer Palot; 4 males, 29-x-2000, Kumarakom; 1 male, 31-x-2000, Velloor (Kottayam Dt.), Coll. P. M. Sureshan.

***Brachythemis contaminata* (Fabricius, 1793)**

1793. *Libellula contaminata* Fabricius, *Ent. Syst.*, 2: 382.
1868. *Brachythemis contaminata* Brauer, *Verh. zool. – bot. Ges. Wien*, 17: 736 ; Fraser, 1936, *Fauna Brit. India Odon.*, 3: 365-366.

Material examined: 1 male, 18-xii-1998, Cheroopa (Kozhikode Dt.); 2 males, 4 females,

19-iii-1999, Pothundi (Palakkad Dt.); 4 males, 5 females, 17-iii-1999, Malampuzha (Palakkad Dt.); 1 male, 27-x-2000, Kanjirappally (Kottayam Dt.); 1 male, 2 females, 30-x-2000, Kidangoor (Kottayam Dt.), Coll. P. M. Sureshan; 3 males, 23-ii-2000, Parumala/Mannar (Alappuzha Dt.), Coll. K. C. Gopi; 1 male, 1 female, 12-ix-2001, Malampuzha (Palakkad Dt.), Coll. Dinesan Cheruvat; 1 male, 3 females, 25-ii-1996, Chimony WLS (Thrissur Dt.), Coll. C. Radhakrishnan; 2 males, 3 females, 24-x-2002, Vadikkadavu (Malappuram Dt.), Coll. K. G. Emiliyamma

***Bradinopyga geminata* (Rambur, 1842)**

1842. *Libellula geminata* Rambur, *Ins. Nevrop.* p. 90.
1911. *Bradinopyga geminata* Ris, *Cat. Coll Selys, fasc.*, **13**: 545 & 548; Fraser, 1936, *Fauna Brit. India Odon.* **3**: 349-350.

Material examined: 2 males, 18-i-1999, Eranhipalam (Kozhikode Dt.), Coll. Ashok kumar; 1 male, 2 females, 20-xiii-1999, Chevayur (Kozhikode Dt.); 1 female, 23-ii-1996, Athirappally (Thrissur Dt.), Coll. C. Radhakrishnan; 2 males, 1 female, 12-ix-2001, Malampuzha (Palakkad Dt.), Coll. Dinesan Cheruvat; 2 males, 4-vi-2003, Thusharagiri (Kozhikode Dt.); 1 female, 21-vii-2004, Madayipara (Kannur Dt.) Coll. Md. Jafer Palot; 3 males, 4 females, 27-x-2004, Kadalundi (Kozhikode Dt.), Coll. K. G. Emiliyamma.

***Cratilla lineata* Foerster, 1903**

1770. *Orthemis lineata* Brauer, *Sitzungsber. Akad. Wien*, **77**: 9.
1903. *Cratilla lineata* Forster, *Ann. Mus. Hunger* p. 537; Fraser, 1936, *Fauna Brit. India Odon.* **3**: 286-288.
1949. *Cratilla lineata calverti*, Lieftinck, *Verh. NaturaiGes. Basel.*, **64**(1): 201-202.

Material examined: 1 female, 5-xi-1995, Muthuvanchal (Wayanad Dt.); 4 females, 18-xii-1998, Thunnilokadavu (Wayanad Dt.); 1 female, 11-xi-1994, Rampur R. F. (Wayanad Dt.), Coll. P. M. Sureshan; 1 female, 26-x-2001, Payangadi (Kannur Dt.), Coll. Md. Jaffer Palot; 1 female, 26-i-1994, Manjucholamala (Kasaragod Dt.), Coll. K. C. Gopi; 2 females, 28-viii-2003, Thusharagiri (Kozhikode Dt.), K. G. Emiliyamma.

***Crocothemis servilia* (Drury, 1770)**

1770. *Libellula servilia* Drury, *III. Ins.*, **1**: 112-113; Rambur, 1842, *Ins. Nevrop.* p. 80.
1868. *Crocothemis servilia* Brauer, *Verh. zool. -bot. Ges. Wien.*, **18**: 737.
1936. *Crocothemis servilia servilia* Fraser, *Fauna Brit. India Odon.*, **3**: 345-347.

Material examined: 1 male, 1 female, 2-iv-1998, Anchuthengu (Thiruvananthapuram Dt.), Coll. P. T. Cherian; 1 male, 21-ix-1999, Kadalundi (Kozhikode Dt.); 1 male, 24-iv-2002, Eengappuzha (Kozhikode Dt.), Coll. K. G. Emiliyamma; 1 female, 16-iii-2001, Kulasekaram (Thiruvananthapuram Dt.); 2 males, 3 females, 6-xi-2002, Payangadi (Kannur Dt.); 1 male, 24-xi-1994, Madayikavu (Kannur Dt.) Coll. K. C. Gopi; 1 male, 21-ix-1999, Kadalundi (Kozhikode Dt.); 3 females, 18-xii-1998, Mavoor/ Pallikadavu (Kozhikode Dt.); 1 female, 20-iii-1999, Mangalam dam (Palakkad Dt.); 1 male, 1 female, 5-ix-2001, Kolavipalam (Kozhikode Dt.), Coll. P. M. Sureshan; 1 male, 9-ix-2001, Chemballikundu (Kannur Dt.); 2 females, 23-vii-2004, Madayipara (Kannur Dt.) Coll. Md. Jafer Palot.

***Diplacodes lefebvrei* (Rambur, 1842)**

1842. *Libellula lefebvrei* Rambur, *Ins. Nevrop.*, p. 112.
1890. *Diplacodeslefebvrei* Kirby, *Cat. Odon.*, P. 42; Fraser, 1936, *Fauna Brit. India Odon.*, **3**: 333-335.

***Diplacodes nebulosa* (Fabricius, 1793)**

1793. *Libellula nebulosa* Fabricius, *Ent. Syst.*, **2**: 379.
1889. *Diplacodes nebulosa* Kirby, *Trans. Zool. Soc. Lond.* **12**: 308; Fraser, 1936, *Fauna Brit. India Odon.*, **3**: 335-336.

Material examined: 2 males, 1 female, 14-viii-2000, Madayipara (Kannur Dt.), Coll. Md. Jafer Palot; 2 males, 27-x-2002, Kadalundi (Kozhikode Dt.), Coll. K. G. Emiliyamma.

***Diplacodes trivialis* (Rambur, 1842)**

1842. *Libellula trivialis* Rambur, *Ins. Nevrop.* p. 115.
1891. *Diplacodes trivialis* Karsch, *Ent. Nachr.*, **17**: 246; Fraser, 1936, *Fauna of Brit. India Odon.* **3**: 336-338.

Material examined: 1 male, 30-x-1995,

Kamathalachi (Parambikulam WLS, Palakkad Dt.); 1 male, 1 female, 14-iii-1996, Cheechali (Parambikulam WLS), 3 females, 23-ii-2000, Parumala (Alappuzha Dt.); 1 male, 1 female, 26-vi-2002, Thavanakkadavu (Ernakulam Dt.), Coll. C. Radhakrishnan; 1 female, 24-iii-1998, Neyyar Dam site (Thiruvananthapuram Dt.); 1 male, 25-iii-1998, Kovalam (Thiruvananthapuram Dt.); 1 male, 1 female, 28-iii-1998, Golden Valley (Thiruvananthapuram Dt.); 1 male, 1 female, 29-iii-1998, way to Chankiri (Thiruvananthapuram Dt.); 1 female, 30-iii-1998, Mottanood river (Thiruvananthapuram Dt.); 1 female, 3-iv-1998, Paighat (Thiruvananthapuram Dt.), Coll. P. T. Cherian; 2 males, 18-iii-2001, Chathankode (Thiruvananthapuram Dt.); 2 males, 1 female, 16-iii-2001, Kulasekaram (Thiruvananthapuram Dt.); 1 male, 17-iii-2001, Parassala, (Thiruvananthapuram Dt.); 1 female, 10-v-1995, Peechi R. F. (Trichur Dt.); 1 female, 13-x-1993, Parappa R. F. (Kasaragod Dt.); 6 females, 6-xi-2002, Payangadi (Kannur Dt.); 2 males, 4 females, 7-xi-2002, Theckumbad island (Kannur Dt.); 1 female, 30-iii-1997, Pulickal (Parambikulam WLS, Palakkad Dt.), Coll. K. C. Gopi; 1 female, 25-iv-2000, Thiruvambadi (Kozhikode Dt.); 1 male, 15-xi-1998, Chalamattom (Kottayam Dt.); 1 male, 2 females, 3-ii-2000, Calicut university campus; 1 male, 1 female, 24-i-2002, Kadalundi (Kozhikode Dt.); 2 males, 6 females, 30-I-2003, Ponnani port area (Malappuram Dt.); 3 males, 25-vi-2004, Thusharagiri (Kozhikode Dt.); 1 male, 11-v-2005, Chembra (Wayanad Dt.), Coll. K. G. Emiliyamma; 1 female, 19-vii-1982, Chathamangalam (Kozhikode Dt.), Coll. K. N. Nair; 3 males, 23-iii-1999, Chuliyar (Palakkad Dt.); 1 female, 20-iii-1999, Mangalam dam site (Palakkad Dt.); 1 female, 4-xi-1995, Pezhakunnu (Parambikulam WLS, Palakkad Dt.); 1 female, 19-ix-2001, Kolavipalam (Kozhikode Dt.); 1 female, 19-ii-1997, Pamba (Pathanamthitta Dt.); 1 male, 2-iii-1994, Vattapoi (Wayanad Dt.), Coll. P. M. Sureshan; 1 male, 1 female, 14-ii-2003, Chinnar WLS (Idukki Dt.), 4 males, 6 females, 14-x-2001, Madayipara (Kannur Dt.); 1 male, 2 females, 8-ix-2001, Malampuzha (Palakkad Dt.);

1 male, 2 females, 27-iii-2003, Manjeswaram (Kasaragod Dt.), Coll. Md. Jafer Palot; 1 male, 17-i-1992, Kuyilimala (Idukki Dt.), Coll. M. B. Raghunathan.

***Epithemis mariae* (Laidlaw, 1915)**

1915. *Amphithemis mariae* Laidlaw, *Rec. Indian Mus.*, **11**: 337-339; Fraser, 1936, *Fauna Brit. India Odon.*, **3**: 258-259.

Material examined: 2 males, 30-iii-1997, Pulickal (Parambikulam WLS, Palakkad Dt.); 2 males, 24-ix-1993, Santhimala (Kasaragod Dt.), Coll. K. C. Gopi; 1 female, 6-xi-1995, Muthalakayam (Parambikulam WLS); 3 males, 1 female, 14-xi-1996, Vellayikkamalai (Idukki WLS, Idukki Dt.), Coll. P. M. Sureshan.

***Hydrobasileus croceus* (Brauer, 1867)**

1867. *Tramea croceus* Brauer, *Verh. zool.-bot. Ges. Wien*, **17**: 813.
1890. *Hydrobasileus croceus* Karsch, *Berlin Ent. Zeit.*, **33**: 351; Fraser, 1936, *Fauna Brit. India Odon.*, **3**: 429-430.

Material examined: 1 female, 21-x-2001, Pandalam (Pathanamthitta Dt.), Coll. Ashok Kumar.

***Hylaeothemis indica* Fraser, 1946**

1889. *Tetrathemis fruhstorferi* Karsch, *Ent. Nachr.*, **15**: 321; Kirby, 1890, *Cat. Odon.*, p. 44.
1909. *Hylaeothemis fruhstorferi* Ris, *Cat. Coll. Selys, fasc.*, **9**: 64-65; Fraser, 1936, *Fauna Brit. India Odon.*, **3**: 261-262.
1991. *Hylaeothemis fruhstorferi apicalis* Tsuda, *A distributional list of world Odonata*, p. 157.
1946. *Hylaeothemis indica* Fraser, *Proc. R. ent. Soc. Lond.*, (B) **15**(7/8): 97-100

Material examined: 1 female, 28-viii-2003, Thusharagiri (Kozhikode Dt.); 1 male, 10-v-2005, Vannathimala (Wayanad Dt.); 1 female, 11-v-2005, Chembra (Wayanad Dt.), Coll. K. G. Emiliyamma.

***Indothemis carnatica* (Fabricius, 1798)**

1842. *Libellula caesia* Rambur, *Ins. Nevrop.* p. 95.
1911. *Indothemis caesia* Ris, *Cat. Coll. Selys, fasc.*, **13**: 529-531; Fraser, 1936, *Fauna Brit. India Odon.*, **3**: 340-341.

1991. *Indothemis carnatica* Tsuda, *A distributional list of World Odonata*, 1991, p. 157.

***Lathrecista asiatica* (Fabricius, 1798)**

1798. *Libellula asiatica* Fabricius, *Ent. Syst., Suppl.* p. 283.
1909. *Lathrecista asiatica asiatica* Ris, *Cat. Coll. Selys, fasc.*, 9: 129-132; Fraser, 1918, *J. Bombay nat. Hist. Soc.*, 26: 147-149; Fraser, 1936, *Fauna Brit. India Odon.*, 3: 281-284.

Material examined: 1 male, 25-x-2001, Aralam WLS (Kannur Dt.); 1 male, 27-xii-2003, Nelliampathy hills (Wayanad Dt.); 1 male, 5-ix-2005, Pazhayangadi (Kannur Dt.) Coll. Md. Jafer Palot; 2 males, 20-x-2003, Kadalundi (Kozhikode Dt.), Coll. K. G. Emiliyamma; 1 male, 4-viii-2001, Edakkad (Kozhikode Dt.), Coll. Ashok kumar.

***Lyriothemis acigastra* (Selys, 1878)**

1878. *Calothemis acigastra* Selys, *Mitth. Mus. Dresden*, p. 309
1883. *Lyriothemis acigastra* Selys, *Ann. Soc. Ent. Belg. Vol.*, 27, pp. 97, 143
1936. Fraser, *Fauna Brit. India Odon.*, 3: 265-267.
2013. *Taprobanica*, 5(1): 73-74.

Material examined: 4male, 1female, 17-vii-2010; 3 male, 29-viii-2010, Aravanchalkavu, (Kannur Dt.); 1 female, 9-ix-2010; 2 female, 21-ix-2010, Madayipara (Kannur Dt.), Coll. Muhamed Jafer Palot.

***Neurothemis fulvia* (Drury, 1773)**

1773. *Libellula fulvia* Drury, *III. Exot. Ins.*, 2: 84-85.
1889. *Neurothemis fulvia* Kirby, *Trans. Zool. Soc. Lond.* 12: 271; Fraser, 1936, *Fauna Brit. India Odon.*, 3: 353-354; Lieftinck, 1954, *Treubia*, 22 (suppl.): 150.

Material examined: 1 male, 25 - iv - 2000, Thiruvambadi (Kozhikode Dt.), Coll. K. G. Emiliyamma; 1 male, 21-iii-1994, Kasadukka (Kasaragod Dt.); 1 female, 14-x-1993, Chempilankai (Kasaragod Dt.); 1 female, 30-v-2002, Kinalur estate (Kozhikode Dt.); 2 females, 13-x-1993, Parappa R. F. (Kasaragod Dt.); 1 male, 19-iii-1994, Kavadikanam (Kasaragod Dt.); 1 male, 24-ix-1993, Santhimala (Kasaragod Dt.), Coll. K. C. Gopi; 1 female, 4-xi-2002, Edakkad

(Kozhikode Dt.), Coll. Ashok Kumar; 2 males, 9-viii-1982, Kudathai (Kozhikode Dt.), Coll. K. N. Nair; 1 female, 18-I-1992, Painavu (Idukki Dt.), Coll. M. B. Raghunathan; 1 male, 6-iv-1995, Aralam WLS (Kannur Dt.), Coll. Md. Jafer Palot; 1 female, 2-iii-1994, Chandanathodu (Wayanad Dt.), Coll. P. M. Sureshan.

***Neurothemis intermedia* (Rambur, 1842)**

1842. *Libellula intermedia* Rambur, *Ins. Nevrop.*, p. 91.
1889. *Neurothemis intermedia* Selys, *Ann. Mus. Civ. Genova*, 27: 454.
1911. *Neurothemis intermedia intermedia* Ris, *Cat. Coll. Selys, fasc.*, 13: 563-564; Fraser, 1936, *Fauna Brit. India Odon.*, 3: 357-358.

Material examined: 2 males, 17-iii-1999, Malampuzha (Palakkad Dt.); 3 males, 1 female, 21-iii-1999, Pothundi (Palakkad Dt.); 3 males, 22-iii-1999, Kanjirampuzha (Palakkad Dt.); 1 male, 16-viii-1997, Amakulam (Kollam Dt.); 1 female, 27-x-1995, Venkoli (Parambikulam WLS, Palakkad Dt.), Coll. P. M. Sureshan; 1 female, 26-I-1994, Manjucholamala (Kasaragod Dt.); 1 male, 23-iii-1994, Bendadukka (Kasaragod Dt.), Coll. K. C. Gopi. 1 female, 1-ix-2001, Madayipara (Kannur Dt.); 1 male, 27-xii-2001, Aralam WLS (Kannur Dt.), Coll. Md. Jafer Palot.

***Neurothemis intermedia atlanta* Ris, 1916**

1916. *Neurothemis intermedia atlanta* Ris, *Cat. Coll. Selys, fasc.* 16: 1168; Fraser, 1924, *Rec. Ind. Mus.*, 26: 438-439; Fraser, 1936, *Fauna Brit. India Odon.*, 3: 358-359.

Material examined: 1 female, 14-x-1993, Chempilankai (Kasaragod Dt.), Coll. K. C. Gopi; 1 male, 1 female, 2-x-2001, Kuniyan (Kasaragod Dt.), Coll. Md. Jafer Palot.

***Neurothemis tullia* (Drury, 1773)**

1773. *Libellula tullia* Drury, *III. Exot. Ins.*, 2: 85.
1890. *Neurothemis tullia* Kirby, *Cat. Odon.*, p. 8
1911. *Neurothemis tullia tullia* Ris, *Cat. Coll. Selys, fasc.* 13: 551; Fraser, 1936, *Fauna Brit. India Odon.*, 3: 360-362.

Material examined: 1 male, 3 females, 3-iv-1998, Paighat (Thiruvananthapuram Dt.), Coll.

P.T. Cherian; 2 males, 14-iv-1997, Vely, Coll. M.B. Raghunathan; 2 males, 14-iii-2001, Attingal (Thiruvananthapuram Dt.); 3 males, 17-iii-2001, Parassala (Thiruvananthapuram Dt.); 2 males, 1 female, 17-iii-2001, Neyyattinkara; 1 male, 1 female, 18-iii-2001, Vithura Chathankodu (Thiruvananthapuram Dt.); 1 male, 1 female, 30-v-2002, Kinalur estate (Kozhikode Dt.), Coll. K. C. Gopi; 2 males, 20-xii-1998, Maryland (Kottayam Dt.); 1 female, 24-x-2002, Vadikkadavu (Malappuram Dt.); 2 females, 9-v-2005, Pookode lake (Wayanad Dt.); 1 male, 25-iv-2000, Thiruvambadi (Kozhikode Dt.); 2 males, 6 females, 22-ii-2001, Kuttiadi (Kozhikode Dt.) Coll. K. G. Emiliyamma; 2 males, 1 female, 8-iii-2002, Kinaloor estate (Kozhikode Dt.), Coll. C. Radhakrishnan; 3 males, 4 females, 18-xii-1998, Mavoor/ Thennilakadavu (Kozhikode Dt.); 2 males, 17-I-1995, Peruvannamuzhi (Kozhikode Dt.); 4 males, 21-iii-1999, Pothundi (Palakkad Dt.), 2 males, 24-x-2000, Kumarakom (Kottayam Dt.); 1 male, 30-x-2000, Kidangoor (Kottayam Dt.); 1 male, 31-x-2000, Velloor (Kottayam Dt.); 1 male, 1 female, 25-x-2000, Kanjirampara (Kottayam Dt.); 2 males, 1 female, 12-xi-1996, Mullakudy (Periyar Tiger Reserve, Idukki Dt.); 1 male, 14-xi-1996, Vellayikkamalai (Idukki WLS); 1 male, 1 female, 14-iii-1996, Cheechali (Parambikulam WLS, Palakkad Dt.), Coll. P. M. Sureshan; 4 males, 2 females, 21-ix-1982, Koduvally (Kozhikode Dt.); 2 males, 1 female, 6-xii-1985, Kurichiarmala (Wayanad Dt.), Coll. K. N. Nair.

***Onychothemis testacea ceylanica* Ris, 1912**

1912. *Onychothemis tonkinensis ceylanica* Ris, *Cat. Coll. Selys, fasc.*, **16**: 832, 835.
1924. *Onychothemis testacea ceylanica* Laidlaw, *Spolia Zeylanica*, **12**: 349; Fraser, 1936, *Fauna Brit. India Odon.*, **3**: 404-406.

***Orthetrum chrysis* Selys, (1891)**

1891. *Libella testacea* race? *chrysis* Selys, *Ann. Mus. Civ. Genova*, **30**: 462.
1900. *Orthetrum chrysis* Ris, *Archivfur Natur.* Bd. **1**: 186, pl. ix, fig. 2; Fraser, 1936, *Fauna Brit. India Odon.*, **3**: 310-311.

Material examined: 3 males, 17 - ii - 2004, Thusharagiri (Kozhikode Dt.); 1 male, 22-ii-2001, Chathancode (Kozhikode Dt.); 1 male, 15-xi-1998, Chalamattom (Kottayam Dt.); 3 males, 17-ii-2004, Thusharagiri (Kozhikode Dt.); 1 male, 27-x-2004, Kadalundi (Kozhikode Dt.), Coll. K. G. Emiliyamma; 2 males, 30-v-2002, Kinalur estate (Kozhikode Dt.); 1 male, 1 female, 6-xi-2001, Thalakkulathur (Kozhikode Dt.), Coll. K. C. Gopi; 1 male, 12-I-1992, Kudayuritty (Idukki Dt.), Coll. M. B. Raghunathan; 1 male, 1 female, 27-x-2001, Aralam WLS (Kannur Dt.); 1 male, 22-x-2001, Meenmuttithodu (Kannavam R.F., Kannur Dt.); 1 male, 4-vi-2003, Thusharagiri (Kozhikode Dt.), Coll. Md. Jafer Palot; 1 male, 1 female, 4-ix-1995, Kottiyur R.F.(Kannur Dt.), Coll. C. Radhakrishnan.

***Orthetrum glaucum* (Brauer, 1865)**

1865. *Libellula glauca* Brauer, *Verh. zool.- bot. Ges. Wien*, **15**: 1012.
1890. *Orthetrum glaucum* Kirby, *Cat. Odon.* p.39; Fraser, 1936, *Fauna Brit. India Odon.*, **3**: 307-309.

Material examined: 2 males, 23-xii-1994, Kurichiat R.F (Wayanad Dt.), Coll. C. Radhakrishnan; 1 male, 1 female, 30-v-2002, Kinalur estate (Kozhikode Dt.); 1 male, 27-x-1993, Pullody (Kasaragod Dt.), Coll. K. C. Gopi; 1 male, 9-xi-1996, Mlappara (Periyar Tiger Reserve, Idukki Dt.); 2 males, 2 females, 9-xi-1994, Periya R.F. (Wayanad Dt.); 1 male, 11-xi-1994, Rampur R.F. (Wayanad Dt.), Coll. P. M. Sureshan; 2 males, 2 females, 23-ix-2004, Thusharagiri (Kozhikode Dt.); 2 males, 12-v-2005, Banasuramala foot hills (Wayanad Dt.), Coll. K. G. Emiliyamma.

***Orthetrum luzonicum* (Brauer, 1868)**

1868. *Libella luzonica* Brauer, *Verh. zool.- bot. Ges. Wien*, **18**: 169, 732.
1890. *Orthetrum luzonicum* Kirby, *Cat. Odon.* p. 38; Fraser, 1936, *Fauna Brit. India Odon.*, **3**: 298-300.

Material examined: 1 male, 30-xii-1998, Chalamattom (Kottayam Dt.); 1 male, 25-iv-2000, Muthappanpuzha (Kozhikode Dt.); 2 males, 24-x-2002, Vadikkadavu (Malappuram Dt.); 1 male, 1

female, 17-ii-2004, Thusharagiri (Kozhikode Dt.); 1 male, 9-v-2005, Pookode lake (Wayanad Dt.), Coll. K. G. Emiliyamma; 1 male, 15-iii-2001, Kallar (Thiruvananthapuram Dt.); 1 male, 24-i-1994, Ranipuram (Kasaragod Dt.); 1 male, 7-xii-2004, Kinalur estate (Kozhikode Dt.), Coll. K. C. Gopi; 1 male, 1 female, 8-iii-2002, Kinalur estate (Kozhikode Dt.); 1 female, 5-ix-2002, Chevayur (Kozhikode Dt.), Coll. C. Radhakrishnan; 1 male, 7-xii-2002, Aralam WLS (Kannur Dt), Coll. Md. Jafer Palot; 1 male, 18-viii-1997, Vallamvetti, Anchal R.F. (Kollam Dt.); 1 female, 12-xi-1994, Kuppadi R.F. (Wayanad Dt.), Coll. P. M. Sureshan.

Orthetrum pruinsum neglectum
(Rambur, 1842)

1842. *Libellula neglecta* Rambur, *Ins. Nevrop.* p. 86.
1909. *Orthetrum pruinsum neglectum* Ris, *Cat. coll. Selys, fasc.*, 9: 181, 239-240;
1936. Fraser, *Fauna Brit. India Odon.*, 3: 311-313.

Material examined: 1 male, 29-x-1995, Sirkarpathy (Parambikulam WLS, Palakkad Dt.); 2 males, 31-x-1995, Anchupoola (Parambikulam WLS); 1 male, 6-xi-1995, Muthalakayam (Palakkad, Parambikulam WLS); 1 male, 6-xi-1996, Karadikkavala (Periyar tiger Reserve, Idukki Dt.); 1 male, 8-xi-1996, Mlappara (Periyar Tiger Reserve, 1 male, 12-xi-1996, Mullakudy (Periyar Tiger Reserve); 2 males, 10-xi-1996, Karikkavu (Periyar Tiger Reserve, Idukki Dt.); 1 male, 17-xi-1999, Karimpuzha (Ernakulam Dt.); 1 male, 1 female, 11-xi-1994, Rampur R.F. (Wayanad Dt.); 1 male, 18-xii-1998, Cheroopa (Kozhikode Dt.), Coll. P. M. Sureshan; 1 male, 16-iii-2001, Kulasekaram; 1 male, 17-iii-2001, Neyyattinkara (Thiruvananthapuram Dt.); 1 male, 24-i-1994, Ranipuram (Kasaragod Dt.); 1 male, 27-x-1993, Pullody (Kasaragod Dt.), Coll. K. C. Gopi; 1 male, 24-x-2002, Vadikkadavu (Malappuram Dt.); 2 males, 17-ii-2004, Thusharagiri (Kozhikode Dt.); 1 male, 27-x-2004, Kadalundi (Kozhikode Dt.), Coll. K. G. Emiliyamma.

Orthetrum sabina (Drury, 1770)

1770. *Libellula sabina* Drury, *III. Exot. Ins.*, 1: 114-115.
1889. *Orthetrum sabina* Kirby, *Trans. Zool. soc. Lond.*, 12: 302; Fraser, 1936, *Fauna Brit. India Odon.*, 3: 300-302.
1954. *Orthetrum sabina sabina*, Lieftinck, *Treubia* 22 (suppl.): 137.

Material examined: 1 male, 17-i-1995, Peruvannamuzhi (Kozhikode Dt.); 2 males, 3 females, 17-iii-1999, Malampuzha (Palakkad Dt.); 2 females, 23-iii-1999, Chulliyar (Palakkad Dt.); 2 males, 22-iii-1999, Kanjirampuzha (Palakkad Dt.), 1 male, 25-x-2000, Kanjirampara (Kottayam Dt.); 2 males, 26-ii-2002, Padanakara (Malappuram Dt.); 1 male, 2-xi-1995, Thunakadavu (Parambikulam WLS, Palakkad Dt.); 1 male, 3-xi-1995, Orukomban (Parambikulam WLS); 1 male, 6-xi-1995, Muthalakayam (Parambikulam WLS), Coll. P. M. Sureshan; 1 male, 18-xii-1997, Karamana (Thiruvananthapuram Dt.), Coll. M. B. Raghunathan; 1 female, 17-iii-2001, Parassala (Thiruvananthapuram Dt.); 1 female, 15-iii-2001, Kallar (Thiruvananthapuram Dt.); 1 male, 22-ii-2000, Thannermukkom (Alappuzha Dt.), Coll. K. C. Gopi; 1 female, 30-vii-1984, Mavoor (Kozhikode Dt.); 3 males, 1 female, 21-ix-1982, Koduvally (Kozhikode Dt.), Coll. K. N. Nair; 1 male, 8-iii-2002, Kinalur estate (Kozhikode Dt.); 1 male, 23-ii-2000, Parumala/Mannar (Alappuzha Dt.); 1 male, 11-x-1995, Peechi R.F. (Thrissur Dt.); 1 male, 23-ii-1994, Kurichiat R.F. (Wayanad Dt), Coll. C. Radhakrishnan; 1 male, 15-xi-1998, Chalamattom (Kottayam Dt.); 1 male, 24-iv-2002, Eengappuzha (Kozhikode Dt.); 2 males, 24-x-2002, Vadikkadavu (Malappuram Dt.); 1 male, 17-ii-2004, Thusharagiri (Kozhikode Dt.); 2 males, 1 female, 27-x-2004, Kadalundi (Kozhikode Dt.), Coll. K. G. Emiliyamma.

Orthetrum taeniolatum (Schneider, 1845)

1845. *Libellula taeniolata* Schneider, *Stett. Ent. Zeit.*, 6: 111; Selys, 1850, *Rev. Odon.*, p. 290.
1890. *Orthetrum taeniolatum* Kirby, *Cat. Odon.*, p. 37; Fraser, 1936, *Fauna Brit. India Odon.* 3: 296-298.

Material examined: 1 male, 22-x-2001, Kannavam R. F. (Kannur Dt.), Coll. Md. Jafer Palot.

***Orthetrum triangulare* (Selys, 1878)**

1878. *Libella triangularis* Selys, *Mitth. Mus. Dresden*, p. 314; id., 1891, *Ann. Mus. Civ. Genova*, **30**: 461.

1909. *Orthetrum triangulare triangulare* Ris, *Cat. Coll. Selys, fasc.*, **9**: 181, 243-244; Fraser, 1936, *Fauna Brit. India Odon.*, **3**: 305-307.

Material examined: 1 male, 12.iv.2005. Kurichyar mala (Wayanad Dt.). Coll. Md Jafer Palot; 1 female, 12-xi-1996, Mullakudy (Periyar Tiger Reserve, Idukki Dt.); 2 males, 8-xi-1996, Mlappara (Periyar Tiger Reserve), Coll. P. M. Sureshan.

***Palpopleura sexmaculata* (Fabricius, 1787)**

1787. *Libellula sexmaculata* Fabricius, *Mant. Ins.*, **1**: 338.

1868. *Palpopleura sexmaculata* Brauer, *Verh. zool.-bot. Ges. Wien*, **18**: 716.

1936. *Palpopleura sexmaculata sexmaculata* Farser, *Fauna Brit. India Odon.*, **3**: 318-320.

Material examined: 1 female, 13-xii-1985, Thariyodu (Wayanad Dt.); 1 female, 18-iv-1984, Meppadi (Wayanad Dt.); 1 male, 4 females, 27-ix-1983, Kottappadi (Wayanad Dt.), Coll. K. N. Nair; 1 male, 8-iii-2006, Kasaragod, Coll. K. G. Emiliyamma. 1 female, 12-xi-1996, Mullakudy (Periyar Tiger Reserve, Idukki Dt.); 1 female, 9-xi-1996, Mlappara (Periyar Tiger Reserve, Idukki Dt.); 1 male, 6-xi-1996, Karadikkavala (Periyar tiger Reserve, Idukki Dt.); 1 female, 12-xi-1994, Kuppadi R.F. (Wayanad Dt.), Coll. P. M. Sureshan; 1 male, 2 females, 11-v-2002, Vallamkulam (Pathanamthitta Dt.), Coll. Ashok Kumar; 1 female, 28-ii-1994, Mananthavady, (Wayanad Dt.); 1 male, 24-xii-1994, Kurichiat R.F. (Wayanad Dt.), Coll. C. Radhakrishnan; 1 male, 1 female, 22-iii-1997, Thunakkadavu, (Parambikulam WLS, Palakkad Dt.); 1 male, 24-i-1994, Ranipuram (Kasaragod Dt.), Coll. K. C. Gopi.

***Pantala flavescens* (Fabricius, 1798)**

1798. *Libellula flavescens* Fabricius, *Ent. Syst. Suppl.* p. 285.

1861. *Pantala flavescens* Hagen, *Syn. Neur. N. Amer.* p. 142; Fraser, 1936, *Fauna Brit. India Odon.*, **3**: 414-416.

Material examined: 5 females, 17-xii-1997, Tropical Botanical Garden, Palode (Thiruvananthapuram Dt.), Coll. M. B. Raghunathan; 1 male, 15-x-2001, Kadalundi (Kozhikode Dt.); 1 male, 30-xii-1998, Chalamattom (Kottayam Dt.); 2 males, 3 females, 24-x-2002, Vadikkadavu (Malappuram Dt.), Coll. K. G. Emiliyamma; 1 male, 4 females, 30-x-2002, Chevayur (Kozhikode Dt.); 1 male, 26-vi-2002, Thavanakkadavu (Kozhikode Dt.); 1 female, 9-x-1995, Vellanimala-Adakappara (Thrissur Dt.), Coll. C. Radhakrishnan; 3 males, 4 females, 20-x-1983, Koumpara (Kozhikode Dt.), Coll. K. N. Nair; 1 male, 17-iii-1999, Malampuzha (Palakkad Dt.); 4 males, 30-x-2000, Kidangoor (Kottayam Dt.); 1 female, 27-x-2000, Kanjirappally (Kottayam Dt.); 2 males, 26-x-2000, Mundakayam (Kottayam Dt.); 2 females, 12-xi-1996, Mullakudy (Periyar Tiger Reserve, Idukki Dt.); 1 male, 19-xi-1996, Chinnar WLS, (Idukki Dt.); 2 males, 24-xi-1999, Idamalayar (Idukki Dt.), Coll. P. M. Sureshan; 1 male, 24-xi-1994, Madayikavu (Kannur Dt.), Coll. K. C. Gopi; 2 males, 1 female, 13-iii-2000, Madayipara (Kannur Dt.), Coll. Md. Jafer Palot.

***Potamarcha congener* (Rambur, 1842)**

1842. *Libellula obscura* Rambur, *Ins. Nevrop.* p. 64.

1890. *Potamarcha obscura* Karsch, *Berlin Ent. Zeit.*, **33**: 371; Fraser, 1936, *Fauna Brit. India Odon.*, **3**: 289-291.

1891. *Potamarcha congener* Selys, *An. Soc. Espan.*, **20**: 221.

Material examined: 5 males, 18-iii-2001, Vithura Chathankodu (Thiruvananthapuram Dt.), Coll. K. C. Gopi; 1 female, 24-iii-1997, Peruvaripallam (Parambikulam WLS, Palakkad Dt.), Coll. C. Radhakrishnan; 1 female, 16-xi-1998, Maryland (Kottayam Dt.), Coll. K. G. Emiliyamma; 1 female, 23-iii-1999, Chulliyar (Palakkad Dt.); 1 male, 1-iii-1994, Thirunelli R.F. (Wayanad Dt.), Coll. P. M. Sureshan.

***Rhodothemis rufa* (Rambur, 1842)**

1842. *Libellula rufa* Rambur, *Ins. Nevrop.* p. 71.
1911. *Rhodothemis rufa* Ris, *Cat. Coll. Selys, fasc.*, **13**: 592-593; Fraser, 1936, *Fauna Brit. India Odon.*, **3**: 368-369.

Material examined: 3 males, 1 female, 24-x-2002, Vadikkalkdavu (Malappuram Dt.); 1 male, 1 female, 27-x-2004, Kadalundi (Kozhikode Dt.), Coll. K. G. Emiliyamma. 1 female, 30-x-2000, Kidangoor (Kottayam Dt.); 1 female, 20-ii-2002, Kottooli (Kozhikode Dt.), Coll. P. M. Sureshan; 1 female, 23-ix-2001, Madayipara (Kannur Dt.); 1 female, 15-ix-2001, Kasaragod, Coll. Md. Jafer Palot.

***Rhyothemis triangularis* Kirby, 1889**

1889. *Rhyothemis triangularis* Kirby, *Trans. Zool. Soc. Lond.*, **12**: 319; Fraser, 1936, *Fauna Brit. India Odon.*, **3**: 427-428.

Material examined: 1 male, 13-xii-2002, Periya R. F (Wayanad), Coll. Jafer Palot.

***Rhyothemis variegata* (Linnaeus, 1763)**

1763. *Libellula variegata* Linnaeus, *Amoenitates Acad.*, **6**: 412.
1867. *Rhyothemis variegata* Hagen, *Stett. Ent. Zeit.*, **28**: 232.
1913. *Rhyothemis variegata variegata* Ris, *Cat. Coll. Selys, fasc.*, **15**: 931; Fraser, 1936, *Fauna Brit. India Odon.*, **3**: 423-424.

Material examined: 1 male, 1 female, 20-xii-1998, Maryland (Kottayam Dt.); 1 male, 22-ii-2001, Kuttiadi (Kozhikode Dt.); 1 female, 25-vi-2004, Thusharagiri (Kozhikode Dt.) Coll. K. G. Emiliyamma; 1 female, 22-x-1998, Chevarambalam (Kozhikode Dt.); 1 male, 3 females, 23-ii-2000, Parumala/Mannar (Alappuzha Dt.), Coll. C. Radhakrishnan; 1 female, 30-v-2002, Kinalur estate (Kozhikode Dt.); 2 males, 7-xi-2002, Theckumbadu island (Kannur Dt.), Coll. K. C. Gopi; 1 female, 30-vii-1984, Mavoor/Myadikunnu (Kozhikode Dt.); 1 female, 7-vii-1982, Quilandy (Kozhikode Dt.); 2 females, 15-xii-1985, Kalpetta (Wayanad Dt.), Coll. K. N. Nair; 2 females, 16-iii-1999, Chittoor (Palakkad Dt.), 1 male, 27-x-2000, Kanjirappally (Kottayam

Dt.), 1 male, 25-x-2000, Kanjirampara (Kottayam Dt.); 1 male, 2 females, 24-x-2000, Kumarakom (Kottayam Dt.); 1 female, 31-x-2000, Velloor (Kottayam Dt.); 2 males, 1 female, 29-x-2000, Kidangoor (Kottayam Dt.); 1 male, 12-xi-1999, Kodanad/Mallana R.F. (Ernakulam Dt.); 1 male, 16-viii-1997, Amakulam (Kollam Dt.), Coll. P. M. Sureshan.

***Sympetrum fonscolombei* (Selys, 1840)**

1837. *Libellula flaveola* (nom.preoc.) Fonscolombe, *Ann. Soc. Ent. France*, **6**: 144.
1874. *Sympetrum fonscolombei* Meyer-Dur, *Mitt. Schweiz. Ent. Ges.*, **4**: 327; Fraser, 1936, *Fauna Brit. India Odon.*, **3**: 377-379.

***Tetrathemis platyptera* Selys, 1878**

1878. *Tetrathemis platyptera* Selys, *Mitt. Mus. Dresden*, p. 316; Kirby, 1890, *Cat. Odon.* p. 44; Fraser, 1936, *Faun Brit. India Odon.*, **3**: 250-251.

Material examined: 1 male, 1 female, 16-xi-1998, Chalamattom (Kottayam Dt.), Coll. K. G. Emiliyamma; 1 male, 2-x-2002, Edakkad (Kozhikode Dt.), Coll. Ashok Kumar; 1 female, 26-x-2000, Mundakayam (Kottayam Dt.), Coll. P. M. Sureshan; 1 male, 23-ix-2001, Madayipara (Kannur Dt.), Coll. Md. Jafer Palot.

***Tholymis tillarga* (Fabricius, 1798)**

1798. *Libellula tillarga* Fabricius, *Ent. Syst. Suppl.* p. 285.
1867. *Tholymis tillarga* Hagen, *Stett. Ent. Zeit.*, **28**: 220; Fraser, 1936, *Fauna Brit. India Odon.*, **3**: 411-413.

Material examined: 1 male, 1 female, 20-vii-1999, Chevayur (Kozhikode Dt.); 2 males, 4-iii-1999, Chevarambalam (Kozhikode Dt.); 1 male, 27-xii-1994, Chethalayam (Wayanad Dt.), Coll. C. Radhakrishnan; 2 females, 25-iv-2000, Pullurampara (Kozhikode Dt.); 1 male, 1 female, 24-x-2002, Vadikkadavu (Malappuram Dt.); 1 female, Mathappuzha (Malappuram Dt.) Coll. K. G. Emiliyamma; 1 female, 29-x-1995, Sirkarpathy (Parambikulam WLS, Palakkad Dt.); 1 male, 30-x-2000, Kidangoor (Kottayam Dt.); 1 male, 19-xi-1996, Chinnar WLS, (Idukki Dt.) Coll. P. M. Sureshan; 1 male, 16-x-2001, Edakkad (Kozhikode Dt.), Coll. Ashok kumar; 1 female,

30-x-2002, Chevayur (Kozhikode Dt.); 1 male, 30-vi-2001, Madayipara (Kannur Dt.), Coll. Md. Jafer Palot; 1 female, 6-xi-2001, Thalakkulathur (Kozhikode Dt.), Coll. K. C. Gopi.

***Tramea basilaris burmeisteri* Kirby, 1889**

1839. *Libellula chinensis* Burmeister, *Handb. Ent.*, 2: 852.
 1889. *Tramea burmeisteri* Kirby, *Trans. Zool. Soc. Lond.*, 12: 316.
 1936. *Tramea basilaris burmeisteri* Fraser, *Fauna Brit. India Odon.*, 3: 432-434.

Material examined: 1 male, 7-iii-2006, Kannur, Coll. K. G. Emiliyamma.

***Tramea limbata similata* (Rambur, 1842)**

1832. *Libellula limbata* Desjardins, *Rapport Soc. Maurice*, p. 1
 1889. *Tramea limbata* Kirby, *Trans. Zool. Soc. Lond.*, 12: 318; Fraser, 1936, *Fauna Brit. India Odon.*, 3: 436-438.
 1920. *Tramea limbata* race *similata* Fraser, *J. Bombay nat. Hist. Soc.*, 27: 53, 54.
 1991. *Tramea limbata similata* Tsuda, *A distributional list of world Odonata*, 1991, p. 184.

Material examined: 1 male, 1-vi-2000, Kadalundi (Kozhikode Dt.), Coll. K. G. Emiliyamma; 1 female, 30-iii-1998, Mottanood river (Thiruvananthapuram Dt.), Coll. P. T. Cherian; 1 male, 16-iii-1999, Chittoor (Palakkad Dt.), 1 male, 25-x-2000, Kanjirampara (Kottayam Dt.); 1 male, 5-ix-2001, Kolavipalam (Kozhikode Dt.), Coll. P. M. Sureshan; 1 male, 29-iv-2003, Madayipara (Kannur Dt.), Coll. Md. Jafer Palot; 1 male, 8-ix-2001, Malampuzha (Palakkad Dt.), Coll. Dinesan Cheruvat.

***Trithemis aurora* (Burmeister, 1839)**

1839. *Libellula aurora* Burmeister, *Handb. Ent.*, 2: 859.
 1868. *Trithemis aurora* Brauer, *Verh. zool.-bot. Ges. Wien.*, 18: 177, 735; Fraser, 1936, *Fauna Brit. India Odon.*, 3: 383-385.

Material examined: 1 male, 1 female, 28-iii-1998, Golden Valley (Idukki); 1 male, 30-iii-1998, Mottanood river (Thiruvananthapuram Dt.), Coll. P. T. Cherian; 3 males, 30-xii-1998,

Chalamattom (Kottayam Dt.); 1 male, 25-iv-2000, Muthappanpuzha (Kozhikode); 3 males, 24-iv-2002, Eengappuzha (Kozhikode Dt.); 1 female, 28-viii-2003, Thusharagiri (Kozhikode Dt.); 1 male, 9-v-2005, Kalpetta (Wayanad Dt.), Coll. K. G. Emiliyamma; 1 male, 15-iii-2001, Kallar (Thiruvananthapuram Dt.); 3 females, 30-v-2002, Kinalur estate (Kozhikode Dt.), Coll. K. C. Gopi; 1 male, 2-xi-1995, Thunakadavu (Parambikulam WLS, Palakkad Dt.); 2 males, 1 female, 3-xi-1995, Orukomban (Parambikulam WLS); 1 male, 1 female, 6-xi-1995, Muthalakayam (Parambikulam WLS); 2 males, 27-x-2000, Kanjirappally (Kottayam Dt.); 1 male, 8-xi-1996, Mlappara (Periyar Tiger Reserve, Idukki Dt.); 1 male, 6-xi-1996, Karadikkavala (Periyar tiger Reserve, Idukki Dt.); 1 male, 18-xi-1996, Chambakkad (Chinnar WLS, Idukki Dt.), Coll. P. M. Sureshan; 1 male, 22-x-2001, Meenmuttithodu (Kannavam R.F., Kannur Dt.), Coll. Md. Jafer Palot; 2 males, 16-xii-1985, Muthanga WLS (Wayanad Dt.), Coll. K. N. Nair; 2 males, 1 female, 23-xii-1994, Kurichiat R.F. (Wayanad Dt.), Coll. C. Radhakrishnan.

***Trithemis festiva* (Rambur, 1842)**

1842. *Libellula festiva* Rambur, *Ins. Nevrop.*, p. 92.
 1868. *Trithemis festiva* Brauer, *Verh. zool.-bot. Ges. Wien.*, 18: 736; Fraser, 1936, *Fauna Brit. India Odon.*, 3: 387-389.

Material examined: 1 male, 28 - iii - 1998, Golden Valley (Thiruvananthapuram Dt.), Coll. P. T. Cherian; 1 male, 8-iii-2002, Kinalur estate (Kozhikode Dt.); 3 males, 23-xii-1994, Kurichiat R.F. (Wayanad Dt), Coll. C. Radhakrishnan; 2 males, 28-xii-1998, Chalamattom (Kottayam Dt.); 1 male, 24-iv-2002, Eengappuzh (Kozhikode Dt.); 2 males, 17-ii-2004, Thusharagiri (Kozhikode Dt.); 1 male, 11-v-2005, Kanthanpara (Wayanad Dt.), Coll. K. G. Emiliyamma; 1 male, 30-v-2002, Kinalur estate (Kozhikode Dt.), Coll. K. C. Gopi; 2 males, 2 females, 19-iii-1999, Pothundi (Palakkad Dt.); 1 male, 8-xi-1996, Mlappara (Periyar Tiger Reserve, Idukki Dt.); 1 male, 6-xi-1996, Karadikkavala (Periyar tiger Reserve, Idukki Dt.); 1 male, 18-xi-1999, Thundathil (Ernakulam Dt.); 2 males, 8-viii-1997,

Parakkadavu (Kollam Dt.); 1 male, 22-vi-1995, Thusharagiri (Kozhikode Dt.), 3 males, 30-iii-1997, Orukomban (Parambikulam WLS, Plakkad Dt.); Coll. P. M. Sureshan; 1 male, 22-x-2001, Kannavam R.F., (Kannur Dt.), Coll. Md. Jafer Palot; 3 males, 16-xii-1985, Muthanga WLS (Wayanad Dt.), Coll. K.N.Nair.

***Trithemis kirbyi* Selys, 1891**

1868. *Trithemis aurora* Kirby (pars), *Proc. Zool. Soc. Lond.*, p. 327.
1891. *Trithemis kirbyi* Selys, *Ann. Mus. Civ. Genova*, **30**: 465.
1912. *Trithemis kirbyi kirbyi* Ris, *Cat. Coll. Selys. Fasc.* **14**: 760, 778; Fraser, 1936, *Fauna Brit. India Odon.*, **3**: 385-387.

Material examined: 1 female, 10-iii-2001, Valiyakarikkandam (Kannur Dt.), Coll. Md. Jafer Palot; 1 female, 11-iv-2000, Adivaram (Kozhikode Dt.), Coll. K. G. Emiliyamma; 1 female, 8-iii-2002, Kinaloor estate (Kozhikode Dt.), Coll. C. Radhakrishnan; 1 female, 6-xi-1996, Karadikkavala (Periyar tiger Reserve, Idukki Dt.); 1 female, 18-xi-1996, Chambakkad (Chinnar WLS, Idukki); 1 female, 23-i-1997, Venkoli (Parambikulam WLS, Palakkad Dt.), Coll. P. M. Sureshan; 1 female, 12-ix-2001, Malampuzha (Palakkad Dt.), Coll. Dinesan Cheruvat; 1 female, 11-x-1995, Peechi R.F. (Thrissur Dt.), Coll. K. C. Gopi.

***Trithemis pallidinervis* (Kirby, 1889)**

1889. *Sympetrum pallidinervis* Kirby, *Trans. Zool. Soc. Lond.*, **12**: 327.
1907. *Trithemis pallidinervis* Morton, *Trans. Ent. Soc. Lond.*, p. 304; Fraser, 1936, *Fauna Brit. India Odon.*, **3**: 389-391.

Material examined: 1 male, 27-iii-1998, Kallar river site (Thiruvananthapuram Dt.), Coll. P. T. Cherian; 1 female, 1 male, 1-ii-2002, Kadalundi (Kozhikode Dt.); 1 male, 29-i-2003, Puthuponnani (Malappuram Dt.); 1 male, 12-v-2005, Banasura foothills (Wayanad Dt.), Coll. K. G. Emiliyamma.

***Urothemis signata* (Rambur, 1842)**

1839. *Libellula sanguinea* Burmeister, *Handb. Ent.*, **2**: 858.

1913. *Urothemis signata signata* Ris, *Cat. Coll. Selys, fasc.* **16**: 1023; Fraser, 1936, *Fauna Brit. India Odon.*, **3**: 442-444.

Material examined: 1 female, 22-ii-2001, Chathancode (Kozhikode Dt.); 2 females, 29-i-2003, B. M. Kayal (Malappuram Dt.), 3 males, 2 females, 20-x-2003, Kadalundi (Kozhikode Dt.), Coll. K. G. Emiliyamma; 1 male, 16-x-2001, Edakkad (Kozhikode Dt.), Coll. Ashok kumar; 2 males, 29-x-2000, Kumarakom (Kottayam Dt.); 1 male, 30-x-2000, Kidangoor (Kottayam Dt.); 1 male, 26-x-2000, Mundakayam (Kottayam Dt.); 1 female, 25-x-2000, Kanjirampara (Kottayam Dt.); 2 males, 3 females 5-ix-2001, Kolavipalam (Kozhikode Dt.), Coll. P. M. Sureshan; 1 male, 26-vi-2002, Thavanakkadavu, (Ernakulam Dt.), Coll. C. Radhakrishnan.

***Zygonyx iris malabarica* Fraser, 1926**

1919. *Zygonyx iris* Fraser (pars), *J. Bombay nat. Hist. Soc.*, **26**: 741-742.
1926. *Zygonyx iris malabarica* Fraser, *J. Bombay nat. Hist. Soc.*, **31**: 763-766; Fraser, 1936, *Fauna Brit. India Odon.*, **3**: 395-396.

Material examined: 1 male, 17-ii-2004, Thusharagiri (Kozhikode Dt.); 1 male, 1 female, 10-v-2005, Vannathimala (Wayanad Dt.), Coll. K. G. Emiliyamma; 1 male, 13-vi-2003, Thusharagiri (Kozhikode Dt.); 1 male, 9-iii-2002, Kappil, (Aralam WLS, Kannur Dt.), Coll. Md. Jafer Palot; 1 male, 27-v-2003, Thusharagiri (Kozhikode Dt.), Coll. C. Radhakrishnan.

***Zygonyx torrida isis* Fraser, 1924**

1924. *Zygonyx isis* Fraser, *Rec. Ind. Mus. vol.*, **26**, pp. 426, 440, 441.
1931. *Zygonyx torrida isis* Fraser, *Rec. Ind. Mus. vol.*, **33**, pp. 446; Fraser, 1936, *Fauna Brit. India Odon.*, **3**: 401-402.

***Zyxomma petiolatum* Rambur, 1842**

1842. *Zyxomma petiolatum* Rambur, *Ins. Nevrop.* p. 30; Hagen, 1858, *Verh. zool.-bot. Ges. Wien.*, **8**: 479; Fraser, 1936, *Fauna Brit. India Odon.*, **3**: 409-410.

Material examined: 1 male, 18-viii-2000, Edakkad (Kozhikode Dt.); 1 female, 2-ii-2000, Kunduparamba (Kozhikode Dt.), Coll. Ashok

kumar; 1 female, 21-ii-2001, Puthiyangadi (Kannur Dt.); 1 female, 26-x-2001, Aralam WLS (Kannur Dt.), Coll. Md. Jafer Palot; 1 male, 1 female, 12-xi-2002, Kadalundi (Kozhikode Dt.), Coll. K. G. Emiliyamma.

Family MACROMIIDAE

Epophthalmia frontalis binocellata

(Fraser, 1924)

1924. *Macromia binocellata* Fraser, *Rec. Indian Mus.*, **26**: 451-452.

1936. *Epophthalmia frontalis binocellata* Fraser, *Fauna Brit. India Odon.*, **3**: 199-201.

Epophthalmia vittata Burmeister, 1839

1839. *Epophthalmia vittata* Burmeister, *Handb. Ent.*, **2**: 845.

1936. *Epophthalmia vittata vittata* Burmeister, *Fauna Brit. India Odon.*, **3**: 194-196.

1953. *Epophthalmia vittata vittata*, Bhasin, *Indian For. Leaf.*, **121** (3): 73.

Macromia annaimallaiensis Fraser, 1931

1931. *Macromia annaimallaiensis* Fraser, *Rec. Indian Mus.*, **33**: 447, 452-453 ; Fraser, 1936, *Fauna Brit. India Odon.*, **3**: 168-169.

Macromia bellicosa Fraser, 1924

1924. *Macromia bellicosa* Fraser, *Rec. Ind. Mus. Vol.* **26**, pp. 427, 453-454, pl. 25, fig. 9; *Fauna Brit. India Odon.* **3**: 175-177.

Macromia cingulata Rambur, 1842

1842. *Macromia cingulata* Rambur, *Ins. Nevrop.* p. 137; Fraser, *Fauna Brit. India Odon.*, **3**: 179-182.

Macromia ellisoni Fraser, 1924

1924. *Macromia ellisoni* Fraser, *Rec. Ind. Mus. vol.*, **26**, pp. 427, 457-458, pl. 25, fig.3; Fraser, *Fauna Brit. India Odon.*, **3**: 169-171.

Macromia flavocolorata Fraser, 1922

1922. *Macromia flavocolorata* Fraser, *J. Bombay nat. Hist. Soc.*, **28**: 702; Fraser, 1936, *Fauna Brit. India Odon.*, **3**: 186-189.

Macromia ida Fraser, 1924

1924. *Macromia ida* Fraser, *Rec. Ind. Mus. vol.*, **26**, pp. 427, 449-450, pl.25, fig. 4; Fraser, 1936, *Fauna Brit. India Odon.*, **3**: 189-190.

Macromia indica Fraser, 1924

1924. *Macromia indica* Fraser, *Rec. Indian Mus.*, **26**: 427, 447-449; Needham, 1932, *Rec. Indian Mus.*, **34**: 211-212; Fraser, 1936, *Fauna Brit. India Odon.*, **3**: 166-167.

Macromia irata Fraser, 1924

1924. *Macromia irata* Fraser, *Rec. Indian Mus.*, **26**: 427, 454-455; Fraser, 1936, *Fauna Brit. India Odon.*, **3**: 190-191.

Suborder ZYGOPTERA

Family CALOPTERYGIDAE

Neurobasis chinensis (Linnaeus, 1758)

1758. *Libellula chinensis* Linnaeus, *Syst. Nat.* **1**: 545; Edwards, 1750, *Nat. Hist. Birds*, **3**: 112.

1842. *Calopteryx chinensis* Rambur, *Ins. Nevrop.*, p. 226.

1890. *Neurobasis chinensis* Kirby, *Cat. Odon.*, p. 102; Fraser, 1924, *Rec. Indian Mus.*, **26**: 428, 479.

1934. *Neurobasis chinensis chinensis* Fraser, *Fauna Brit. India Odon.*, **2**: 121-124; Lieftinck, 1954, *Treubia* **22** (suppl.): 23.

Material examined: 2 males, 2 females, 11-v-2005, Kanthanpara (Wayanad Dt.); 2males, 1female, 17-ii-2004, Thusharagiri (Kozhikode Dt.), Coll.K.G.Emiliyamma; 1 female, 27-x-1995, Venkoli (Parambikulam WLS, Palakkad Dt.); 1male, 7-xi-1996, Thanikudy (Periyar Tiger Reserve, Idukki Dt.); 1 male, 1 female, 15-xi-1999, Evergreen (Ernakulam Dt.), Coll. P.M. Sureshan; 1 female, 22-x-2001, Meenmuttithodu (Kannavam R.F., Kannur Dt.), Coll. Md.Jafer Palot; 1 male, 1 female, 24-xii-1994, Kurichiat R.F. (Wayanad Dt); 1 male, 25-xii-1994, Kuruva island (Wayanad Dt.), Coll. C. Radhakrishnan.

Vestalis apicalis Selys, 1873

1873. *Vestalis apicalis* Selys, *Bull. Acad. Belg.* (2) **36**: 612; Kirby, 1890, *Cat. Odon.*, p. 102.

1934. *Vestalis apicalis apicalis* Fraser, *Fauna Brit. India Odon.*, **2**: 128-130.

Material examined: 3 males, 16-iii-2001, Kulasekaram (Thiruvananthapuram Dt.), Coll. K. C. Gopi; 1 male, 1 female, 25-iv-2000, Thiruvambadi (Kozhikode Dt.); 2 males, 24-iv-2002, Puthuppady (Kozhikode Dt.); 1 male, 1 female, 11-iv-2000, Adivaram (Kozhikode Dt.),

Coll. K.G.Emiliyamma; 1 male, 30-x-1995, Kamathalachi (Parambikulam WLS, Palakkad Dt.); 1 female, 28-x-2000, Bharanganam (Kottayam Dt.); 2 males, 1 female, 15-xi-1999, Evergreen (Ernakulam Dt.); 1 female, 8-viii-1997, Parakkadavu (Kollam Dt.); 1 female, 13-viii-1994, Begur R. F. (Wayanad Dt.); 2 males, 7-iv-1995, Karimkappu (KannurDt.); 1 male, 8-viii-1997, Parakkadavu (Kollam Dt.), Coll. P.M. Sureshan; 3 males, 16-iii-2001, Kulasekaram (Thiruvananthapuram Dt.); 1 male, 4 females, 30-v-2002, Kinalur estate (Kozhikode Dt.); 2 males, 23-iii-1994, Bendadukka (Kasaragod Dt.), Coll. K.C.Gopi; 1 male, 15-ix-2001, Kasaragod; 1 male, 23-x-2001, Kannavam R. F. (Kannur Dt.), Coll. Md. Jafer Palot; 1 male, 15-xii-1985, Kurichiyad (Wayanad Dt.), Coll. K.N.Nair.

***Vestalis gracilis* (Rambur, 1842)**

1842. *Calopteryx gracilis* Rambur, *Ins. Nevrop.*, p. 224.
1854. *Vestalis gracilis* Selys & Hagen, *Mem. Soc. Sci. Liege*, 9: 84. *Vestalis gracilis gracilis* Fraser, 1934, *Fauna Brit. India Odon.*, 2: 126-128.

Material examined: 1 male, 1 female, 7-xii-2004, Kinalur estate (Kozhikode Dt.); 3 males, 16-iii-2001, Kulasekaram (Thiruvananthapuram Dt.), Coll. K.C.Gopi; 1 male, 1 female, 25-iv-2000, Thiruvambadi (Kozhikode Dt.), Coll. K.G. Emiliyamma; 1 male, 18-iii-1996, Cheechali (Parambikulam WLS, Palakkad Dt.); 1 male, 25-ii-1996, Chimony WLS (Thrissur Dt.); 1 female, 24-xii-1994, Kurichiat R.F.(Wayanad Dt.); 2 females, 25-xii-1994, Kuruva island (Wayanad Dt.); 2 males, 4 females, 4-ix-1995, Kottiyur R.F.(Kannur Dt.)Coll. C. Radhakrishnan; 1 male, 15-xii-1997, Kovalam (Thiruvananthapuram Dt.); 3males, 2females, 18-i-1992, Painavu (Idukki Dt.), Coll. M. B. Raghunathan; 1 male, 2-viii-1995, Mavoor/Pallikadavu (Kozhikode Dt.); 1 female, 8-ii-1996, Kakkayam (Kozhikode Dt.); 3 males, 2 females, 17-i-1995, Peruvannamuzhi (Kozhikode Dt.); 1 male, 20-iii-1999, Mangalam Dam (Palakkad Dt.); 1 male, 1 female, 29-x-2000, Idamaruku (Kottayam Dt.), 1 male, 12-xi-1996, Mullakudy (Periyar Tiger Reserve, Idukki Dt.); 1 female, 15-xi-1999, Evergreen (Ernakulam

Dt.); 1 female, 16-viii-1997, Amakulam (Kollam Dt.); 4 males, 2 females, 31-i-1995, Paripputhodu (Kannur Dt.), Coll. P. M. Sureshan; 1 male, 23-iii-1994, Bendadukka (Kasaragod Dt.); 2 females, 15-xii-1985, Kurichiyad (Wayanad Dt.), Coll. K.N.Nair.

***Vestalis submontana* (Fraser, 1934)**

1929. *Vestalis gracilis amoena* Fraser, *J. Bombay nat. Hist. Soc.*, 33: 583.
1934. *Vestalis gracilis montana* Fraser, *Fauna Brit. India Odon.*, 2: 128 (1934)
1934. *Vestalis submontana* Fraser, *Fauna Brit. India Odon.*, 2: 128 (1934); Hamalainen, 2011, *Notul. Odonatol.*, vol. 7, No. 8, pp. 69-76.

Material examined: 1 male, 1 female, 26-i-1997, Peruvaripallam (Palakkad Dt.); 1 female, 16-iii-2001, Kulasekaram (Thiruvananthapuram Dt.); 1 female, 24-ix-1993, Santhimala (Kasaragod Dt.), Coll. K. C. Gopi; 1female, 29-x-2000, Idamaruku (Kottayam Dt.), Coll. P.M.Sureshan; 1male, 13-vi-2003, Thusharagiri (Kozhikode Dt.), Coll. Md. Jafer Palot; 1 female, 10-v-2005, Vannathimala (Wayanad Dt.), Coll. K. G. Emiliyamma.

Family CHLOROCYPHIDAE

***Calocypha laidlawi* (Fraser, 1924)**

1924. *Rhinocypha laidlawi* Fraser, *Rec. Indian Mus.*, 26: 482-483.
1928. *Calocypha laidlawi* Fraser, *J.Bombay nat.Hist. Soc.*, 33: 457-458; Fraser, 1934, *Fauna Brit. India Odon.*, 2: 53-55.

***Libellago lineata indica* (Fraser, 1928)**

1919. *Micromerus lineatus* Fraser, *Rec. Indian Mus.* 16: 197-198, (larva); Laidlaw, 1924, *Spolia Zeylanica*, 12: 354, 355.
1928. *Micromerus lineatus indica* Fraser, *J.Bombay nat. Hist. Soc.*, 33: 686-687.
1934. *Libellago lineata indica* Fraser, *Fauna Brit. India Odon.*, 2: 63-65.

Material examined: 1 male, 21-iii-1999, Mangalam dam (Palakkad Dt.), Coll. P. M. Sureshan; 2 males, 1 female, 24-iv-2002, Eengappuzha (Kozhikode Dt.), Coll. K.G.Emiliyamma; 2 females, 30-v-2002, Kinalur estate (Kozhikode Dt.), Coll. K. C. Gopi; 1 female,

26-viii-1982, Naduvattur (Kozhikode Dt.), Coll. K.N. Nair; 1 male, 23-ix-2001, Madayipara (Kannur Dt.); 1 male, 7-xii-2002, Aralam WLS (Kannur Dt.); 1 male, 23-x-2001, Kannavam R.F. (Kannur Dt.), Coll. Md. Jafer Palot.

***Rhinocypha bisignata* Hagen in Selys, 1853**

1855. *Rhinocypha bisignata* Selys, *Syn. Cal.* 62; Kirby, 1890, *Cat. Odon.* p. 113; Laidlaw, 1917, *Rec. Indian Mus.*, **13**: 38; Fraser, 1934, *Fauna Brit. India Odon.*, **2**: 49-52.

Material examined: 1 male, 28-iii-1998, Golden Valley; 1 male, 29-iii-1998, Way to Chankiri (Thiruvananthapuram Dt.), Coll. P. T. Cherian; 2 females, 25-iv-2000, Muthappanpuzha (Kozhikode Dt.), 1 male, 2 females, 30-xii-1998, Chalamattom (Kottayam Dt.); 1 female, 24-iv-2002, Poolode (Kozhikode Dt.); 1 male, 11-v-2005, Kanthanpara (Wayanad Dt.), Coll. K.G.Emiliyamma; 1 male, 1 female, 29-x-1995, Sirkarpathy (Parambikulam WLS, Palakkad Dt.); 1 female, 29-x-2000, Idamaruku (Kottayam Dt.); 1 male, 1 female, 28-x-2000, Bharanganam (Kottayam Dt.); 1 female, 30-x-2000, Kidangoor (Kottayam Dt.); 4 males, 1 female, 6-xi-1996, Karadikkavala; 1 male, 10-xi-1996, Karikkavu (Periyar tiger Reserve, Idukki Dt.); 1 male, 15-xi-1999, Evergreen (Ernakulam Dt.); 1 male, 23-xii-1994, Kurichiyat (Wayanad Dt.); 1 female, 9-viii-1997, Kazhuthuruthi (Kollam Dt.), Coll. P. M. Sureshan; 2 males, 15-iii-2001, Ponmudi (Thiruvananthapuram Dt.); 1 male, 1 female, 30-v-2002, Kinalur estate (Kozhikode Dt.), Coll. K. C. Gopi; 1 male, 1 female, 9-iii-2001, Aralam WLS (Kannur Dt.); 2 males, 3 females, 4-vi-2003, Thusharagiri (Kozhikode), Coll. Md. Jafer Palot.

Family COENAGRIONIDAE

***Aciagrion hisopa* (Selys, 1876)**

1876. *Pseudagrion hisopa* Selys, *Bull. Acad. Belg.* (2) **42**: 509.
1933. *Aciagrion hisopa* Selys, *Ann. Mus. Civ. Genova*, (2) **10** (30): 511-512; Fraser, *Fauna Brit. India Odon.*, **1**: 340-342.
1954. *Aciagrion hisopa hisopa* Lieftinck, *Treubia*, **22** (suppl.): 76.

***Aciagrion occidentale* Laidlaw, 1919**

1919. *Aciagrion hisopa* Selys, race *occidentalis* Laidlaw, *Rec. Indian Mus.*, **26**: 186.
1923. *Aciagrion occidentale* Fraser, *J. Bombay nat. Hist. Soc.*, **29**: 749.
1933. *Aciagrion occidentale*, Fraser, *Fauna Brit. India Odon.*, **1**: 335-337.

Material examined: 1 male, 1 female, 27-iii-1998, Kallar River site (Thiruvananthapuram Dt.); 1 female, 1 male, 25-iii-1998, Kovalam (Thiruvananthapuram Dt.), Coll. P. T. Cherian; 1 female, 9-iii-2001, Kappil Road (Kannur Dt.); 1 male, 2 females, 22-vii-2004, Madayipara (Kannur Dt.) Coll. Md. Jafer Palot; 2 males, 3 females, 23-ii-1997, Muzhiyar (Kozhikode Dt.), Coll. P. M. Sureshan; 2 males, 6-xi-2002, Payangadi (Kannur Dt.), Coll. K. C. Gopi; 1 male, 24-xii-1994, Kurichiat R. F. (Wayanad Dt.), Coll. C. Radhakrishnan; 2 males, 3 females, 28-viii-2003, Thusharagiri (Kozhikode Dt.); 1 female, 10-v-2005, Chembra (Wayanad Dt.), Coll. K.G. Emiliyamma.

***Agriocnemis keralensis* Peters, 1981**

1981. *Agriocnemis keralensis* Peters, *Dtsch. Ent. Z., N. F.* **28**, Heft I- III, Seite, 93-108.

Material examined: 2 males, 3 females. 30. X.2000, Kidangur (Kottayam Dt.), Coll. P. M. Sureshan.

***Agriocnemis pieris* Laidlaw, 1919**

1919. *Agriocnemis pieris* Laidlaw, *Rec. Indian Mus.*, **16**: 179-180; Fraser, 1923, *J. Bombay nat. Hist. Soc.*, **29**: 747; Fraser, 1933, *Fauna Brit. India Odon.*, **1**: 384-385.

Material examined: 1 male, 22-ii-2001, Chathancode (Kozhikode Dt.), 3 males, 9-v-2005, Kalpetta (Wayanad Dt.), Coll. K. G. Emiliyamma; 2 males, 30-v-2002, Kinalur estate (Kozhikode Dt.); 1 male, 1 female, 19-iii-1994, Kavadikanam (Kasaragod Dt.); Coll. K. C. Gopi; 2 males, 27-x-2000, Ponkunnam (Kottayam Dt.); 2 females, 24-ii-2000, Nedumudi (Alappuzha Dt.), Coll. K. C. Gopi; 2 males, 18-xi-1999, Thundathil/Cherukadu (Ernakulam Dt.), Coll. P. M. Sureshan.

***Agriocnemis pygmaea* (Rambur, 1842)**

1842. *Agrion pygmaeum* Rambur, *Ins. Nevrop.* p. 278.
1877. *Agriocnemis pygmaea* Selys, *Syn. Agr. 5me Legion: Agrion (suite fin)*, p. 52; Fraser, 1933, *Fauna Brit. India Odon.*, 1: 398-401; Lieftinck, 1954, *Treubia*, 22 (suppl.) 73.

Material examined: 1 male, 18-iii-1996, Karimala (Ernakulam Dt.) 7 males, 5 females, 30-x-2000, Kidangoor (Kottayam Dt.); 5 males, 3 females, 29-x-2000, Kumarakom (Kottayam Dt.); 1 female, 17-I-1992, Kuyilimala (Idukki); 1 male, 1 female, 20-ii-2002, Cheruvannur (Kozhikode Dt.); 2 males, 3 females, 19-iii-1999, Nenmara (Palakkad Dt.), Coll. P. M. Sureshan; 4 females, 5 males, 25-iii-1998, Kovalam (Thiruvananthapuram Dt.); 1 female, 27-iii-1998, Kallar river site (Thiruvananthapuram Dt.), Coll: P. T. Cherian; 1 female, 16-xii-1997, Vely (Thiruvananthapuram Dt.), Coll: M. B. Raghunathan; 1male, 3females, 14-iii-2001, Attingal (Thiruvananthapuram Dt.); 3 males, 2 females, 17-iii-2001, Parassala (Thiruvananthapuram Dt.); 1 female, 17-iii-2001, Neyyattinkara, (Thiruvananthapuram Dt.); 3 males, 1 female, 16-iii-2001, Kulasekaram (Thiruvananthapuram Dt.); 1 female, 30-v-2002, Kinalur estate (Kozhikode Dt.); 1 male, 19-iii-1994, Kavadikanam (Kasaragod Dt.), Coll: K.C.Gopi; 1 female, 22-ii-2000, Chathancode (Kozhikode Dt.); 2 males, 2 females, 24-x-2002, Vadikkadavu (Malappuram Dt.); 3 males, 3 females, 27-x-2004, Kadalundi (Kozhikode Dt.), Coll. K.G.Emiliyamma; 1 female, 2-x-2001, Kuniyan (Kasaragod Dt.), Coll. Md. Jafer Palot; 1 male, 24-xii-1994, Kurichiat R. F. (Wayanad Dt); 4 males, 3 females, 25-xii-1994, Kuruva island (Wayanad Dt.), Coll. C. Radhakrishnan.

***Agriocnemis splendidissima* Laidlaw, 1919**

1919. *Agriocnemis splendidissima* Laidlaw, *Rec. Indian Mus.*, 16: 180-182; Fraser, 1923, *J. Bombay nat. Hist. Soc.*, 29: 47; Fraser, 1933, *Fauna Brit. India Odon.*, 1: 392-394.

Material examined: 1 male, 24-iv-2002, Puthuppady (Kozhikode Dt.), Coll. K. G. Emiliyamma; 2 males, 1 female, 24-xii-

1994, Kurichiat R. F. (Wayanad Dt.), Coll. P. M. Sureshan; 1 male, 1 female, 26-xii-1994, Noolpuzha (Wayanad Dt.), Coll. C. Radhakrishnan.

***Archibasis oscillans* (Selys, 1877)**

1924. *Pseudagrion praeclarum* Fraser, *Rec. Indian Mus.*, 36: 428.
1936. *Archibasis mimetes praeclara* Fraser, *Fauna Brit. India Odon.*, 3: 310-312.
1991. *A. oscillans* Selys, *A distributional list of World Odonata*, 1991, p. 32

***Ceriagrion cerinorubellum* (Brauer, 1865)**

1865. *Pyrrhosoma cerinorubellum* Brauer, *Verh. zool. -bot. Ges. Wien*, 15: 511. *Ceriagrion cerinorubellum* Selys, 1876, *Bull. Acad. Belg.*, (2) 42: 526; Fraser, 1933, *Fauna Brit. India Odon.*, 1: 326-328.

Material examined: 3 females, 3-iv-1998, Paighat (Thiruvananthapuram Dt.), Coll: P. T. Cherian; 2 males, 1 female, 18-iii-2001, Vithura-Chathankodu (Thiruvananthapuram Dt.); 1 male, 2 females, 7-xi-2002, Theckumbadu island (Kannur Dt.), Coll. K. C. Gopi; 3 male, 2 females, 22-ii-2001, Chathancode, (Kozhikode Dt.); 2 males, 1 female, 24-x-2002, Vadikkadavu (Malappuram Dt.); 2 males, 1 female, 27-x-2004, Kadalundi (Kozhikode Dt.); 4 males, 1female, 9-v-2001, Madayipara (Kannur Dt.), Coll. Md. Jafer Palot; 1male, 3females, 29-x-2000, Kumarakom (Kottayam Dt.); 6 males, 2 females, 31-x-2000, Velloor (Kottayam Dt.); 4 males, 5-ix-2001, Kolavipalam (Kozhikode Dt.), Coll. P. M. Sureshan; 1 male, 22-ii-2000, Thanneermukkom (Alappuzha Dt.), Coll. C. Radhakrishnan.

***Ceriagrion coromandelianum* (Fabricius, 1798)**

1798. *Agrion coromandelianum* Fabricius, *Ent. Syst. Suppl.*, p. 287.
1876. *Ceriagrion coromandelianum* Selys, *Bull. Acad. Belg.*, (2) 42: 528; Fraser, 1933, *Fauna Brit. India odon.*, 1: 315-316.

Material examined: 1male, 14-iii-2001, Thenmalaiurukunnu (Thiruvananthapuram Dt.), Coll. P. T. Cherian; 1 male, 1 female, 14-iii-2001, Attingal (Thiruvananthapuram Dt.); 2 males, 18-iii-2001, Vithura-Chathankodu (Thiruvananthapuram

Dt.); 4 males, 1 female, 17-iii-2001, Parassala (Thiruvananthapuram Dt.); 2 males, 1 female, 17-iii-2001, Neyyattinkara (Thiruvananthapuram Dt.); 1 male, 23-iii-1994, Bendadukka (Kasaragod Dt.), Coll. K. C. Gopi; 4 males, 2 females, 25-x-2000, Kanjirampara (Kottayam Dt.); 1male, 20-ii-2002, Cheruvannur (Kozhikode Dt.); 2 males, 18-iii-1999, Walayar (Palakkad Dt.); 1 female, 21-iii-1999, Parli (Palakkad Dt.), Coll. P. M. Sureshan; 1 male, 1-ix-2001, Madayipara (Kannur Dt.), Coll. Md. Jafer Palot; 1 male, 24-x-2002, Vadikkadavu (Malappuram Dt.); 1 male, 1 female, 23-ix-2004, Thusharagiri (Kozhikode Dt.); 5males, 1female, 27-x-2004, Kadalundi (Kozhikode Dt.), Coll. K. G. Emiliyamma; 1 male, 24-xii-1994, Kurichiat R. F. (Wayanad Dt.), Coll. C. Radhakrishnan.

***Ceriagrion olivaceum* Laidlaw, 1914**

1914. *Ceriagrion olivaceum* Laidlaw, *Rec. Indian Mus.* **8**: 345-346; Fraser, 1933, *Fauna Brit. India Odon.*, **1**: 324-325.

Material examined: 1 male, 23-ix-2004, Thusharagiri (Kozhikode Dt.), Coll. K. G. Emiliyamma; 1male, 21-xi-2007, Kundur (Bhadra WLS, Karnataka), Md. Jafer Palot.

***Ceriagrion rubiae* Laidlaw, 1916**

1916. *Ceriagrion rubiae* Laidlaw, *Rec. Indian. Mus.*, **12**: 132-133; Fraser, 1933, *Fauna Brit. India Odon.*, **1**: 318-319.

Material examined: 3 males, 3 females, 7-iii-2006, Kasaragod, Coll. K. G. Emiliyamma; 2 males, 21-vii-2004, Madayipara (Kannur Dt.), Coll. Md. Jafer Palot.

***Ischnura aurora* (Brauer, 1865)**

1858. *Agrion delicatum* Hagen, *Verh. zool. -bot. Ges. Wien*, **8**: 479.
1865. *Agrion aurora* Brauer, *Verh. Zool. -bot. Ges. Wien*, **15**: 510.
1876. *Ischnura delicata* Selys, *Bull. Acad. Belg.*, (2) **41**: 281; Fraser, 1933, *Fauna Brit. India Odon.*, **1**: 360-362.
1915. *Ischnura aurora* Ris, *Nova Caledonia, Zool.*, **2**: 67.
1991. *Ischnura aurora aurora* Tsuda, *A distributional list of World Odonata*, p. 34.

Material examined: 1male, 18-iii-2001 Vithura-Chathankodu (Thiruvananthapuram Dt.); 1male, 24-ii-2000, Nedumudi (Alappuzha Dt.), Coll. K. C. Gopi; 1 male, 2 females, 1-ii-2002, Kadalundi (Kozhikode Dt.); 1 male, 11-v-2005, Kanthanpara (Wayanad Dt.), Coll. K. G. Emiliyamma; 1 male, 1 female, 27-ii-2002, Melur (Kannur Dt.); 3 males, 1 female, 22-iii-1999, Kanjirampuzha (Palakkad Dt.), Coll. P. M. Sureshan; 1 female, 11-v-2002, Vallamkulam (Pathanamthitta Dt.), Coll. Ashok Kumar; 1 male, 25-xii-1994, Kuruva island (Wayanad Dt.), Coll. C. Radhakrishnan; 1 male, 21-vii-2004, Madayipara (Kannur Dt.), Coll. Md. Jafer Palot.

***Ischnura senegalensis* (Rambur, 1842)**

1842. *Agrion senegalensis* Rambur, *Ins. Nevrop.* p. 276.
1876. *Ischnura senegalensis* Selys, *Bull. Acad. Belg.*, (2) **41**: 273; Fraser, 1933, *Fauna Brit. India odon.*, **1**: 348-351; Lieftinck, 1954, *Treubia* (suppl.): 74.

Material examined: 1 male, 27-x-2004, Kadalundi (Kozhikode Dt.), Coll. K. G. Emiliyamma; 3 males, 25-iii-1998, Kovalam (Thiruvananthapuram Dt.), Coll. P. T. Cherian.

***Mortonagrion varralli* Fraser, 1920**

1920. *Mortonagrion varralli* Fraser, *J. Bombay nat. Hist. Soc.*, **27**: 148; Fraser, 1931, *Rec. Indian Mus.*, **33**: 464; Fraser, 1933, *Fauna Brit. India Odon.*, **1**: 409-411.

Material examined: 2 males, 2 females, 7-xi-2002, Theckumbadu island (Kannur Dt.), Coll. K. C. Gopi; 1 male, 1 female, 18-i-2004, Mathappuzha (Malappuram Dt.); 1 male, 4-ii-2004, Kadalundi (Kozhikode Dt.), Coll. K.G.Emiliyamma; 2 males, 22-vii-2004, Madayipara (Kannur Dt.), Coll. Md. Jafer Palot.

***Onychargia atrocyana* (Selys, 1865)**

1865. *Onychargia atrocyana* Selys, *Bull. Acad. Belg.*, (2) **20**: 416; Fraser, 1933, *Fauna Brit. India Odon.*, **1**: 417-418; Lieftinck, 1954, *Treubia*, **22** (suppl.): 53.

Material examined: 2 males, 3 females, 9-v-2005, Pookode Lake (Wayanad Dt.), Coll. K. G. Emiliyamma.

***Paracercion calamorum* (Ris, 1916)**

1919. *Argiocnemis dyeri* Fraser, *Rec. Indian Mus.*, **16**: 451-452.
1923. *Coenagrion dyeri* Fraser, *J. Bombay nat. Hist. Soc.*, **29**: 748; Fraser, 1933, *Fauna Brit. India odon.*, **1**: 413-415.
1984. *Cercion calamorum dyeri* Lieftinck *et al.*, *Cat. Taiwanese Dragonflies* p. 23.

***Pseudagrion decorum* (Rambur, 1842)**

1842. *Agrion decorum* Rambur, *Ins. Nevrop.* p. 258.
1876. *Pseudagrion decorum* Selys, *Bull. Acad. Belg.*, (2) **42**: 504; Kirby, 1890,
1933. *Cat. Odon.* p.153; Fraser, *Fauna Brit. India Odon.*, **1**: 286-289.

***Pseudagrion indicum* Fraser, 1924**

1924. *Pseudagrion indicum* Fraser, *Rec. Indian Mus.*, **26**: 495-497; Fraser, 1933, *Fauna Brit. India Odon.*, **1**: 303-304.

Material examined: 1 female, 23-x-2001, Kannavam R. F. (Kannur Dt.), Coll. Md. Jafer Palot; 1 male, 17-ii-2004, Thusharagiri (Kozhikode Dt.), Coll. K. G. Emiliyamma; 3 males, 31-iii-2004, Kinalur estate (Kozhikode Dt.) Coll. K. C. Gopi; 1 male, 8-iii-2002, Kinalur estate (Kozhikode Dt.), Coll. C. Radhakrishnan.

***Pseudagrion malabaricum* Fraser, 1924**

1924. *Pseudagrion malabaricum* Fraser, *Rec. Indian Mus.*, **26**: 494-495; Fraser, 1933, *Fauna Brit. India Odon.*, **1**: 284-286.

Material examined: 5 males, 18-iii-2001, Vithura - Chathankodu (Thiruvananthapuram Dt.) Coll. K. C. Gopi.

***Pseudagrion microcephalum* (Rambur, 1842)**

1842. *Agrion microcephalum* Rambur, *Ins. Nevrop* p. 259.
1876. *Pseudagrion microcephalum* Selys, *Bull. Acad. Belg.*, (2) **42**: 504.
1890. Kirby, *Cat. Odon.*, p.153; Fraser, 1933, *Fauna Brit. India Odon.*, **1**: 278-280.

Material examined: 4 males, 2 females, 8-iii-2002, Kinaloor estate (Kozhikode Dt.); 1 male, 26-vi-2002, Thavanakkadavu (Kozhikode Dt.), Coll. C. Radhakrishnan; 2 males, 24-iv-2002,

Puthuppady (Kozhikode Dt.), 1 male, 1 female, 27-x-2004, Kadalundi (Kozhikode Dt.), Coll. K. G. Emiliyamma; 1 female, 19-xi-1996, Chinnar WLS, (Idukki Dt.) Coll. P. M. Sureshan; 1 male, 2-x-2001, Kuniyan (Kasaragod Dt.), Coll. Md. Jafer Palot; 2 males, 20-ix-2001, Malampuzha (Palakkad Dt.), Coll. Dinesan Cheruvat; 1 male, 6-xi-2002, Payangadi (Kannur Dt.), Coll. K. C. Gopi.

***Pseudagrion rubriceps* Selys, 1876**

1876. *Pseudagrion rubriceps* Selys, *Bull. Acad. Belg.*, (2) **42**: 510; Fraser, 1933, *Fauna Brit. India Odon.*, **1**: 296-299.
1954. *Pseudagrion rubriceps rubriceps* Lieftinck, *Treubia* 22 (suppl.): 60; Mitra, 1983, *Ent. mon. Mag.*, **119**: 29.

Material examined: 1 male, 2 females, 15-iii-2001, Kallar (Thiruvananthapuram Dt.), Coll. K. C. Gopi; 1 male, 19-xi-1996, Chinnar WLS, (Idukki Dt.) Coll. P. M. Sureshan; 3 males, 12-ix-2001, Malampuzha (Palakkad Dt.), Coll. Dinesan Cheruvat.

Family EUPHAEIDAE***Dysphaea ethela* Fraser, 1924**

1924. *Dysphaea ethela* Fraser, *Rec. Indian Mus.*, **26**: 480-482; Fraser, 1934, *Fauna Brit. India Odon.*, **2**: 92-94.

***Euphaea cardinalis* (Fraser, 1924)**

1924. *Pseudophaea cardinalis* Fraser, *Rec. Indian Mus.*, **26**: 512-513.
1929. *Indophaea cardinalis* Fraser, *J. Bombay nat. Hist. Soc.*, **33**: 295-296; Fraser, 1934, *Fauna Brit. India Odon.*, **2**: 108-110.

Material examined: 1 male, 12-xi-1996, Mullakudy (Periyar Tiger Reserve, Idukki Dt.); 1 male, 15-xi-1999, Evergreen (Ernakulam Dt.), Coll. P. M. Sureshan; 1 male, 26-x-2001, Aralam WLS (Kannur Dt.), Coll. Md. Jafer Palot.

***Euphaea dispar* (Rambur, 1842)**

1842. *Euphaea dispar* Rambur, *Ins. Nevrop.* p. 230;
1890. *Pseudophaea dispar* Kirby, *Cat. Odon.* p. 109; Laidlaw 1917, *Rec. Indian Mus.*, **13**: 32.
1929. *Indophaea dispar* Fraser, *J. Bombay nat. Hist. Soc.*, **33**: 294-295; Fraser, 1934, *Fauna Brit. India Odon.*, **2**: 105-108.

Material examined: 1 male, 2 females, 9-vii-2004, Thusharagiri (Kozhikode Dt.); 1 male, 28-viii-2003, Thusharagiri (Kozhikode Dt.); 1 male, 12-v-2005, Banasura foothills (Wayanad Dt.); 1 male, 10-v-2005, Vannathimala (Wayanad Dt.), Coll. K. G. Emiliyamma; 1 male, 1 female, 8-iii-2002, Aralam WLS (Kannur Dt.); 4 males, 4-vi-2003, Thusharagiri (Kozhikode Dt.), Coll. Md. Jafer Palot.

***Euphaea fraseri* (Laidlaw, 1920)**

1920. *Pseudophaea fraseri* Laidlaw, *Rec. Indian Mus.*, **21**: 23-27.
1929. *Indophaea fraseri* Fraser, *J. Bombay nat. Hist. Soc.*, **33**: 296-298; Fraser, 1934, *Fauna Brit. India Odon.*, **2**: 110-112.

Material examined: 3 males, 30-v-2002, Kinalur estate (Kozhikode Dt.), Coll. K.C. Gopi; 1 male, 11-iv-2000, Adivaram (Kozhikode Dt.), Coll. K. G. Emiliyamma; 1 male, 1 female, 26-x-2001, Aralam WLS (Kannur Dt.); 1 male, 23-x-2001, Kannavam R.F., (Kannur Dt.); 1 male, 13-vi-2003, Thusharagiri (Kozhikode Dt.); 1 male, 5-iv-1995, Uppukunnu (Kannur Dt.); 1 male, 21-ix-2003, Periya R. F. (Wayanad Dt.), Coll. Md. Jafer Palot; 1 male, 12-viii-1994, Thirunelli (Wayanad Dt.); 1 male, 23-xii-1994, Kurichiyat (Wayanad Dt.); 2 males, 13-viii-1994, Irumpupalam, Begur R.F. (Wayanad Dt.), Coll. P.M. Sureshan.

Family LESTIDAE

***Indolestes gracilis birmanus* (Selys, 1891)**

1916. *Lestes gracilis birmanus* Ris, nec Selys, *Suppl. Ent.*, **5**: 13-14. *Ceylonolestes davenporti* Fraser, 1930, *J. Bombay nat. Hist. Soc.*, **34**: 96-97; Fraser, 1933, *Fauna Brit. India Odon.*, **1**: 69-71.

***Indolestes pulcherrimus* Fraser, 1924**

1924. *Ceylanicolestes pulcherrima* Fraser, *Rec. Ind. Mus.* Vol. **26**, pp. 487-489, pl. 26, fig. 6; Fraser, 1933, *Fauna Brit. India Odon.*, **1**: 72-74.

***Lestes dorothea* Fraser, 1924**

1933. *Lestes dorothea* Fraser, *Rec. Ind. Mus.* vol, **26**, pp. 484-486; Fraser, *Fauna Brit. India Odon.*, **1**: 35-36

***Lestes elatus* Hagen in Selys, 1862**

1858. *Lestes elata* Hagen, *verh. zool. – bot. Ges. Wien*, **8**: 478; Fraser, 1933, *Fauna Brit. India Odon.*, **1**: 37-40.
1890. *Lestes elatus* Kirby, *Cat. Odon.*, p. 162.

Material examined: 1 female, 25-iii-1998, Kovalam (Thiruvananthapuram Dt.), Coll. P. T. Cherian; 1 female, 22-ii-2001, Chathancode (Kozhikode Dt.); 1 male, 1 female, Mathappuzha (Malappuram Dt.), 11-iii-2006, Coll. K. G. Emiliyamma; 1 female, 4-ix-1995, Kottiyur R.F. (Kannur Dt.); 1 male, 26-xii-1994, Noolpuzha (Wayanad Dt.); 1 male, 25-xii-1994, Kuruva island (Wayanad Dt.), Coll. C. Radhakrishnan; 1 female, 20-vii-2004, Madayipara (Kannur Dt.), Coll. Md. Jafer Palot.

***Lestes malabarica* Fraser, 1929**

1929. *Lestes malabarica* Fraser, *J. Bombay nat. Hist. Soc.*, **33**: 847-848; Fraser, 1933, *Fauna Brit. India Odon.*, **1**: 40-43.

Material examined: 1 male, 21-vii-2004, Madayipara (Kannur Dt.), Coll. Md. Jafer Palot.

***Lestes patricia* Fraser, 1924**

1924. *Lestes patricia* Fraser, *Rec. Ind. Mus.* vol, **26**, pp. 486; Fraser, 1933, *Fauna Brit. India Odon.*, **1**: 47-48

***Lestes praemorsus* Hagen in Selys, 1862**

1862. *Lestes praemorsa* Selys, *Bull. Acad. Belg.* (2) **13**: 320
1890. *Lestes praemorsus* Kirby, *Cat. Odon.*, p. 162.
1933. *Lestes praemorsa praemorsa* Selys, *Fauna Brit. India Odon.*, **1**: 30-33.

Material examined: 1 male, 21-vii-2004, Madayipara (Kannur Dt.), Coll. Md. Jafer Palot.

***Lestes viridulus* Rambur, 1842**

1842. *Lestes viridulus* Rambur, *Hist. Nat. Ins. Nevrop.* pp. 252-253; Fraser, *Fauna Brit. India Odon.*, **1**: 45-46.

Family PLATYCNEMIDIDAE

***Copera marginipes* (Rambur, 1842)**

1842. *Platycnemis marginipes* Rambur, *Ins. Nevrop.* p. 240.

1890. *Copera marginipes* Kirby, *Cat. Odon.* p. 129; Fraser, 1933, *Fauna Brit. India Odon.*, **1**: 192-197; Lieftinck, *Treubia* **22** (suppl.): 51-52.

Material examined: 6 males, 4 females, 16-iii-2001, Kulasekaram (Thiruvananthapuram Dt.); 2 males, 2 females, 30-v-2002, Kinalur estate (Kozhikode Dt.); 1 male, 23-ii-2000, Parumala/Mannar (Alappuzha Dt.), Coll. K. C. Gopi; Coll. K.C.Gopi; 1 female, 2-iv-1998, Anchuthengu (Thiruvananthapuram Dt.); 1 male, 9-iv-1998, Thenmalai urukunnu (Thiruvananthapuram Dt.), Coll. P. T. Cherian; 2 females, 25-iv-2000, Thiruvambadi (Kozhikode Dt.); 1 male, 1 female, 22-ii-2001, Chathancode (Kozhikode Dt.); 1 male, 24-iv-2002, Puthuppady (Kozhikode Dt.); 3 males, 30-xii-1998, Chalamattom (Kottayam Dt.); 1 male, 11-v-2005, Kanthanpara (Wayanad Dt.), Coll. K. G. Emiliyamma; 1 male, 6-ix-2001, Madayipara (Kannur Dt.); 1 male, 1 female, 22-x-2001, Meenmuttithodu (Kannavam R.F., Kannur Dt.), Coll. Md. Jafer Palot; 1 female, 1-v-1999, Mayanad (Kozhikode Dt.), Coll. Ashok Kumar; 2 males, 1 female, 19-xi-1996, Chinnar WLS, (Idukki Dt.) Coll. P.M.Sureshan; 2 males, 2 females, 20-ix-2001, Malampuzha (Palakkad Dt.), Coll. Dinesan Cheruvat.

***Copera vittata deccanensis* Laidlaw, 1917**

1863. *Psilocnemis vittata* Selys, *Bull. Acad. Belg.*, (2) **16**: 170.
1890. *Copera vittata* Kirby, *Cat. Odon.* p. 129; Fraser, 1933, *Fauna Brit. India Odon.*, **1**: 198-201.
1923. *Copera vittata deccanensis* Laidlaw, *Rec. Indian Mus.*, **13**: 337-339; Fraser, 1923, *J. Bombay nat. Hist. Soc.*, **29**: 744.

Material examined: 1 male, 2 females, 18-iii-1996, Karimala (Ernakulam Dt.), Coll. C. Radhakrishnan; 1 male, 3 females, 31-iii-2004, Kinalur estate (Kozhikode Dt.) Coll. K. C. Gopi; 1 male, 9-vii-2004, Thusharagiri (Kozhikode Dt.), Coll. K. G. Emiliyamma; 1 male, 10-iii-2001, Valiyakarikkandam (Kannur Dt.), Coll. Md. Jafer Palot; 1 male, 12-I-1992, Kudayuritty (Idukki Dt.), Coll. M.B. Raghunathan.

Family PLATYSTICTIDAE

***Platysticta deccanensis* Laidlaw, 1915**

1915. *Platysticta deccanensis* Laidlaw, *Rec. Indian Mus.*, **11**: 388; Fraser, 1933, *Fauna Brit. India Odon.*, **1**: 124-126.
1860. *Platysticta maculata* Selys, *Bull. Acad. Belg.*, (2) **10**: 437; Fraser, 1933, *Fauna Brit. India Odon.*, **1**: 121-123.

Material examined: 1 male, 14-viii-2008, Kolamala (Kozhikode Dt.), Coll. K. G. Emiliyamma.

***Protosticta antelopoides* Fraser, 1931**

1931. *Protosticta antelopoides* Fraser, *Rec. Indian Mus.*, **33**: 467-468; Fraser, 1933, *Fauna Brit. India Odon.*, **1**: 107-109.

Material examined: 1 female, 4-vi-2003, Thusharagiri (Kozhikode Dt.), Coll. Md. Jafer Palot; 1 male, 9-vii-2004, Thusharagiri (Kozhikode Dt.); 1 female, 10-v-2005, Vannathimala (Wayanad Dt.), Coll. K. G. Emiliyamma.

***Protosticta davenporti* Fraser, 1931**

1931. *Protosticta davenporti* Fraser, *J. Bombay nat. Hist. Soc.*, **35**: 70-71; Fraser, 1933, *Fauna Brit. India Odon.*, **1**: 105-107.

***Protosticta gravelyi* Laidlaw, 1915**

1915. *Protosticta gravelyi* Laidlaw, *Rec. Indian Mus.*, **11**: 389-390; Fraser, 1933, *Fauna Brit. India Odon.*, **1**: 103-105.

Material examined: 1 male, 2 females, 9-vii-2004, Thusharagiri (Kozhikode Dt.), Coll. K. G. Emiliyamma; 1 male, 30-v-2002, Kinalur estate (Kozhikode Dt.), Coll. K.C. Gopi; 1 female, 4-vi-2003, Thusharagiri (Kozhikode Dt.), Coll. Md. Jafer Palot; 1 male, 31-i-1995, Paripputhodu (Kannur Dt.), Coll. P. M. Sureshan.

***Protosticta hearseyi* Fraser, 1922**

1922. *Protosticta hearseyi* Fraser, *Rec. Indian Mus.*, **24**: 5-6; Fraser, 1933, *Fauna Brit. India Odon.*, **1**: 113-115.

Material examined: 1 male, 1 female, 23-iii-1979, New Amarambalam RF (Silent Valley NP), Coll. K. R. Rao.

***Protosticta mortoni* Fraser, 1924**

1924. *Protosticta mortoni* Fraser, *Rec. Indian Mus.*, **26**: 500-501; Fraser, 1933, *Fauna Brit. India Odon.*, **1**: 111-113.

Material examined: 4 males, 12-v-2005, Banasura foot hills (Wayanad Dt.), Coll. K. G. Emiliyamma.

***Protosticta rufostigma* Kimmins, 1958**

1958. *Protosticta rufostigma* Kimmins, *Bull. British Mus. Nat. Hist. (Ent.)*, vol. 7, No. 7, pp. 349-350.

***Protosticta sanguinostigma* Fraser, 1922**

1922. *Protosticta sanguinostigma* Fraser, *Rec. Indian Mus.*, **24**: 6-7; Fraser, 1933, *Fauna Brit. India Odon.*, **1**: 109-111.

Material examined: 1 male, 11-v-2005, Chembra (Wayanad Dt.); 1 male, 28-viii-2003, Thusharagiri (Kozhikode Dt.), Coll. K. G. Emiliyamma; 2 males, 3 females, 4-vi-2003 & 13-vi-2003, Thusharagiri (Kozhikode Dt.), Coll. Md. Jafer Palot.

Family PROTONEURIDAE

***Caconeura gomphoides* (Rambur, 1842)**

1842. *Argia gomphoides* Rambur, *Ins. Nevrop*, p. 256.
1917. *Indoneura gomphoides* Laidlaw, *Rec. Ind. Mus. Vol.*, **13**, pp. 347-348, pl.15, fig. 7; Fraser, 1933, *Fauna Brit. India Odon.*, **1**: 252-254.

***Caconeura ramburi* (Fraser, 1922)**

1917. *Indoneura gomphoides* Laidlaw, (*ramburi*, nec. *Gomphoides*) *Rec. Indian Mus.*, **13**: 347-348; Fraser, 1933, *Fauna Brit. India Odon.*, **1**: 254-256.
1922. *Indoneura ramburi* Fraser, *Rec. Indian Mus.*, **24**: 2-3.

Material examined: 4 males, 2 females, 28-viii-2003 & 9-vii-2004, Thusharagiri (Kozhikode Dt.), Coll. K. G. Emiliyamma; 3 males, 1 female, 4-vi-2003 & 13-vi-2003, Thusharagiri (Kozhikode Dt.), Coll. Md. Jafer Palot; 1 male, 1 female, 12-viii-1997, Kattilapara (Kollam Dt.), Coll. P. M. Sureshan.

***Caconeura risi* (Fraser, 1931)**

1931. *Indoneura risi* Fraser, *Rec. Indian Mus.*, **33**: 469-471; Fraser, 1933, *Fauna Brit. India Odon.*, **1**: 258-259.

Material examined: 3 males, 29-x-2000, Idamaruku (Kottayam Dt.), Coll. P. M.

Sureshan; 1 male, 27-x-2001, Aralam WLS (Kannur Dt.), Coll. Md. Jafer Palot. 5 males, 16-iii-2001, Kulasekaram (Thiruvananthapuram Dt.); 1 male, 18-iii-2001, Vithura-chathankodu (Thiruvananthapuram Dt.); 2 females, 30-v-2002, Kinalur estate (Kozhikode Dt.), Coll. K. C. Gopi; 1 male, 11-iv-2000, Adivaram (Kozhikode Dt.), Coll. K. G. Emiliyamma.

***Caconeura t-coerulea* (Fraser, 1933)**

1922. *Indoneura ramburi* Fraser, *Rec. Indian Mus.*, **24**: p.3; Fraser, 1933, *Fauna Brit. India Odon.*, **1**: 256.

***Disparoneura apicalis* (Fraser, 1924)**

1924. *Chloroneura apicalis* Fraser, *Rec. Indian Mus.*, **26**: pp. 429, 501-503, fig. 4; Fraser, 1933, *Fauna Brit. India Odon.*, **1**: 248-250

***Disparoneura quadrimaculata* (Rambur, 1842)**

1842. *Argia quadrimaculata* Rambur, *Ins. Nevrop*, p. 255.
1917. *Chloroneura quadrimaculata* Laidlaw, *Rec. Ind. Mus.*, vol. **13**, pp.323, 344; Fraser, 1933, *Fauna Brit. India Odon.*, **1**: 246-248

***Elatoneura souteri* (Fraser, 1924)**

1924. *Disparoneura souteri* Fraser, *Rec. Indian Mus.*, **26**: 521, 523; Fraser, 1933, *Fauna Brit. India Odon.*, **1**: 232-234.

***Elatoneura tetrica* (Laidlaw, 1917)**

1917. *Disparoneura tetrica* Laidlaw, *Rec. Indian Mus.*, **13**: 345-346; Fraser, 1923, *J. Bombay nat. Hist. Soc.*, **29**: 743; Fraser, 1933, *Fauna Brit. India Odon.*, **1**: 235-236.

***Esme cyaneovittata* Fraser, 1922**

1922. *Esme cyaneovittata* Fraser, *Mem. Dept. Agric. India (Ent.)*, **7**: 45-46 ; Fraser, 1933, *Fauna Brit. India Odon.*, **1**: 263-264.

***Esme longistyla* Fraser, 1931**

1931. *Esme longistyla* Fraser, *Rec. Ind. Mus.*, **33**: 449, 471-472, fig. 6; Fraser, 1933, *Fauna Brit. India Odon.*, **1**: 266-268.

***Esme mudiensis* Fraser, 1931**

1931. *Esme mudiensis* Fraser, *Rec. Ind. Mus.*, **33**: 472-473; Fraser, 1933, *Fauna Brit. India Odon.*, **1**: 264-266.

Material examined: 1 male, 13-vi-2003, Thusharagiri (Kozhikode Dt.), Coll. K.G. Emiliyamma.

***Melanoneura bilineata* Fraser, 1922**

1922. *Melanoneura bilineata* Fraser, *Mem. Dept. Agric. India (Ent.)*, 7: 55; Fraser, 1933, *Fauna Brit. India Odon.*, 1: 260-262.

Material examined: 1 female, 13-vi-2003, Thusharagiri (Kozhikode Dt.), Coll. K. G. Emiliyamma.

***Phylloneura westermanni* (Selys, 1860)**

1860. *Alloneura westermanni* Selys, *Bull. Acad. Belg.*, (2): 10: 447.
1922. *Phylloneura westermanni* Fraser, *Rec. Indian Mus.*, 24: 3-4; Fraser, 1933, *Fauna Brit. India Odon.*, 1: 269-271.

Material Examined: 1 male, 2 females, 28-viii-2003, Thusharagiri (Kozhikode Dt.); 2 males, 23-ix-2004, Thusharagiri; 1 male, 10-v-2005, Vannathimala (Wayanad Dt.), Coll. K. G. Emiliyamma; 2 males, 1 female, 27-v-2003, Thusharagiri (Kozhikode Dt.), Coll. C. Radhakrishnan; 1 male, 2 females, 4-vi-2003 & 13-vi-2003, Thusharagiri (Kozhikode Dt.), Coll. Md. Jafer Palot.

***Prodasineura verticalis annandalei*
(Fraser, 1921)**

1917. *Disparoneura tetrica* Laidlaw, *Rec. Indian Mus.*, 13: 345-346; Fraser, 1923, *J. Bombay nat. Hist. Soc.*, 29: 743; Fraser, 1933, *Fauna Brit. India Odon.*, 1: 214-216.

Material examined: 1 male, 24-iv-2002, Puthuppady (Kozhikode Dt.); 3 males, 1 female, 11-iv-2000, Adivaram (Kozhikode Dt.), Coll. K. G. Emiliyamma; 4 males, 30-v-2002, Kinalur estate (Kozhikode Dt.); 1 male, 30-iii-1997, Pulickal (Parambikulam WLS, Palakkad Dt.); 1 male, 31-iii-2004, Kinalur estate (Kozhikode Dt.) Coll. K. C. Gopi.

DISCUSSION AND OBSERVATION

The Odonata of southern Western Ghats comprise of 169 species representing two suborders, 14 families and 82 genera. The Anisopteran fauna comprises of 54 genera and 105 species, with 40 species endemic to Western Ghats and Zygopteran fauna comprises of 28 genera

and 64 species including 28 species endemic to Western Ghats (Subramanian, 2007). The families Gomphidae, Corduliidae, Platystictidae and Protoneuridae exhibit high levels of endemism.

Many dragonflies (Anisoptera), especially the members of families Aeshnidae, Chlorogomphidae, Corduliidae and Gomphidae are highly seasonal and occur in very low population densities. Hence, the representation of these families in the collection is very less. Among Anisoptera, family Libellulidae is the most species rich (49 species), followed by Gomphidae (25 species), Corduliidae (12 species), Macromidae and Aeshnidae with 10 and 9 species respectively. All the above families, except Libellulidae has high endemism, Gomphidae (20 endemic species), Corduliidae (10 endemics) and Macromiidae (6 endemics). Endemic odonates of the Western Ghats are mostly found in riverine habitats such as montane streams and rivers. A large proportion (82%) of the endemics survives exclusively in riverine habitats (Subramanian, 2007). In the case of family Libellulidae, the members occupies with very diverse habitats from sea level to higher elevation in the forest.

The damselflies (Zygoptera) are less speciose than dragonflies. The family Coenagrionidae has the highest species diversity with 21 species followed by Protoneuridae (14 species) and Platystictidae and Lestidae (8 species each). The families Protoneuridae and Platystictidae have high endemism. The members of damselflies are weak fliers, can be seen near and far away from water. The species of family Protoneuridae are always seen near water hanging on leaf blades. The genera such as *Vestalis* were observed far away from water, occupying each and every leaves of forest plants. *Rhinocypha bisignata* always found settled on rocks inside the water or near water. *Libellago lineata* were found near slow flowing streams. The members of genus *Agriocnemis* were observed settled on plants in the marshy area and occasionally far away from water also. *Ceriagrion cerinorubellum* is a common species, oftenly encountered in gardens and houseyards, where as

C. olivaceum and *C. rubiae* are forest species. There are 10 species of dragonflies and damselflies (Table 1) coming under IUCN Threatened and Near Threatened categories (Subramanian *et al.*, 2011). *Onychargia atrocyana* has been collected near pond filled with weeds. The members of families Calopterygidae, Euphaeidae, Platystictidae and Protoneuridae, are forest dwellers.

Table -1

Family	Species	Ctegrory
Gomphidae	<i>Heliogomphus promelas</i> (Selys, 1873)	NT
Corduliidae	<i>Idionyx galeata</i> Fraser, 1924	NT
Gomphidae	<i>Megalogomphus hannyingtoni</i> (Fraser, 1923)	NT
Protoneuridae	<i>Melanoneura bilineata</i> Fraser, 1922	NT
Protoneuridae	<i>Phylloneura westermanni</i> (Selys, 1860)	NT
Libellulidae	<i>Indothemis carnatica</i> (Fabricius, 1798)	NT
Gomphidae	<i>Chlorogomphus xanthoptera</i> (Fraser, 1919)	VU
Protoneuridae	<i>Disparoneura apicalis</i> (Fraser, 1924)	VU
Platystictidae	<i>Platysticta deccanensis</i> Laidlaw, 1915	VU
Platystictidae	<i>Protosticta sanguinostigma</i> Fraser, 1922	VU

During the present study, *Melanoneura bilineata*, *Phylloneura westermanni*, *Platysticta deccanensis* and *Protosticta sanguinostigma* were from the forest areas of Thusharagiri (Kozhikode) and Wayanad. The habitats of these species are Myristica swamps, which are rare formations of evergreen forests and important for endemic odonates (Subramanian, 2007).

Major threats to the Western Ghats odonates have been identified as agricultural activity, stream flow regulation, pesticide, fertilizer and

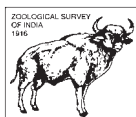
sediment runoff, urban and industrial development resulting decline in habitats such as waterbodies, conversion of ponds, tanks and pools for agricultural purposes and building and road construction cause irreparable damage to habitats that support odonates. Beside, sand mining, riparian deforestation, and dumping of waste, also threaten the habitats of odonates (Subramanian *et al.*, 2011). In order to conserve the odonate fauna of Western Ghats, we have to protect the habitats of this significant faunal group.

REFERENCES

- Asiathamby, M and Manickavasagam, S. 2002. Odonata of Annamalai University, Annamalainagar, Tamil Nadu, India. *Zoos' Print*, **17**(2): 704-706.
- Emiliyamma, K.G. and Radhakrishnan, C. 2000. Odonata (Insecta) of Parambikulam Wildlife Sanctuary, Kerala, India. *Rec. zool. Surv. India*, **98**(1): 157-167.
- Emiliyamma, K.G. and Radhakrishnan, C. 2002. Additions to the Odonata (Insecta) of Thiruvananthapuram district, Kerala. *Zoos' Print Journal*, **17**(10): 914-917.
- Emiliyamma, K.G, Radhakrishnan, C. and Muhamed Jafer Palot. 2005. *Pictorial Handbook – Common Dragonflies and Damselflies of Kerala*, : 1-67, Zoological Survey of India.

- Emiliyamma, K.G. 2005. On the Odonate (Insecta) fauna of Kottayam District, Kerala, India. *Zoos' Print*, **20**(12): 2108-2110.
- Emiliyamma, K.G. and Radhakrishnan, C. 2006. First report of *Cyclogomphus heterostylus* Selys (Odonata: Insecta) from Kerala, South India. *Rec. zool. Surv. India* : **106** (part-2): 123-124.
- Emiliyamma, K.G. and Radhakrishnan, C. 2006. Insecta: Odonata; in: *Fauna of Biligiri Rangaswamy Wildlife Sanctuary, Conservation Area Series*, **27**: 21-25, Zoological Survey of India, Kolkata.
- Emiliyamma, K.G. Radhakrishnan, C. and Muhamed Jafer Palot. 2007. Odonata (Insecta) of Kerala. *occ. paper*. 269, pub. by Zoological Survey of India, 1-200, 6 plates.
- Emiliyamma, K.G. and Radhakrishnan, C. 2007. Insecta: Odonata. In: *Fauna of Kudremukh National Park, Conservation Area Series*, **32**: 27-48.
- Emiliyamma, K.G. and Radhakrishnan, C. 2007. Insecta: Odonata. In *Fauna of Bannerghatta National Park, Conservation Area Series*, **33**: 39-41.
- Emiliyamma, K.G. 2009. Insecta: Odonata. In: *Fauna of Tamil Nadu, State Fauna Series*, **17**: 35-39.
- Emiliyamma, K.G. Md. Jafer Palot, Radhakrishnan, C. and Balakrishnan, V.C. 2013. *Lyriothemis acigastra*: a new addition to the Odonata Fauna of Peninsular India. *Taprobanica*, Vol., **5**(1): 73-74.
- Fraser, F.C. 1931. Additions to the survey of the Odonata (Dragonfly) fauna of Western India, with descriptions of nine new species. *Rec. Indian Mus.*, **33**: 443-474.
- Fraser, F.C. 1933. The Fauna of British India, including Ceylon and Burma. Odonata, vol. 1. pp. XIII + 428. Taylor & Francis Ltd., London: 1-423.
- Fraser, F.C. 1934. The Fauna of British India, including Ceylon and Burma. Odonata, vol. 2. pp. XIII + 398. Taylor & Francis Ltd., London: 1-398.
- Fraser, F.C. 1936. The Fauna of British India, including Ceylon and Burma. Odonata, vol. 3. p. XII + 461. Taylor & Francis Ltd., London.
- Gunther Peters. 1981. Trockenzeit – Libellen aus dem indischen Tiefland. *Dtsch. Ent. Z., N. F.* **28**. Heft, I-III, seite 93-108.
- Gunathilagaraj, K., Soundararajan, R.P. Chitra, N. and Swamiappan, M. 1999. Odonata in the rice fields of Coimbatore. *Zoos' Print*, **14**(6): 43-44.
- Jafer Palot, M., Radhakrishnan, C. and Soniya, V.P. 2005. Odonata (Insecta) diversity of a ricefield habitat in Palakkad district, Kerala, S.India. *Rec. zool. Surv. India*, **104** (Part 1-2): 71-77.
- Jafer Palot, M, Dinesan Cheruvat, Emiliyamma, K.G. and Radhakrishnan, C. 2002. Dragonfly Menace at the National Fish Seed Farm, Malampuzha, Kerala. *Fishing chimes*, **22** (5): 56 & 60.
- Jafer Palot, M and Soniya, V.P. 2004. Studies on the Odonata (Insecta) from a backwater swamp on Northern Kerala. *J. Bombay nat. Hist. Soc.*, **101** (1): 177-179.
- Kandibane, M. S. Raguraman and N. Ganapathy, 2005. Relative abundance and diversity of Odonata in an irrigated rice field of Madurai, Tamil Nadu. *Zoos' Print*, **20**(11): 2051-2052.
- K. A. Subramanian, Francy Kakkasserry and Manoj Nair, V. 2011. The status and distribution of dragonflies and damselflies (Odonata) of the Western Ghats. In *The Status and Distribution of Freshwater Biodiversity in the Western Ghats, India*. Cambridge, UK Gland, Switzerland: IUCN and Coimbatore, India: Zoo Outreach Organisation Compiled by Molur, S, Smith K. G., Daniel, B. A. and Darwall, W. R. T.

- Mathavan, S. and Miller, P.L. 1989. A collection of dragonflies (Odonata) made in the Periyar National Park, Kerala, South India, in January 1988. *Soc. Int. Odonatol. Rapid Comm. (suppl.)*, **10**: 1-10.
- Mitra, T.R. 2002. Geographical distribution of Odonata (Insecta) of Eastern India. *Memoirs of the Zoological Survey of India*, **19**(1): 1-208.
- Mitra, T.R. 2003. Ecology and biogeography of Odonata with special reference to Indian fauna. *Rec. zool. Surv. India, Occ. Pap.*, **202**: 1-41.
- Mitra, T.R. 2006. *Handbook on – Common Indian Dragonflies (Insecta: Odonata)*: 1-124, Zoological Survey of India.
- Prasad, M. and Varshney, R.K. 1995. A checklist of the Odonata of India including data on larval Studies. *Oriental Ins.*, **29**: 385-428.
- Prasad, M. and Kulkarni, P.P. 2000. Insecta: Odonata. in: *Fauna of Nilgiri Biosphere Reserve, Conservation Area Series*, **11**: 73-83.
- Radhakrishnan, C. 1997. Ecology and conservation status of Entomofauna of Malabar. *Zoos' Print*, **11**: 2-5.
- Radhakrishnan, C. and Emiliyamma, K.G. 2004. Odonata (Insecta) of Kerala: A systematic database. In: *Advancements in Insect Biodiversity*, Ed. Rajiv K. Gupta. Agrobios, Jodhpur.
- Ramachandra Rao, K. and Lahiri, A.R. 1982. First records of Odonates (Arthropoda: Insecta) from the Silent Valley and New Amarambalam Reserved Forests. *J. Bombay nat.Hist. Soc.*, **79** (3): 557-562.
- Schorr, M. Lindeboom, M. and Paulson, D. 2011. World Odonata List. <http://www.pugetsound.edu/x6140.xml>
- Subramanian, K.A. and Sivaramakrishnan, K.G. 2002. Conservation of Odonate fauna in Western Ghats- A biogeographic perspective. : pp. 11-22. *Vistas of Entomological Research for the new Millennium* (eds. K.P. Sanjayan, V. Mahalingam and M.C. Muralirangan). *G.S. Gill Research Institute*, Chennai.
- Subramanian, K.A. 2005. Damselflies and dragonflies of peninsular India-A field Guide. Ebook of the Project Lifescape. Indian Academy of Sciences and Centre for Ecological Sciences, Indian Institute of Science, Bangalore, India. 118pp. Available online in PDF format: http://ias.ac.in/initiat/sci_ed/lifescape/odonates.html
- Subramanian, K.A. 2007. Endemic Odonates of the Western Ghats: Habitat Distribution and Conservation. In: *Biology of Odonata* (Ed.Tyagi). pp.257-271. Scientific Publishers, Jodhpur, India.
- Subramanian, K.A. 2009. A Checklist of Odonata (Insecta) of India. (online version). <http://zsi.gov.in/zoological-survey-of-india/zsi>.



**ON A COLLECTION OF AQUATIC BEETLES
(COLEOPTERA: GYRINIDAE, HALIPLIDAE, NOTERIDAE,
DYTISCIDAE, HYDROPHILIDAE AND HYDROCHIDAE)
OF MADHYA PRADESH, INDIA**

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INTRODUCTION

The most successful order of the insect, Coleoptera includes 3, 87,100 described species from the whole world representing about 38% of insect species (1,020,007 species) of all the orders (Zhang, 2011). Of these, 40,000 species belong to aquatic beetles pertaining to at least eighteen families. Despite of having multitudes of freshwater aquatic habitats in India, knowledge on these beetles is quite insufficient.

The current knowledge of aquatic beetle fauna of Madhya Pradesh is limited to the works of Vazirani (1977 and 1984) described *Haliphus pruthii*, 1966 and *Haliphus agarwali*, 1984 under family Haliplidae and also reported some more species on Dytiscidae, Gyrinidae and Haliplidae from Madhya Pradesh. Brancucci (1983) described *Laccophilus kaszabi* and *Laccophilus punctatissimus* of family Dytiscidae from Madhya Pradesh. Chandra (2008) reported 17 aquatic species from Madhya Pradesh. Chandra *et al.*, (2010) and Ghosh & Nilsson (2012) reported thirty nine dytiscid species from Madhya Pradesh. So far, 74 aquatic species were known from Madhya Pradesh. The present work is based mainly on the collection made by scientific team of Central Zone Regional Centre, ZSI Jabalpur from different water bodies of Madhya Pradesh. The collection comprises 39 species belonging to 22 genera under

6 families of aquatic beetles. Altogether, a list of 85 aquatic species currently known from Madhya Pradesh state is also appended. Of these, twelve species marked with asterisks are reported for the first time recorded from the state. For current valid names of the taxa, the work on “*The Fauna of India- Gyrinidae and Haliplidae*” by Vazirani (1984), “*World catalogue of the Hydrophilidae & Hydrochidae*” by Andrew E. Z. Short & Martin Fikacek (2011), “*World catalogue of Noteridae*” by A.N. Nilsson (2012) and “*Catalogue of India & adjacent countries of Dytiscidae*” by Ghosh & Nilsson (2012) were followed.

Order COLEOPTERA

I. Family GYRINIDAE

Subfamily ENHYDRINAE

Genus *Dineutus* Macleay, 1825

1825. *Dineutus* Macleay, *Annulosa javanica* ed., 1: 30.

1. *Dineutus (Protodineutus) indicus* Aube, 1938

1938. *Dineutus indicus* Aube, *Species coleopteres*, 6: 772.

Material examined: Jabalpur, Mahadwari, 04.II.1963 (20exs.), coll. J.S. Bhatti (Reg. No. I513); Khargone, Babulgaon, 19.II.1971 (9exs.), coll. H. Khajuria (Reg. No. I7795-96); Shahdol, Amarkantak, Amanara gourela, 17.IV.1979 (28 exs.), coll. K. R & Party (Reg. No. I12856).

Distribution: India (Andhra Pradesh, Assam, Bihar, Kerala, Madhya Pradesh, Maharashtra, Manipur, Odisha, Pondicherry, West Bengal), Pakistan.

Subfamily GYRININAE

Genus **Gyrinus** Geoffroy, 1762

1762. *Gyrinus* Geoffroy, *Hist. Ins. Paris*, 1: 193.

2. **Gyrinus convexiusculus** Macleay, 1871

1762. *Gyrinus convexiusculus* Macleay, *Trans. Ent. Soc. N.S. Wales*, 2: 128.

Material examined: Gagai village, 31.IV.1965 (35exs), coll. H. P. Agarwal & Party (Reg. No. I1294); Shahdol, Doodhdhara, Amarkantak, 06.II.1980 (11exs.), coll. P.D. Rane.

Distribution: India (Andhra Pradesh, Assam, Bihar, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Manipur, Odisha, Pondicherry, West Bengal), Sri Lanka.

Subfamily ORECHTOCHILINAE

Genus **Orectochilus** Eschscholtz, 1833

1833. *Orectochilus* Eschscholtz, in *Dejean's Catalogue Coleopteres*, ed. II: 59.

3. **Orectochilus (Patrus) discifer**
(Walker, 1859)

1859. *Gyrinus discifer* Walker, *Ann. Mag. Nat. Hist.*, 3(3): 51.

1930. *Orectochilus (Patrus) discifer*: Ochs, *Cat. Ind. Ins.*, pt. 19: 24.

Material examined: Hoshangabad, Pachmarhi, Chhoragarh, 02. IV. 1979 (65exs.), coll. P. D. Rane & Party (Reg. No. I12801).

Distribution: India (Andhra Pradesh, Bihar, Madhya Pradesh, Maharashtra, West Bengal), Sri Lanka.

4. **Orectochilus (Patrus) semivestitus**
Guerin, 1840

1840. *Orectochilus (Patrus) semivestitus* Guerin, *Revue. zool*, 3: 38.

Material examined: Betul, Katawadi, 22. III. 1990 (60exs.), coll. H. S. Sharma (Reg. No. I14192).

Distribution: India (Andhra Pradesh, Bihar, Kerala, Madhya Pradesh, Maharashtra, Tamil Nadu, West Bengal), Sri Lanka.

II. Family HALIPLIDAE

Genus **Halipilus** Latreille, 1802

1802. *Halipilus* Latreille, *Hist. Nat. Crust. Ins.*, 3: 77.

5. **Halipilus (Liaphlus) angustifrons**
Regimbart, 1892

1892. *Halipilus angustifrons* Regimbart, *Ann. Soc. Ent. Belg.*, 36: 112.

Material examined: Jabalpur, Bheraghat, 02.IV.1966 (2exs.), coll. H. S. Sharma (Reg. No. I2828); Panagar tank, Katni road, 27.IX.1968 (175exs.), coll. V. S. Durve (Reg. No. I5205).

Distribution: India (Bihar, Karnataka, Kerala, Madhya Pradesh, Manipur, Punjab, Rajasthan, Tamil Nadu, Tripura, West Bengal), China, Indonesia, Nepal, Philippines, Sri Lanka.

6. **Halipilus (Liaphlus) pulchellus indicus**
Regimbart, 1899

1899. *Halipilus pulchellus var.indicus* Regimbart, *Ann. Soc. ent. Fr.*, 68: 188.

1955. *Halipilus (Liaphlus) pulchellus*: Guignot, *Mem. Soc. R. ent. Belg.*, 27: 295.

1966. *Halipilus (Liaphlus) pulchellus indicus*: Vazirani, *Proc. Zool. Soc. Calcutta*, 19: 133.

Material examined: Mandla, Kanha National Park, 29.IV.1964 (15exs.), coll. H. Khajuria (Reg. No. I5580); Lamehta ghat, 03.IV.1968 (4exs.), coll. H.P. Agarwal & Party (Reg. No. I4875); Lamehta ghat, 03.IV.1968 (2exs.), coll. H.P. Agarwal & Party (Reg. No. I4876).

Distribution: India (Bihar, Madhya Pradesh, Odisha, Rajasthan, West Bengal) China, Indonesia, Nepal, Philippines and Sri Lanka.

III. Family NOTERIDAE

Subfamily NOTERINAE

Tribe **Neohydrocoptini**

Genus **Neohydrocoptus** Sato, 1972

1859. *Hydrocoptus* Motschulsky: *Etud. Entom.* 8: 43.

1972. *Neohydrocoptus* Sato, *Ann. Hist. Natu. Mus. Nat. Hung.*, 64: 144.

1989. *Neohydrocoptus*: Nilsson et al, N. Stat, *Entomologica Scandinavica* **20**: 313.

7. *Neohydrocoptus subvittulus*
(Motschulsky, 1859)

1859. *Hydrocoptus subvittulus* Motschulsky, *Etud. Entom.*, **8**: 43.
2012. *Neohydrocoptus subvittulus* (Motschulsky): Nilsson, A. *World Catalogue of the Family Noteridae, Version* 16.VIII.2011, p. 8.

Material examined: Jabalpur, Budhagar, 16.VI.1971 (1ex.), H.S. Sharma & Party (Reg. No. I801); Budhagar, 27.IV.1974 (1ex.), coll. D.S. Mathur (Reg. No. I9870); Bheraghat Nala, Murakhad village, 16.I.1975 (1ex.), coll. S.K. Mishra (Reg. No. I10493); Shahdol, Amarkantak, 19.II.1980 (12exs.), coll. P.D. Rane & Party.

Distribution: India (Andhra Pradesh, Assam, Bihar, Kerala, Madhya Pradesh, Odisha, Punjab, Rajasthan, Uttar Pradesh, West Bengal), Sri Lanka, China.

Tribe Noterini

Genus *Canthydrus* Sharp, 1882

1882. *Canthydrus* Sharp, *Sci. Trans. R. Dublin Soc.*, **2**: 269.

8. *Canthydrus angularis* Sharp, 1882

1882. *Canthydrus angularis* Sharp, *Sci. Trans. R. Dublin Soc.*, **2**: 277.
1977. *Canthydrus morsbachii* (Wehncke): Vazirani, *Rec. zool. Surv. India*, Occ. paper No. **6**: 7.
2012. *Canthydrus angularis* Sharp: Nilsson, A. *World Catalogue of the Family Noteridae, Version* 16. VIII. 2011, p. 9.

Material examined: Jabalpur, (Reg. No. I4839), Baleha Tank, Katni Road, 04.III.1968 (1ex.); Budhagar, 30.VII.1969 (6exs.), coll. H. S. Sharma & Party; Narmada River, 17.III.1970 (1ex), coll. V.V. Rao & Party; PANNA, 19.XI.1988 (6exs.), coll. P.D. Rane & Party; Shankh river, Noorabad, 06.I.1995 (4exs), coll. H. S. Sharma & Party.

Distribution: India (Andhra Pradesh, Goa, Kerala, Madhya Pradesh, Odisha, West Bengal), Africa, Myanmar, Indonesia and Thailand.

9. *Canthydrus laetabilis* (Walker, 1858)

1858. *Hydroporus laetabilis* Walker, *Ann. Mag. Nat. Hist.*, **3**(2): 205.
2012. *Canthydrus laetabilis* (Walker): Nilsson, A. *World Catalogue of the Family Noteridae, Version* 16. VIII. 2011, p. 13.

Material examined: Jabalpur, Katni Road, Baleha Tank, 30.XII.1969 (4exs.); 08.VII.1970 (3exs.), coll. H. P. Agarwal & Party, 19.II.1970 (3exs.), coll. V. V. Rao & Party; Budhagar, 07.IV.1971 (5exs.), coll. H. S. Sharma & Party; 21.II.1975 (2exs.), coll. S. Mathur & Party; SHIVPURI, 22.III.1980 (3exs.), coll. D. K. Harshey; TIKAMGARH, 17.III.1994 (1ex.), coll. U. A. Gajbe & Party.

Distribution: India (Andhra Pradesh, Assam, Bihar, Kerala, Madhya Pradesh, Odisha, Punjab, Rajasthan, Uttar Pradesh, West Bengal), Philippines, Sri Lanka.

10. *Canthydrus ritsemae* (Regimbart, 1880)

1880. *Hydrocanthydrus ritsemae* Regimbart, 1880: *Notes Leyden Mus.*, **2**: 213.
1899. *Canthydrus ritsemae* Regimbart: *Ann. Soc. ent. Fr.*, **68**: 252.

Material examined: Jabalpur, Shahpura Rly. Bridge, 10.IV.1968 (1ex.), coll. V.S. Durve (Reg. No. I4998); Narmada River, 17.III.1970 (17exs), coll. V.V. Rao & Party (Reg. No. I6433); Tank, Chatarpur village, 15.VI.1970 (1ex.), coll. H.P. Agarwal & Party (Reg. No. I6633); Amkhas, Nagpur road, 25.VI.1970 (1ex.), coll. H.P. Agarwal & Party.

Distribution: India (Andhra Pradesh, Assam, Bihar, Madhya Pradesh, Odisha, West Bengal), Thailand, Indonesia, Myanmar, Singapore, Vietnam.

IV. Family DYTISCIDAE

Subfamily DYTISCINAE

Tribe Aciliini

Genus *Rhantaticus* Sharp, 1882

1882. *Rhantaticus* Sharp, *Sci. Trans. R. Dublin Soc.*, **2**: 691.

2012. *Rhantaticus* Sharp: Ghosh & Nilsson, *Skorvnopparn supplement*, 3: 18.

11. ***Rhantaticus congestus*** (Klug, 1833)

1833. *Hydaticus congestus* Klug: *Symb. Physicae, Insectes Madagascar*, p. 48.
2012. *Rhantaticus congestus*: Ghosh & Nilsson, *Skorvnopparn supplement*, 3: 18.

Material examined: Jabalpur, Ranital, 18.V.1966 (5exs), coll. V.V. Rao (Reg. No. I2681); Katni road, Heron River, 05.X.1966 (1ex.), coll. V.S. Durve (Reg. No. I3138); Chikhaldia, Badgaon, 16.II.1971 (1ex.), coll. D.K. Ghoshal (Reg. No. I7698); SHIVPURI, Shivpuri N. P., 27.III.1980 (9exs.), coll. D. K. Harshey (Reg. No. I13075); 29.III.1980 (25exs.) (Reg. No. I13079).

Distribution: India (Andhra Pradesh, Arunachal Pradesh, Delhi, Jharkhand, Madhya Pradesh, Maharashtra, Manipur, Odisha, Rajasthan, Tamil Nadu, Uttarakhand, Uttar Pradesh, West Bengal), Bangladesh, Nepal, China, Japan, Philippines, Saudi Arabia, Sunda Islands, Taiwan, Madagascar, North Africa, Afrotropical region, Australian region.

Genus ***Sandracottus*** Sharp, 1882

1882. *Sandracottus* Sharp, *Sci. Trans. R. Dublin Soc.*, 2: 672.
2012. *Sandracottus* Sharp: Ghosh & Nilsson, *Skorvnopparn supplement* 3: 18.

12. ***Sandracottus dejeani*** (Aube, 1838)

1838. *Hydaticus dejeani* Aube: *In Dejeans species Coleopteres*, 6: 165.
2012. *Sandracottus dejeani*: Ghosh & Nilsson, *Skorvnopparn supplement* 3: 18.

Material examined: Jabalpur, Budhagar, 27.V.1969 (1ex.), coll. V.S. Durve (Reg. No. I5626); Baleha Tank, 12.IV.1970 (2exs.), coll. H. Khajuria (Reg. No. I6612); Chikhaldia, Badgaon, 16.II.1971 (3exs.), coll. D.K. Ghoshal (Reg. No. I770-I773); Piparia, Kundum road, 18.IV.1983 (14exs.), coll. S.K. Misra (Reg. No. I13027).

Distribution: India (Arunachal Pradesh, Andhra Pradesh, Gujarat, Himachal Pradesh,

Jharkhand, Kerala, Madhya Pradesh, Maharashtra, Odisha, Rajasthan, Tamil Nadu, Uttarakhand, Uttar Pradesh, West Bengal), Pakistan, Iran, Afrotropical region, Australian region.

13. ***Sandracottus mixtus*** (Blanchard, 1843)

1843. *Hydaticus mixtus* Blanchard, *Insectes coleopteres*, 4.
2012. *Sandracottus mixtus*: Ghosh & Nilsson, *Skorvnopparn supplement*, 3: 19.

Material examined: Jabalpur, Amkhas, 11.VII.1975 (1ex.), coll. P.D. Rane (Reg. No. I10759); Budhagar, 2.XII.1975 (15 exs.), coll. D.S. Mathur (Reg. No. I11839); 28.II.1976, (6exs.) (Reg. No. I11896); Hoshangabad, 12.I.1990 (13exs.), coll. U.A. Gajbe (Reg. No. I14162); Mandla, Deotari, 15.VI.1992 (4exs.), coll. U.A. Gajbe (Reg. No. I15114).

Distribution: India (Andhra Pradesh, Madhya Pradesh, Nagaland, Tamil Nadu, Uttarakhand, Uttar Pradesh, West Bengal), Myanmar, China, Indonesia, Japan and Vietnam.

Tribe **Cybistrini**

Genus ***Cybister*** Curtis, 1827

1827. *Cybister* Curtis, *Brit. Entom. Lond.*, 4: 151.
2012. *Cybister* Curtis: Ghosh & Nilsson, *Skorvnopparn supplement*, 3: 19.
14. ***Cybister (Cybister) pectoralis*** Sharp, 1882
1882. *Cybister pectoralis* Sharp, *Sci. Trans. R. Dublin Soc.*, 2: 736.
1977. *Cybister (Melanectes) pectoralis*: Vazirani, *Rec. zool. Surv. India, Occ. Paper No.* 6: 91.
2012. *Cybister (Cybister) pectoralis*: Ghosh & Nilsson, *Skorvnopparn supplement*, 3: 21.

Material examined: Jabalpur, Amkhas, Nagpur road, 15.OI.1976 (6exs.), coll. B.S. Guram (Reg. No. I11861); Bidia River, 15.X.1986 (12exs.), coll. D.S. Mathur (Reg. No. I13534); Damoh, 18.OI.1994 (5exs), coll. H.P. Agarwal & Party (Reg. No. I15749); Tikamgarh, Kundeswar, Jamini, 19.III.1994 (1ex.), coll. U.A. Gajbe (Reg. No. I15922).

Distribution: India (Andhra Pradesh, Bihar, Madhya Pradesh, Maharashtra, West Bengal).

15. ***Cybister (Cybister) tripunctatus lateralis***
(Fabricius, 1798)

1795. *Cybister tripunctatus* Olivier, *Entom. Hist. nat. Ins.*, **3**: 14.
1798. *Dytiscus lateralis* Fabricius, *Suppl. Entom. Syst.*, p. 64.
1832. *Cybister asiaticus* Sharp, *Sci. Trans. R. Dublin Soc.*, **2**: 731.
1977. *Cybister tripunctatus asiaticus*: Vazirani, *Rec. zool. Surv. India, Occ. Paper No. 6*: 62.
2012. *Cybister (Cybister) tripunctatus lateralis*: Ghosh & Nilsson, *Skorvnopparn supplement*, **3**: 21.

Material examined: Jabalpur, Gwarighat, 19.VII.1966 (1ex.), coll. H.P. Agarwal & Party (Reg. No. I2894); Jabalpur, 10.II.1971 (3exs.), coll. V.V. Rao (Reg. No. I7541-7543); Lamehtaghat, 08.IV.1974 (23exs.), coll. H. Khajuria (Reg. No. I9855); Pariat River, Katni road, 02.VIII.1975 (2exs.), coll. H. Khajuria; Mohania village, 29.X.1975 (2exs.), coll. H.P. Agarwal & Party (Reg. No. I11765).

Distribution: India (Andaman & Nicobar Islands, Andhra Pradesh, Assam, Delhi, Gujarat, Himachal Pradesh, Jammu & Kashmir, Karnataka, Madhya Pradesh, Maharashtra, Manipur, Meghalaya, Odisha, Rajasthan, Sikkim, Tamil Nadu, Tripura, Uttarakhand, Uttar Pradesh, West Bengal), Afghanistan, Bangladesh, Bhutan, Myanmar, Nepal, Pakistan, Sri Lanka, China, Cyprus, Iran, Iraq, Japan, Kyrgyzstan, Mongolia, Russia, Syria, Tajikistan, Turkmenistan, Turkey, Uzbekistan, Europe.

16. ***Cybister (Melanectes) convexus*** Sharp, 1882

1882. *Cybister convexus* Sharp, *Sci. Trans. R. Dublin Soc.*, **2**: 718.
1945. *Cybister (Melanectes) convexus*: Brinck, *Kung. Fysiog. Salls. Handl.*, **56**(4): 11.

Material examined: Jabalpur, Puri Village, 16.IV.1964 (16exs.), coll. H.P. Agarwal & Party (Reg. No. I485); Lamehta ghat, 08.IV.1974 (5exs.), coll. H. Khajuria (Reg. No. I9848); Adhartal, 03.IX.1975 (6exs.), coll. H. Khajuria (Reg. No. I10835); Budhagar, 23.XI.1976 (2exs.), coll. D.S. Mathur (Reg. No. I12215).

Distribution: India (Andhra Pradesh, Assam, Madhya Pradesh, Manipur, Meghalaya, Sikkim, Uttar Pradesh, West Bengal), China.

Tribe **Eretini**

Genus **Eretes** Laporte, 1833

1833. *Eretes* Laporte, *Ann. Soc. Entom. France*, **1**: 397.
2012. *Eretes* Laporte: Ghosh & Nilsson, *Skorvnopparn supplement*, **3**: 23.

17. ***Eretes griseus*** (Fabricius, 1781)

1781. *Dytiscus griseus* Fabricius, *Species Ins.*, **1**: 293.
2012. *Eretes griseus*: Ghosh & Nilsson, *Skorvnopparn supplement*, **3**: 23.

Material examined: Shahdol, Bandhavgarh N.P., 26.II.1976 (12exs.), coll. N.K. Sinha (Reg. No. I12020); Jabalpur, Patan River, Pavai, 20.II.1987 (60exs.), coll. R.K. Singh & party (Reg. No. I13690); Morena, Deori, Kuanari River, 05.OI.1995, (11exs) (Reg. No. 630913).

Distribution: India (Himachal Pradesh, Jammu & Kashmir, Uttar Pradesh), Afghanistan, Bhutan, Nepal, Pakistan, China, Iran, Iraq, Japan, Kuwait, Oman, Sinai, South Korea, Syria, Turkey, Yemen, Afrotropical region, Australian region, Russia, Europe, North Africa.

Tribe **Hydaticini**

Genus **Hydaticus** Leach, 1817

1817. *Hydaticus* Leach, *zool. Miscell.* **3**: 69.
2012. *Hydaticus* Leach: Ghosh & Nilsson, *Skorvnopparn supplement*, **3**: 24.

18. ***Hydaticus (Prodaticus) ricinus***

Wewalka, 1979

1979. *Hydaticus ricinus* Wewalka, *Koleopterologische Rundschau*, **54**: 128.
2012. *Hydaticus (Prodaticus) ricinus*: Ghosh & Nilsson, *Skorvnopparn supplement*, **3**: 27.

Material examined: Jabalpur, Baleha Tank, 12.IV.1970 (2exs.), coll. H.P. Agarwal & Party (Reg. No. I6610); Balsagar tank, Nagpur road, 23.VI.1970 (3exs.), coll. H.S. Sharma (Reg. No. I6665); Gangli Village, 10.II.1971 (60exs.), coll. V.V. Rao (Reg. No. I7538); Budhagar tank, 31.VIII.1975 (2exs.), coll. H.P. Agarwal

& Party (Reg. No. I10774); Budhagar tank, 23.01.1976 (10exs.), coll. D.S. Mathur (Reg. No. I11874); 28.II.1976 (5exs.) (Reg. No. I11895); KHARGONE, Narmada River, Bogad, 13.II.1971 (3exs.), coll. V.V. Rao (Reg. No. I7588); MANDLA, Supkhar, Kanha N.P., 01.XII.1984 (1ex.), coll. D.S. Mathur (Reg. No. I13400).

Distribution: India: (Assam, Madhya Pradesh, Tamil Nadu), Afghanistan, Bhutan, Myanmar, Nepal, Pakistan, Sri Lanka, China, Laos, Thailand, Vietnam.

Remarks: This species is recorded for the first time from Madhya Pradesh.

19. *Hydaticus (Prodaticus) vittatus vittatus*
(Fabricius, 1775)

1775. *Dytiscus vittatus* Fabricius, *Syst. Ent.*: 825.

1975. *Hydaticus vittatus vittatus*: Wewalka, *Koleopterologische Rundschau*, 52: 87.

2012. *Hydaticus (Prodaticus) vittatus vittatus*: Ghosh & Nilsson, *Skorvnopparn supplement* 3: 27.

Material examined: Jabalpur, Budhagar, 21.XI.1974 (4exs.), coll. D.S. Mathur (Reg. No. I10309); 1ex. Budhagar, 17.V.1977, coll. D.S. Mathur (Reg. No. I12221); Shahdol, Bijuria, 23.II.1976 (1ex.), coll. N.K. Sinha (Reg. No. I11895).

Distribution: India (Andhra Pradesh, Assam, Bihar, Gujarat, Himachal Pradesh, Jammu & Kashmir, Jharkhand, Kerala, Madhya Pradesh, Maharashtra, Manipur, Meghalaya, Odisha, Pondicherry, Rajasthan, Sikkim, Tamil Nadu, Tripura, Uttarakhand, Uttar Pradesh, West Bengal), Bangladesh, Bhutan, Myanmar, Nepal (Danda Pakhar, Godavari), Pakistan, Sri Lanka, China, Indonesia, Japan, Korea, Philippines, Taiwan, Thailand, Vietnam, Australian region.

Subfamily HYDROPORINAE

Tribe BIDESSINI

Genus ***Hydroglyphus*** Motschulsky, 1853

1853. *Hydroglyphus* Motschulsky, *Imprimerie de la Societe de Literature Finnoise*, p. 5.

1945. *Guignotus*: Guignot, *Mem. Mus. Natn. Hist. nat.*, 19: 226.

2012. *Hydroglyphus*: Ghosh & Nilsson, *Skorvnopparn supplement*, 3: 29

20. *Hydroglyphus flammulatus* (Sharp, 1882)

1882. *Bidessus flammulatus* Sharp, *Sci. Trans. R. Dublin Soc.*, 2: 359.

2012. *Hydroglyphus flammulatus*: Ghosh & Nilsson, *Skorvnopparn supplement*, 3: 29.

Material examined: Jabalpur, Narmada River, Tilwaraghat, 07.V.1969 (1ex.), coll. V.V. Rao & Party (Reg. No. I5600); Left bank of Narmada River, 16.XI.1969 (4exs.), coll. V.V. Rao & Party (Reg. No. I7587); Narmada River, 17.III.1970 (7exs.), coll. V.V. Rao & Party (Reg. No. I 6434); SHAHDOL, Amarkantak, 12.VI.1970 (28exs.), coll. P.D. Rane & Party; Baleha Tank, Katni Road, 13.II.1971 (7exs.), coll. H.P. Agarwal & Party (Reg. No. I6609); Narmada River, Tilwaraghat, 12.III.1992 (1ex.), coll. V.V. Rao & Party (Reg. No. I14991).

Distribution: India (Himachal Pradesh, Madhya Pradesh, Rajasthan, Sikkim, Uttarakhand), Afghanistan, Bhutan, Nepal, Pakistan, China, Cyprus, Iran, Iraq, Israel, Kazakhstan, Kyrgyzstan, Lebanon, Mongolia, North Korea, Saudi Arabia, Syria, Tajikistan, Turkey, Turkmenistan, Uzbekistan, Vietnam, Russia, Europe and North Africa.

21. *Hydroglyphus inconstans*
(Regimbart, 1892)

1892. *Bidessus inconstans* Regimbart, *Ann. Soc. Ent. Fr.*, 36: 119.

2012. *Hydroglyphus inconstans*: Ghosh & Nilsson, *Skorvnopparn supplement*, 3: 30.

Material examined: Jabalpur, Garudeshwar, 12.V.1966 (1ex.), coll. H.P. Agarwal & Party (Reg. No. I2698); Tilwaraghat, 04.V.1968 (2exs.), coll. H.S. Sharma (Reg. No. I2673); Narmada River, 17.III.1970 (1ex.), coll. V.V. Rao & Party (Reg. No. I6435); Katangi Road, 08.II.1980 (2exs.), coll. H.P. Agarwal & Party (Reg. No. I4973); Hoshangabad, Pachmarhi, Chhoragarh, 02.IV.1979 (8exs.), coll. K. Ghoshal & Party (Reg. No. I8554).

Distribution: India (Andaman & Nicobar Islands, Andhra Pradesh, Assam, Goa, Gujarat, Jharkhand, Karnataka, Madhya Pradesh, Maharashtra, Manipur, Odisha, Rajasthan, Sikkim, Tamil Nadu, Tripura, Uttarakhand, West Bengal), Bangladesh, Bhutan, Myanmar, Nepal, Sri Lanka, China, Indonesia, Japan, Malaysia, Taiwan.

22. *Hydroglyphus pendjabensis* (Guignot, 1954)

1954. *Guignotus pendjabensis* Guignot, *Opusc. Ent. Lund.*, **19**: 221.

2012. *Hydroglyphus pendjabensis*: Ghosh & Nilsson, *Skorvnopparn supplement*, **3**: 31.

Material examined: Jabalpur, Gwarighat, 23.IV.1966 (1ex.), coll. H.P. Agarwal & Party (Reg. No. I12802); Narmada River, Tilwaraghat, 07.V.1969 (1ex.), coll. V.V. Rao & Party (Reg. No. I5601); Tilwaraghat, 17.III.1970 (1ex.), coll. H.K. Khajuria (Reg. No. I 2646); Narmada River, 17.III.1970 (1ex.), coll. V.V. Rao & Party (Reg. No. I 6436); SHAHDOL DIST, 08.III.1976 (4exs.), coll. N.K. Sinha (Reg. No. I12121).

Distribution: India (Andhra Pradesh, Delhi, Goa, Gujarat, Jharkhand, Madhya Pradesh, Maharashtra, Odisha, Rajasthan, Tamil Nadu, Uttar Pradesh, West Bengal), Bangladesh, Myanmar, Nepal, Pakistan.

Tribe Hydrovatini

Genus *Hydrovatus* Motschulsky, 1853

1853. *Hydrovatus* Motschulsky: *Imprimerie de la Societe de Literature Finnoise*, p. 4.

2012. *Hydrovatus* Motschulsky: Ghosh & Nilsson, *Skorvnopparn supplement*, **3**: 37.

23. *Hydrovatus confertus* Sharp, 1882

1882. *Hydrovatus confertus* Sharp, *Sci. Trans. R. Dublin Soc.*, **2**: 329.

2012. *Hydrovatus confertus*: Ghosh & Nilsson, *Skorvnopparn supplement*, **3**: 37.

Material examined: Shahdol, Amarkantak, 19.V.1966 (1ex.), coll. H.P. Agarwal & Party (Reg. No. I2688); Jabalpur, Narmada River, Tilwaraghat, 07.V.1969 (6exs.), coll. V.V. Rao & Party (Reg. No. I5599); Tikamgarh, 19.IX.1993

(10exs.), coll. R.K. Singh & Party (Reg. No. I 15416).

Distribution: India (Andaman & Nicobar Islands, Assam, Delhi, Jharkhand, Kerala, Madhya Pradesh, Manipur, Pondicherry, Punjab, Rajasthan, Tamil Nadu, Tripura, Uttar Pradesh, West Bengal), Bangladesh, Bhutan, Myanmar, Nepal, Pakistan, Sri Lanka, Cambodia, China, Indonesia, Laos, Malaysia, Thailand, Vietnam.

Remarks: This species is recorded for the first time from Madhya Pradesh.

Subfamily LACCOPHILINAE

Genus *Laccophilus* Leach, 1815

1815. *Laccophilus* Leach, *The Edinburgh encyclopaedia*, **9**(1): 84.

2012. *Laccophilus* Leach: Ghosh & Nilsson, *Skorvnopparn supplement*, **3**: 46.

24. *Laccophilus elegans* Sharp, 1882

1882. *Laccophilus elegans* Sharp, *Sci. Trans. R. Dublin Soc.*, **2**: 302.

2012. *Laccophilus elegans*: Ghosh & Nilsson, *Skorvnopparn supplement*, **3**: 47.

Material examined: Jabalpur, Amkhas, Nagpur road, 19.X.1968 (11exs.), coll. H.P. Agarwal & Party; Narmada River, 31.X.1969 (1ex.), coll. H. Khajuria (Reg. No. I5993); MANDSAUR, Mahargarh, 14.VIII.1990 (1ex.), coll. R.K. Singh (Reg. No. I14380); Tikamgarh, 18.III.1994 (5exs.), coll. U.A. Gajbe (Reg. No. I15915).

Distribution: India (Andaman & Nicobar Islands, Andhra Pradesh, Bihar, Chhattisgarh, Karnataka, Madhya Pradesh, Nagaland, Odisha, West Bengal), Vietnam.

Remarks: This species is recorded for the first time from Madhya Pradesh.

25. *Laccophilus ellipticus* Regimbart, 1889

1889. *Laccophilus ellipticus* Regimbart, *Ann. Soc. Ent. Fr.*, **(6) 9**: 152.

2012. *Laccophilus ellipticus*: Ghosh & Nilsson, *Skorvnopparn supplement*, **3**: 47.

Material examined: Jabalpur, Baleha Tank, 12.VI.1970 (2exs.), coll. H. Khajuria (Reg. No.

I6613); Tamar River, Bargi road, 26.VI.1972 (5exs.), coll. R.K. Singh & party (Reg. No. I9131); Shahdol, Bandhavgarh, 05.III.1976 (3exs.), coll. N.K. Sinha (Reg. No. I12095).

Distribution: India (Andhra Pradesh, Assam, Bihar, Goa, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Meghalaya, Odisha, Pondicherry, Tamil Nadu, West Bengal), Myanmar, Sri Lanka, China, Cambodia, Indonesia, Thailand, Vietnam.

26. ***Laccophilus inefficiens*** (Walker, 1859)

1859. *Hydroporus inefficiens* Walker, *Ann. Mag. Nat. Hist.*, 3: 51.

2012. *Laccophilus inefficiens*: Ghosh & Nilsson, *Skorvopparn supplement* 3: 49.

Material examined: Ratlam, Ratlam stn, 23.VIII.1990 (3exs.), coll. R.K. Singh & party (Reg. No. I14450); Chindwara, Gayani River stn, Patalkot, 28.II.1994 (2exs.), coll. H.S. Sharma (Reg. No. I15848).

Distribution: India (Andaman & Nicobar Islands, Andhra Pradesh, Assam, Bihar, Goa, Gujarat, Himachal Pradesh, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Manipur, Meghalaya, Odisha, Punjab, Rajasthan, Sikkim, Tripura, Tamil Nadu, Uttarakhand, Uttar Pradesh, West Bengal), Bangladesh, Bhutan, Myanmar, Nepal, Pakistan, Sri Lanka, Indonesia, Iran and Malaysia.

27. ***Laccophilus uniformis*** Motschulsky, 1859

1859. *Laccophilus uniformis* Motschulsky, *Etudes Entom.*, 8: 46.

2012. *Laccophilus uniformis*: Ghosh & Nilsson, *Skorvopparn supplement*, 3: 52.

Material examined: Jabalpur, Heron River at katangi village, 15.VI.1966 (3exs.), coll. H.S. Sharma (Reg. No. I 2768); Budhagar tank on Katni road, 30.VII.1969 (5exs.), coll. H.S. Sharma (Reg. No. I5731); Amkhas, 22.X.1974 (3exs.), coll. B.S. Guram (Reg. No. I2272); Khandu, Kukru, 30.III.1990 (18exs.), coll. H.S. Sharma (Reg. No. I14241).

Distribution: India (Andaman & Nicobar Is., Andhra Pradesh, Assam, Bihar, Chhattisgarh,

Delhi, Madhya Pradesh, Manipur, Odisha, Sikkim, West Bengal), Bangladesh, Myanmar, Sri Lanka, Cambodia, China, Indonesia, Laos, Thailand and Vietnam.

V. Family HYDROPHILIDAE

Subfamily HYDROPHILINAE

Tribe **Hydrophilini**

Genus ***Hydrophilus*** Muller, 1764

1764. *Hydrophilus* Muller, *Fauna Ins. Fridrichsdalina*, p. 16.

28. ***Hydrophilus olivaceus*** Fabricius, 1781

1781. *Hydrophilus olivaceus* Fabricius, *Spec. ins.*, 1: 289.

Material examined: Jabalpur, Baleha Tank, Panagar village, 08.OI.1969 (5exs.), coll. H.P. Agarwal & Party (Reg. No. I5359); Budhagar, 24.IV.1969 (5exs.), coll. H.P. Agarwal & Party (Reg. No. 5582); Pariat nala, 15.OI.1970 (2exs.), coll. H.S. Sharma & Party (Reg. No. I6326); Budhagar, 26.X.1976 (2exs.), coll. K. Reddaiah (Reg. No. I12193).

Distribution: India (Andhra Pradesh, Madhya Pradesh, Maharashtra, Manipur, West Bengal).

Tribe **Berosini**

Genus ***Berosus*** Leach, 1817

1817. *Berosus* Leach, *Zool. Misc.*, 3: 92.

29. ***Berosus indicus*** Motschulsky, 1861

1861. *Berosus indicus* Motschulsky, *Bull. Soc. Imp. Nat. Moscou*, 34 (1): 110.

Material examined: Jabalpur, Bheraghat, 23.IV.1970 (4exs.), coll. H.P. Agarwal & Party (Reg. No. I6528); Amkhas, 19.IV.1975 (2exs.), coll. B.S. Guram (Reg. No. I10394); Budhagar, 23.I.1976 (6exs.), coll. D.S. Mathur (Reg. No. I11875).

Distribution: India (Bihar, Karnataka, Kerala, Madhya Pradesh, Manipur, Punjab, Rajasthan, Tamil Nadu, Tripura, West Bengal), China, Indonesia, Nepal, Philippines, Sri Lanka.

30. ***Berosus pulchellus*** Macleay, 1817

1817. *Berosus pulchellus* Macleay, *Annul. Jav*, 35.

1995. *Berosus pulchellus* Macleay: Biswas & Mukhopadhyay, *Fauna of West Bengal, State Fauna Series.*, 3(6 A): 163.

Material: Jabalpur, Richhai village, 13.IV.1966 (13exs.), coll. H.P. Agarwal & Party (Reg. No. I2589); Piparia village, 18.IV.1983 (4exs.), coll. S.K. Misra (Reg. No. I13028); KHARGONE, Bogad, 13.II.1971 (4exs.), coll. V.V. Rao (Reg. No. I7591);

Distribution: India (Andhra Pradesh, Delhi, Haryana, Karnataka, Kerala, Madhya Pradesh, Meghalaya, Rajasthan, Tamil Nadu, Tripura, West Bengal), China, Hongkong, Indonesia, Japan, Malaysia, Nepal, Philippines, Sri Lanka, Taiwan.

Remarks: This species is recorded for the first time from Madhya Pradesh.

Genus *Regimbartia* Zaitzev, 1908

1908. *Regimbartia* Zaitzev, *Horae Soc. Ent. Ross.*, **38**: 362.

31. *Regimbertia attenuata* (Fabricius, 1801)

1801. *Hydrophilus attenuata* Fabricius, *Syst. Eleuth.*, **1**: 253.
1924. *Regimbartia attenuata*: Kinsch, *Col. Cat.*, **14**(79): 276.

Material: Jabalpur, Shahpura Rly. Bridge, 10.V.1968 (1ex.), coll. V.S. Durve (Reg. No. I5002); Budhagar, 14.IV.1970 (1ex.), coll. V.V. Rao (Reg. No. II6493); 12.V.1970 (4exs.), (Reg. No. I6494); 06.X.1972 (1ex.), coll. D.S. Mathur (Reg. No. I9260); 26.X.1976 (4exs.), coll. K. Reddiah (Reg. No. I12197); Babul gaon, KHARGONE dist., 04.II.1971 (6exs.), coll. V.V. Rao (Reg. No. I7342); Nagpur road, Amkhas, 02.VI.1971 (4exs.), coll. D.K. Ghoshal (Reg. No. I7999); Bhadaya Kund road, 26. III.1980 (1ex.), coll. D.K. Harshey (Reg. No. I13068).

Distribution: India (Andhra Pradesh, Madhya Pradesh, Maharashtra, Manipur, West Bengal), Australia, Japan, Sri Lanka, South Asia.

Remarks: This species is recorded for the first time from Madhya Pradesh.

Tribe ACIDOCERINI

Genus *Enochrus* Thomson, 1859

32. *Enochrus esuriens* (Walker, 1858)

1858. *Philiphydrus esuriens* Walker, *Ann. Mag. Nat. Hist.*, (32) **2**: 209.
1924. *Enochrus esuriens*: Kinsch, *Col. Cat.*, **14**(79): 209.

Material: Jabalpur, Lameta ghat, 11.OI.1967 (5exs.), coll. V.S. Durve (Reg. No. I3406); Bargi village, 24.VII.1970 (2exs.), coll. H.P. Agarwal & Party (Reg. No. I6750); Mortakka village, 09.X.1969 (1ex.), coll. H. Khajuria (Reg. No. I5972); Narila village, 26.X.1975 (2exs.), coll. H.P. Agarwal & Party (Reg. No. I11698).

Distribution: India (Madhya Pradesh, Manipur, Andaman & Nicobar Is., West Bengal), Australia, Indonesia, Philippines, Sri Lanka.

Remarks: This species is recorded for the first time from Madhya Pradesh.

Genus *Helochaeres* Mulsant, 1844

1844. *Helochaeres* Mulsant, *Hist. Nat. Col. Fr. Palp.*, p. 197.

33. *Helochaeres ancholaris* Sharp, 1890

1890. *Helochaeres ancolaris* Sharp, *Trans. Ent. Soc. Lond.*, **352**.

Material: Jabalpur, Heron River, 12.V.1966 (2exs.), coll. H.S. Sharma (Reg. No. I2671); Supatal, Nagpur road, 15.IV.1968 (1ex.), coll. H.P. Agarwal & Party (Reg. No. I4921); Tilwaraghat, 12.II.1970 (1ex.), coll. H.P. Agarwal & Party (Reg. No. I6356); KHARGONE, 21.II.1971 (1ex.), coll. H. Khajuria (Reg. No. I7828); Garudeshwar, Narmada River, 22.XII.19710 (2exs.), coll. H. Khajuria (Reg. No. I8457-58); Amkhas, 15.VI.1975 (4exs.), P.D. Rane (Reg. No. I21455); Hasdeo river, 14.XI.1979 (1ex.), coll. K.R. & Party (I12675).

Distribution: India (Andhra Pradesh, Bihar, Madhya Pradesh, Maharashtra, West Bengal), Cambodia, Indochina, Indonesia, Philippines, Sri Lanka.

Remarks: This species is recorded for the first time from Madhya Pradesh.

34. *Helochaeres crenatus* Regimbart, 1903

1903. *Helochaeres crenatus* Regimbart, *Ann. Soc. Ent. Fr.*, 72: 54.

Material: Jabalpur, Madan mahal, 17.II.1967 (3exs.), coll. H. Khajuria (Reg. No. I3569); Baleha Tank, 30.XII.1969 (2exs.), coll. H.P. Agarwal & Party (Reg. No. I5934); Budhagar, 15.VII.1970 (5exs.), coll. H.P. Agarwal & Party (Reg. No. I6721-25); Malwara, 17.II.1971 (11exs.), coll. D.K. Ghoshal (Reg. No. I7742); Madan Mahal, 13.VI.1975 (2exs.), coll. P.D. Rane (Reg. No. I10736).

Distribution: India: (Andhra Pradesh, Bihar, Madhya Pradesh, Pondicherry, Tripura, West Bengal), Cambodia, Indonesia and Philippines.

35. *Helochaeres pallens* (Macleay, 1825)

1825. *Enhydrus pallens* Macleay, *Annual. Javan.* p. 35.

1926. *Helochaeres pallens*: d' Orchymont, *Ann. Bull. Soc. Ent. Belg.*, 66: 232.

Material: Jabalpur, Bilpathar, Shahpura, 28.0I.1967 (20exs.), coll. V.S. Durve (Reg. No. I3481); Chatarpur village, 15.VI.1970 (15exs.), coll. H.S. Sharma (Reg. No. I6628); Budhagar, 29.0I.1971 (1ex.), coll. H.S. Sharma (Reg. No. I7322); MANDLA, Kanha National Park, 20.III.1979 (31exs.), coll. N.K. Sinha (Reg. No. I12868).

Distribution: India (Andhra Pradesh, Assam, Bihar, Madhya Pradesh, West Bengal), Egypt, Indonesia, Madagascar, Philippines, Syria.

Remarks: This species is recorded for the first time from Madhya Pradesh.

Subfamily SPHAERIDIINAE

Genus *Dactylosternum* Wollaston, 1854

1854. *Dactylosternum* Wollaston, *Ins. Mad.* p. 99.

36. *Dactylosternum abdominal* Fabricius, 1792

1792. *Dactylosternum abdominal* Fabricius, *Entom. Syst.* 1: 98.

1924. *Dactylosternum abdominal*: Knisch, *Col. Cat.*, 14 (79): 115.

Material: Jabalpur, Katni road, 14.IV.1970 (3exs.), coll. V.V. Rao (Reg. No. I64994).

Distribution: India (Andhra Pradesh, Madhya Pradesh, Manipur, West Bengal), North & South America.

Remarks: This species is recorded for the first time from Madhya Pradesh.

Genus *Sphaeridium* Fabricius, 1775

1775. *Sphaeridium* Fabricius, *Syst. Ent.* p. 66.

37. *Sphaeridium dimidiatum* Gory, 1834

1834. *Sphaeridium dimidiatum* Gory, *In Guerin, Icon, regne Anim & Ins*, 73.

1924. *Sphaeridium dimidiatum*: Biswas & Mukhopadhyay, *Fauna of West Bengal, State Fauna Series*, 3(6 A): 151.

Material: Jabalpur, Baleha Tank, Panagar village, 08.0I.1969 (2exs.), coll. H.P. Agarwal & Party (Reg. No. I5359).

Distribution: India (Andhra Pradesh, Madhya Pradesh, West Bengal), China, Indonesia, Nepal, Philippines, Sri Lanka.

Remarks: This species is recorded for the first time from Madhya Pradesh.

38. *Sphaeridium quinque maculatum*

Fabricius, 1798

1798. *Sphaeridium quinque maculatum* Fabricius, *Ent. Syst. Suppl.*, p. 39.

1995. *Sphaeridium quinque maculatum*: Biswas and Mukhopadhyay, *Fauna of West Bengal, State Fauna Series.*, 3: (6 A): 151- 152.

Material: khargone, Bogad, 12.II.1971 (1ex.), coll. V.V. Rao (Reg. No. I7591).

Distribution: India (Bihar, Karnataka, Kerala, Madhya Pradesh, Manipur, Punjab, Rajasthan, Tamil Nadu, Tripura, West Bengal), China, Indonesia, Nepal, Philippines, Sri Lanka.

Remarks: This species is recorded for the first time from Madhya Pradesh.

VI. Family HYDROCHIDAE

Genus *Hydrochus* Leach, 1817

1817. *Hydrochus* Leach, *Zool. Misc.*, III, p. 90.

39. *Hydrochus binodosus* Motschulsky, 1860

1860. *Hydrochus binodosus* Motschulsky, *Schrenka Reis.*, 2: 104.

1995. *Hydrochus binodosus*: Biswas & Mukhopadhyay, *Fauna of West Bengal, State Fauna Series*, 3: (6 A): 149.

Material: Jabalpur, Lametaghat, 11.0I.1967 (1ex.), coll. V.S. Durve (Reg. No. I3406); Baleha Tank, Panagar village, 08.0I.1969 (5exs.), coll. H.P. Agarwal & Party (Reg. No. I5359).

Distribution: India (Assam, Madhya Pradesh, West Bengal), Indonesia, Sri Lanka.

Remarks: This species is recorded for the first time from Madhya Pradesh.

SUMMARY

The study records 39 species of aquatic beetles pertaining to 22 genera and six families namely, Gyrinidae, Haliplidae, Noteridae, Dytiscidae, Hydrophilidae and Hydrochidae. Of these, 12 species are reported for the first time from the state. A list of 85 species of aquatic beetles known from Madhya Pradesh is appended.

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REFERENCES

- Biswas S. & Mukhopadhyay P. 1995: *Insecta: Coleoptera: Fauna of West Bengal, State Fauna Series*, 3(6 A): 1-51, Zoological Survey of India, Kolkata.
- Bistrom O. 1997: Taxonomic revision of the genus *Hydrovatus* Motschulsky (Coleoptera, Dytiscidae). *Entomologica Basiliensia*, **19**: 57-584.
- Brancucci M. 1983b: Révision des espèces est-paléarctiques, orientales et australiennes du genre *Laccophilus* (Col. Dytiscidae). *Entomologische Arbeiten aus dem Museum G. Frey*, **31/32**: 241-426.
- Chandra K. 2008: *Faunal Diversity of Jabalpur District, Madhya Pradesh*, Coleoptera: Dytiscidae, Zoological Survey of India, 159-186.
- Chandra K., Sharma R.M. and Ojha, P. 2010: A Compendium on the Faunal Resources of Narmada River Basin in Madhya Pradesh, *Rec. zool. Surv. India, Occ. Paper* No. **310**: 53-55.
- D'Orchymont A. 1928: *Catalogue of Indian Insects*, Part **14**: 1-146. Govt. of India Publication, Hydrophilidae: Coleoptera.
- Ghosh S.K. & Nilsson A.N. 2012: Catalogue of the diving beetles of India and adjacent Countries (Coleoptera: Dytiscidae). *Skorvnooppn Supplement*, **3**: 1-77.
- Knisch A. 1924: *Coleopterorum Catalogus*, (Schenkling edited), **14**(Pars 79), 306 pp.
- Miller K.B. 2002: Revision of the genus *Eretes* Laporte, 1833 (Coleoptera: Dytiscidae). *Aquatic Insects*, **24**(4): 247-272.
- Nilsson A.N. 2012: A World Catalogue of the Family Noteridae. Version 16.VIII.2011, 54 pp.
- Nilsson A.N. 2013: A World Catalogue of the family Dytiscidae, or the Diving Beetles (Coleoptera, Adephaga). Version 1.I.2013. Umea: distributed electronically as a PDF file by the author, 304 pp.
- Pederzani F. 1995: Keys to identification of the genera and subgenera of adult Dytiscidae (sensu lato) of the world (Coleoptera: Dytiscidae). *Atti. Acc. Rov. Agiati, a.* 244 (1994), ser. Vii, **4**: 5-83.
- Schenkling S. (ed.) 1910-40: *Coleopterorum Catalogus*. 31 vol., 170 pars; W. Junk Publ., The Hague.

- Short Andrew E. Z. & Fikacek Martin 2011: World Catalogue of the Hydrophiloidea (Coleoptera): Additions and Corrections II (2006–2010), *Acta Entomologica Musei Nationalis Pragae*, Volume **51**(1): 83–122.
- Vazirani, T.G. 1969a: Contribution to the study of aquatic beetles (Coleoptera). 2. A review of the subfamilies Noterinae, Laccophilinae, Dytiscinae and Hydroporinae (In part) from India. *Oriental Ins.*, **2**(3 & 4): 221–341.
- Vazirani, T.G. 1969b: Contribution to the study of aquatic beetles (Coleoptera). VI. A review of Hydroporinae: Dytiscidae, in part, from India, *Bull. Mus. Nat. Hist. Nat. Paris* (2) **41**(1): 203–225.
- Vazirani T.G. 1977: Catalogue of Oriental Dytiscidae *Rec. zool. Surv. India, Occ. Pap.* No. **6**: 1–111.
- Vazirani, T.G. 1984: *The Fauna of India*. Coleoptera, Family Gyrinidae and Family Haliplidae; Zoological Survey of India, Calcutta, Pp. 140.
- Wewalka G. 1975: Revision der Artengruppe des *Hydaticus vittatus* (Fabricius), (Dytiscidae, Col.). *Koleopterologische Rundschau*, **52**: 87–100.
- Wewalka, G. 1979: Revision der Artengruppe des *Hydaticus* (Guignotites) *fabricii* (Mac Leay), (Col., Dytiscidae). *Koleopterologische Rundschau*, **54**: 119–139.
- Zhang, Z.Q. 2011: Animal biodiversity: An introduction to higher-level classification and taxonomic richness. *Zootaxa*, **3148**: 07–12.

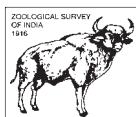
List of aquatic beetle species and sub-species known from Madhya Pradesh

I. Family : GYRINIDAE	
1.	<i>Dineutus (Protodineutus) indicus</i> Aube, 1938
2.	<i>Dineutus (Spinosodineutus) unidentatus</i> (Aube, 1838)
3.	<i>Aulonogyrus obliquus</i> (Walker, 1958)
4.	<i>Gyrinus convexiusculus</i> Macleay, 1871
5.	<i>Orectochilus (Patrus) cardoni</i> Regimbart, 1891
6.	<i>O. (P.) discifer</i> (Walker, 1859)
7.	<i>O. (P.) fletcheri</i> Ochs, 1925
8.	<i>O. (P.) haemorrhous</i> Regimbart, 1891
9.	<i>O. (P.) indicus</i> Regimbart, 1883
10.	<i>O. (P.) limbatus</i> Regimbart, 1883
11.	<i>O. (P.) orissaensis</i> Vazirani, 1958
12.	<i>O. (P.) productus</i> Regimbart, 1883
13.	<i>O. (P.) ritsemae</i> Regimbart, 1882
14.	<i>O. (P.) semivestitus</i> Guerin, 1840
II. Family HALIPLIDAE	
15.	<i>Haliplus (Liaphlus) agarwali</i> Vazirani, 1984
16.	<i>H. (L.) angustifrons</i> Regimbart, 1892
17.	<i>H. (L.) kapuri</i> Vazirani, 1975
18.	<i>H. (L.) pruthii</i> Vazirani, 1966
19.	<i>H. (L.) pulchellus indicus</i> Regimbart, 1899
III. Family NOTERIDAE	
20.	<i>Neohydrocoptus subvittulus</i> (Motschulsky, 1859)
21.	<i>Canthydrus angularis</i> Sharp, 1882
22.	<i>C. laetabilis</i> (Walker, 1858)
23.	<i>C. luctuosus</i> (Aube, 1838)
24.	<i>C. ritsemae</i> (Regimbart, 1880)
IV. Family DYTISCIDAE	
25.	<i>Agabus (Gaurodytes) debilipes</i> Régimbart, 1899
26.	<i>Rhantaticus congestus</i> (Klug, 1832)
27.	<i>Sandracottus dejeani</i> (Aubé, 1838)
28.	<i>S. festivus</i> (Illiger, 1801)
29.	<i>S. mixtus</i> (Blanchard, 1843)
30.	<i>Cybister (Cybister)cognatus</i> Sharp, 1882

31.	<i>C. (C.) confusus</i> Sharp, 1882
32.	<i>C. (C.) concessor</i> Guignot, 1947
33.	<i>C. (C.) limbatus</i> (Fabricius)
34.	<i>C. (C.) pectoralis</i> Sharp, 1882
35.	<i>C. (C.) rugulosus</i> (Redtenbacher, 1844)
36.	<i>C. (C.) tripunctatus lateralis</i> (Fabricius, 1798)
37.	<i>C. (C.) ventralis</i> Sharp, 188
38.	<i>C. (Melanectes) convexus</i> Sharp, 1882
39.	<i>C. (M.) posticus</i> Aube, 1838
40.	<i>C. (M.) sugillatus</i> Erichson, 1834
41.	<i>Eretes griseus</i> (Fabricius, 1781)
42.	<i>Hydaticus (Prodaticus) luczonicus</i> Aube, 1838
43.	<i>H. (P.) incertus</i> Regimbart, 1888
44.	<i>H. (P.) ricinus</i> Wewalka, 1979 *
45.	<i>H. (P.) vittatus vittatus</i> (Fabricius, 1775)
46.	<i>Hydroglyphus flammulatus</i> (Sharp, 1882)
47.	<i>H. geminus</i> (Fabricius, 1792)
48.	<i>H. inconstans</i> (Regimbart, 1892)
49.	<i>H. pendjabensis</i> (Guignot, 1954)
50.	<i>Leiodytes indicus</i> (Regimbart, 1892)
51.	<i>Peschetius quadricostatus</i> (Aube, 1838)
52.	<i>Hydrovatus confertus</i> (Sharp, 1882) *
53.	<i>H. rufescens</i> Motschulsky, 1859
54.	<i>H. sinister</i> Sharp, 1890
55.	<i>Herophydrus musicus</i> (Klug, 1834)
56.	<i>Hyphoporus aper</i> Sharp, 1882
57.	<i>H. elevatus</i> Sharp, 1882
58.	<i>H. severini</i> Régimbart, 1892
59.	<i>Hyphydrus gschwendtneri</i> Guignot, 1942
60.	<i>H. lyratus flavicans</i> Régimbart, 1892
61.	<i>H. renardi</i> Severin, 1890
62.	<i>Laccophilus anticatus anticatus</i> Sharp, 1890
63.	<i>Laccophilus elegans</i> Sharp, 1882*
64.	<i>Laccophilus ellipticus</i> Régimbart, 1899

65.	<i>L. flexuosus</i> Aubé, 1838
66.	<i>L. inefficiens</i> (Walker, 1859)
67.	<i>L. kaszabi</i> Brancucci, 1983
68.	<i>L. parvulus parvulus</i> Aubé, 1838
69.	<i>L. punctatissimus</i> Brancucci, 1983
70.	<i>L. sharpi</i> Régimbart, 1889
71.	<i>L. uniformis</i> Motschulsky, 1859
72.	<i>Neptosternus circumductus</i> Régimbart, 1899
	V. Family HYDROPHILIDAE
73.	<i>Hydrophilus olivaceus</i> (Fabricius, 1781)
74.	<i>Sternolophus rufipes</i> Fabricius
75.	<i>Berosus indicus</i> Motschulsky, 1861
76.	<i>B. pulchellus</i> Macleay, 1825*
77.	<i>Regimbartia attenuata</i> (Fabricius, 1801)
78.	<i>Enochrus esuriens</i> (Walker, 1858) *
79.	<i>Helochares ancholaris</i> Sharp, 1890*
80.	<i>H. crenatus</i> Regimbart, 1903
81.	<i>H. pallens</i> (Macleay, 1825) *
82.	<i>Dactylosternum abdominale</i> Fabricius, 1792 *
83.	<i>Sphaeridium dimidiatum</i> Gory, 1834*
84.	<i>Sphaeridium quinquemaculatum</i> Fabricius, 1798*
	VI. Family HYDROCHIDAE
85.	<i>Hydrochus binodosus</i> Motschulsky, 1860*

* First time recorded from Madhya Pradesh.



AQUATIC BEETLES (COLEOPTERA) OF CHHATTISGARH, INDIA

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INTRODUCTION

With more than 3.8 lakh described species of beetles (Coleoptera) throughout the world (Zhang, 2011), 12,604 species belong to aquatic beetles (Jach and Balke, 2008). Despite the vast fresh water bodies in India, the information on aquatic beetles of several states is still lacking.

The catalogues and review work on aquatic beetles of world are published by Schenkling (1910-40), Knisch (1924), Wewalka (1975 & 1979), Brancucci (1983), Pederzani (1995), Miller (2002), Andrew and Martin (2011), Nilsson [2011 (palcat.) & 2013 (world cat.)], Fery (2003), Toledo (2009). The information on aquatic beetles of India is known through the works of D'Orchymout (1928) and Vazirani (1969a, 1969b, 1977, 1984), where in the species from Central India were also included. Subsequently, Chandra *et. al* (2010) and Ghosh & Nilsson (2012) reported total seventy two aquatic beetle species from Madhya Pradesh. However, the aquatic beetle fauna from Chhattisgarh state was not known. Hence the present work was undertaken.

The present work is based mainly on the collection made by the scientific team of Zoological Survey of India from HQs, Kolkata and Central Zone Regional Centre, Jabalpur from different water bodies of various districts (Surguja, Raipur, Bastar, Korba, Bilaspur and Raigarh) and Barnawapara Wildlife Sanctuary (BWLS)) in Chhattisgarh. The study yielded identification of 19 species of aquatic beetles belonging to 10 genera and 4 families namely Gyrinidae, Noteridae,

Dytiscidae and Hydrophilidae. For current valid names of the taxa, the work on "World catalogue of the Hydrophilidae" by Andrew & Martin (2011), "World catalogue of Noteridae" by Nilsson (2011) and "Catalogue of India & adjacent countries of Dytiscidae" by Ghosh & Nilsson (2012) was followed.

Order COLEOPTERA

I. Family GYRINIDAE

Subfamily ENHYDRINAE

Genus *Dineutus* Macleay, 1825

1825. *Dineutus* Macleay, *Annulosa javanica* ed., 1: 30.

1. *Dineutus (Protodineutus) indicus* Aube, 1938

1938. *Dineutus indicus* Aube, *Species coleopteres*, 6: 772.

Material examined: Surguja dist, Baharghat, 16.I.1975, coll. S.K. Misra (1ex) (Reg. No. I10498); Tiger point, 21.XI.2011, coll. A. Raha & party (2ex); Raipur dist, BWLS, Mohda village, 5.X.2011, coll. S. Gupta & party (5ex); Jagdalpur dist, Makdi FRH, 10.XI.2011, coll. R.P. Gupta & party (3ex).

Distribution: India (Andhra Pradesh, Assam, Bihar, Chhattisgarh, Kerala, Madhya Pradesh, Maharashtra, Manipur, Odisha, Pondicherry, West Bengal), Pakistan.

II. Family NOTERIDAE

Subfamily NOTERINAE

Tribe *Noterini*

Genus *Canthydrus* Sharp, 1882

1882. *Canthydrus* Sharp, *Sci. Trans. R. Dublin Soc.*, 2: 269.

2011. *Canthydrus*: Nilsson, A World Catalogue of the family Noteridae. Version 16.VIII.2011, p. 9.

2. *Canthydrus ritsemae* (Regimbart, 1880)

1880. *Hydrocanthydrus ritsemae* Regimbart, 1880: *Notes Leyden Mus.*, 2: 213.
1977. *Canthydrus ritsemai*: Vazirani, *Rec. zool. surv. India, Occ. paper No*, 6: 8.
2011. *Canthydrus ritsemae*: Nilsson, A World Catalogue of the family Noteridae. Version 16.VIII.2011, p. 17.

Material examined: Surguja dist, Ambikapur, 09.I.1975, coll. H. Khajuria & Party (3ex) (Reg. No. I10465).

Distribution: India (Andhra Pradesh, Assam, Bihar, Chhattisgarh, Madhya Pradesh, Odisha, West Bengal), Thailand, Indonesia, Myanmar, Singapore, Vietnam.

III. Family DYTISCIDAE

Subfamily DYTISCINAE

Tribe ACILIINI

Genus *Sandracottus* Sharp, 1882

1882. *Sandracottus* Sharp, *Sci. Trans. R. Dublin Soc.*, 2: 672.
2012. *Sandracottus*: Ghosh & Nilsson, *Skorvnopparn supplement*, 3: 18.
- ## 3. *Sandracottus dejeani* (Aube, 1838)
1838. *Hydaticus dejeani* Aube, *In Dejeans species Coleopteres*, 6: 165.
2012. *Sandracottus dejeani*: Ghosh & Nilsson, *Skorvnopparn supplement*, 3: 18.

Material examined: Surguja dist, Tiger point, 21.XI.2011, coll. A. Raha & party (4ex).

Distribution: India (Arunachal Pradesh, Andhra Pradesh, Chhattisgarh, Gujarat, Himachal Pradesh, Jharkhand, Kerala, Madhya Pradesh, Maharashtra, Odisha, Rajasthan, Tamil Nadu, Uttarakhand, Uttar Pradesh, West Bengal), Pakistan, Iran, Afrotropical region, Australian region.

Tribe *Cybistrini*

Genus *Cybister* Curtis, 1827

1827. *Cybister* Curtis, *Brit. Entom. Lond.*, 4: 151.
2012. *Cybister*: Ghosh & Nilsson, *Skorvnopparn supplement*, 3: 19.

4. *Cybister (s.str.) cognatus* Sharp, 1882

1882. *Cybister cognatus* Sharp, *Sci. Trans. R. Dublin Soc.*, (2) 2: 744.
2012. *Cybister (s.str.) cognatus*: Ghosh & Nilsson, *Skorvnopparn supplement*, 3: 19.

Material examined: Raipur dist, BWLS, 07.VII.2011, coll. S. Gupta & party (1ex).

Distribution: India (Bihar, Chhattisgarh, Goa, Gujarat, Himachal Pradesh, Jharkhand, Madhya Pradesh, Maharashtra, West Bengal), Indonesia.

5. *Cybister (s.str.) confusus* Sharp, 1882

1882. *Cybister confusus* Sharp, *Sci. Trans. R. Dublin Soc.*, (2) 2: 739.
2012. *Cybister (s.str.) confusus*: Ghosh & Nilsson, *Skorvnopparn supplement*, 3: 19.

Material examined: Raipur dist, BWLS, 07.VII.2011, coll. S. Gupta & party (1ex).

Distribution: India (Bihar, Chhattisgarh, Jharkhand, Karnataka, Madhya Pradesh, Maharashtra, Manipur, Odisha, Tamil Nadu, Tripura, West Bengal), Bangladesh, Pakistan, Sri Lanka.

6. *Cybister (s.str.) cardoni* Severin, 1890

1890. *Cybister cardoni* Severin, *Ann. Soc. ent. Belg.* 34, C.R.: 4(12):193.
2012. *Cybister (s.str.) cardoni*: Ghosh & Nilsson, *Skorvnopparn supplement*, 3: 19.

Material examined: Raipur dist, BWLS, 07.VII.2011, coll. S. Gupta & party (1ex).

Distribution: India (Chhattisgarh, Jharkhand), Bangladesh, Myanmar, Pakistan, Sri Lanka.

7. *Cybister (s.str.) limbatus* (Fabricius, 1775)

1775. *Dytiscus limbatus* Fabricius, *Systema Ent.*, 230.
2012. *Cybister (s.str.) limbatus*: Ghosh & Nilsson, *Skorvnopparn supplement*, 3: 20.

Material examined: Raipur dist, BWLS, 08.VII.2011, coll. S. Gupta & party (1ex).

Distribution: India (Arunachal Pradesh, Bihar, Chhattisgarh, Goa, Gujarat, Jharkhand, Kerala, Madhya Pradesh, Maharashtra, Manipur, Odisha, Tamil Nadu, Tripura, Uttar Pradesh, West Bengal),

Afghanistan, Pakistan, China, Japan, Indonesia, Philippines, Taiwan, Vietnam.

8. *Cybister (s.str.) pectoralis* Sharp, 1882

1882. *Cybister pectoralis* Sharp, *Sci. Trans. R. Dublin Soc.*, **2**: 736.

1977. *Cybister (Melanectes) pectoralis*: Vazirani, *Rec. zool. Surv. India, Occ. Paper No. 6*: 91.

2012. *Cybister (s.str.) pectoralis*: Ghosh & Nilsson, *Skorvnopparn supplement*, **3**: 21.

Material examined: Bastar, 08.I.1974, coll. R.K. Singh (1ex) (Reg. No. No. I9831).

Distribution: India (Andhra Pradesh, Bihar, Chhattisgarh, Madhya Pradesh, Maharashtra, West Bengal).

9. *Cybister (s.str.) tripunctatus lateralis* (Fabricius, 1798)

1798. *Dytiscus lateralis* Fabricius, *Suppl. Entom. Syst.*, p. 64.

1832. *Cybister asiaticus* Sharp: *Sci. Trans. R. Dublin Soc.*, **2**: 731.

1977. *Cybister tripunctatus asiaticus*: Vazirani, *Rec. zool. Surv. India, Occ. Paper No. 6*: 62.

2012. *Cybister (s.str.) tripunctatus lateralis*: Ghosh & Nilsson, *Skorvnopparn supplement*, **3**: 21.

Material examined: Korba dist, Katghora, 24.XI.2011, coll. A. Raha & party (1ex); Pali RH, 25.XI.2011, coll. A. Raha & party (1ex).

Distribution: India (Andaman & Nicobar Islands, Andhra Pradesh, Assam, Chhattisgarh, Delhi, Gujarat, Himachal Pradesh, Jammu & Kashmir, Karnataka, Madhya Pradesh, Maharashtra, Manipur, Meghalaya, Odisha, Rajasthan, Sikkim, Tamil Nadu, Tripura, Uttarakhand, Uttar Pradesh, West Bengal), Afghanistan, Bangladesh, Bhutan, Myanmar, Nepal, Pakistan, Sri Lanka, China, Cyprus, Iran, Iraq, Japan, Kyrgyzstan, Mongolia, Russia, Syria, Tajikistan, Turkmenistan, Turkey, Uzbekistan, Europe.

10. *Cybister (Melanectes) sugillatus* Erichson, 1834

1834. *Cybister sugillatus* Erichson, *Beiträge zur Zoologie, Supplement*, **28**: 227.

2012. *Cybister (Melanectes) sugillatus*: Ghosh & Nilsson, *Skorvnopparn supplement*, **3**: 22.

Material examined: Raipur dist, BWLS, 07.VII.2011, coll. S. Gupta & party (1ex)

Distribution: India (Assam, Bihar, Chhattisgarh, Himachal Pradesh, Madhya Pradesh, Maharashtra, Manipur, Odisha, Sikkim, Tamil Nadu, Tripura, Uttarakhand, Uttar Pradesh, West Bengal), Afghanistan, Bhutan, Myanmar, Nepal, Pakistan, Sri Lanka, China, Indonesia, Japan, Philippines.

Tribe Eretini

Genus *Eretes* Laporte, 1833

1833. *Eretes* Laporte, *Ann. Soc. Entom. France*, **1**: 397.

2012. *Eretes* Laporte: Ghosh & Nilsson, *Skorvnopparn supplement*, **3**: 23.

11. *Eretes griseus* (Fabricius, 1781)

1781. *Dytiscus griseus* Fabricius, *Species Ins.*, **1**: 293.

2012. *Eretes griseus*: Ghosh & Nilsson, *Skorvnopparn supplement*, **3**: 23.

Material examined: Raipur dist, BWLS, 03.VII.2011, coll. K. Chandra & party (1ex).

Distribution: India (Chhattisgarh, Himachal Pradesh, Jammu & Kashmir, Uttar Pradesh), Afghanistan, Bhutan, Nepal, Pakistan, China, Iran, Iraq, Japan, Kuwait, Oman, Russia, Sinai, South Korea, Syria, Turkey, Yemen, Afrotropical region, Australian region, Europe, North Africa.

Remarks: This species is recorded for the first time from Chhattisgarh. This species was earlier reported and identified as *Eretes sticticus* (Linnaeus) from India.

Tribe Hydatcini

Genus *Hydaticus* Leach, 1817

1817. *Hydaticus* Leach, *zool. Miscell.*, **3**: 69.

2012. *Hydaticus* Leach: Ghosh & Nilsson, *Skorvnopparn supplement*, **3**: 24.

12. *Hydaticus (Prodaticus) ricinus* Wewalka, 1979

1979. *Hydaticus ricinus* Wewalka, *Koleopterologische Rundschau*, **54**: 128.

2012. *Hydaticus (Prodaticus) ricinus*: Ghosh & Nilsson, *Skorvnoopparn supplement*, 3: 27.

Material examined: Raipur dist, BWLS, 08.VIII.2011, coll. S. Gupta & party (1ex).

Distribution: India (Assam, Chhattisgarh, Tamil Nadu), Afghanistan, Bhutan, Myanmar, Nepal, Pakistan, Sri Lanka, China, Laos, Thailand, Vietnam.

Subfamily LACCOPHILINAE

Genus *Laccophilus* Leach, 1815

1815. *Laccophilus* Leach, *the Edinburgh encyclopaedia*, 9(1): 84.

2012. *Laccophilus* Leach: Ghosh & Nilsson, *Skorvnoopparn supplement*, 3: 46.

13. *Laccophilus elegans* Sharp, 1882

1882. *Laccophilus elegans* Sharp, *Sci. Trans, R. Dublin Soc.*, 2: 302.

2012. *Laccophilus elegans*: Ghosh & Nilsson, *Skorvnoopparn supplement*, 3: 47.

Material examined: Bilaspur dist, 08.III.1992, coll. U.A. Gajbe (1ex) (Reg. No. I14980).

Distribution: India (Andaman & Nicobar Islands, Andhra Pradesh, Bihar, Chhattisgarh, Karnataka, Madhya Pradesh, Nagaland, Odisha, West Bengal), Vietnam.

14. *Laccophilus ellipticus* Regimbart, 1889

1889. *Laccophilus ellipticus* Regimbart, *Ann. Soc. Ent. Fr.*, (6) 9: 152.

2012. *Laccophilus ellipticus*: Ghosh & Nilsson, *Skorvnoopparn supplement*, 3: 47.

Material examined: Bilaspur dist, 09.III.1992, coll. U.A. Gajbe (1ex) (Reg. No. I14987).

Distribution: India (Andhra Pradesh, Assam, Bihar, Chhattisgarh, Goa, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Meghalaya, Odisha, Pondicherry, Tamil Nadu, West Bengal), Myanmar, Sri Lanka, China, Cambodia, Indonesia, Thailand, Vietnam.

15. *Laccophilus inefficiens* (Walker, 1859)

1859. *Hydroporus inefficiens* Walker, *Ann. Mag. Nat. Hist*, 3: 51.

2012. *Laccophilus inefficiens*: Ghosh & Nilsson, *Skorvnoopparn supplement*, 3: 49.

Material examined: Bastar dist, 09.I.1974, coll. R.K. Singh & party (1ex) (Reg. No. I9852); Sarguja dist, Bharaghat nala, 16.I.1974, coll. S.K. Misra (60 ex) (Reg. No. I10497).

Distribution: India (Andaman & Nicobar Islands, Andhra Pradesh, Assam, Bihar, Chhattisgarh, Goa, Gujarat, Himachal Pradesh, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Manipur, Meghalaya, Odisha, Punjab, Rajasthan, Sikkim, Tripura, Tamil Nadu, Uttarakhand, Uttar Pradesh, West Bengal), Bangladesh, Bhutan, Myanmar, Nepal, Pakistan, Sri Lanka, Indonesia, Iran, Malaysia.

16. *Laccophilus uniformis* Motschulsky, 1859

1859. *Laccophilus uniformis* Motschulsky, *Etudes Entom.*, 8: 46.

2012. *Laccophilus uniformis*: Ghosh & Nilsson, *Skorvnoopparn supplement*, 3: 52.

Material examined: Bilaspur, Katani, 06.VI.2000, coll. Y.N. Gupta, (1ex) (Reg. No. I8796).

Distribution: India (Andaman & Nicobar Is., Andhra Pradesh, Assam, Bihar, Chhattisgarh, Delhi, Madhya Pradesh, Manipur, Odisha, Sikkim, West Bengal), Bangladesh, Myanmar, Sri Lanka, Cambodia, China, Indonesia, Laos, Thailand, Vietnam.

IV. Family HYDROPHILIDAE

Subfamily HYDROPHILINAE

Tribe *Hydrophilini*

Genus *Hydrophilus* Muller, 1764

1764. *Hydrophilus* Muller, *Fauna Ins. Fridrichsdalina*, p. 16.

17. *Hydrophilus olivaceous* Fabricius, 1781

1781. *Hydrophilus olivaceous* Fabricius, *Spec. ins.*, 1: 289.

Material examined: Rajgarh dist, Betwa River, 03.X. 1995, coll. H.S. Sharma & Party (3ex) (Reg. No. I25583).

Distribution: India (Andhra Pradesh, Chhattisgarh, Madhya Pradesh, Maharashtra, Manipur, West Bengal).

Genus ***Sternolophus*** Solier, 1834

1834. *Sternolophus* Solier, *Ann. Soc. ent. Fr.*, 3: 302, 310.

18. ***Sternolophus rufipes*** (Fabricius, 1792)

1792. *Hydrophilus rufipes* Fabricius, *Entom. Syst*, 1: 183.

Material examined: Raipur dist, BWLS, 30.VII.2011, coll. S. Gupta & party (1ex); Latadodar, 27.IX.2011 (2ex); Jagdalpur dist, Makdi Forest Rest House, 08.XI.2011 (2ex); 10.XI.2011, coll. R.P. Gupta & party (1ex).

Distribution: India (Andhra Pradesh, Bihar, Chhattisgarh, Jammu & Kashmir, Maharashtra, Meghalaya, Manipur, Punjab, Sikkim, Tripura, Uttar Pradesh, West Bengal), Sunda Is., Myanmar, Philippines, Japan, Formosa, Indonesia, Indochina, China, Sri Lanka.

Tribe **Acidocerini**

Genus ***Helochaeres*** Mulsant, 1844

1844. *Helochaeres* Mulsant, *Hist. Nat. Col. Fr., Palp.*, p. 197.

19. ***Helochaeres crenatus*** Regimbart, 1903

1903. *Helochaeres crenatus* Regimbart, *Ann. Soc. Ent. Fr.*, 72: 54.

Material examined: Surguja dist, Baharghat, 06.I. 1975, coll. H. Khajuria (3ex) (Reg. No. I10442).

Distribution: India: (Andhra Pradesh, Bihar, Chhattisgarh, Madhya Pradesh, Pondicherry, Tripura, West Bengal), Cambodia, Indonesia, Philippines.

SUMMARY

The study comprises of 19 species of aquatic beetles belonging to 10 genera and 4 families namely Gyrinidae, Noteridae, Dytiscidae and Hydrophilidae. All the species are reported for the first time from Chhattisgarh state.

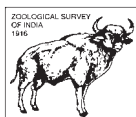
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REFERENCES

- Andrew, E. Z. Short and Martin, Fikacek 2011: World Catalogue Of The Hydrophiloidea (Coleoptera): Additions And Corrections II (2006–2010), *Acta Entomologica Musei Nationalis Pragae*, Volume, **51**(1): 83–122.
- Brancucci, M. 1983: Révision des espèces est-paléarctiques, orientales et australiennes du genre *Laccophilus* (Col. Dytiscidae). *Entomologische Arbeiten aus dem Museum G. Frey*, **31/32**: 241-426.
- Chandra, K., Sharma R.M. and Ojha, P. 2010: A Compendium on the Faunal Resources of Narmada River Basin in Madhya Pradesh, *Rec. zool. Surv. India, Occ. Paper No.* **310**: 53-55.
- D'Orchymont, A. 1928: *Catalogue of Indian Insects*, Part **14**: 1-146. Govt. of India Publication, Hydrophilidae: Coleoptera.
- Fery H. 2003: Taxonomic and distributional notes on *Hygrotus* Stephens, with emphasis on the Chinese fauna and a key to the Palearctic species. Pp. 133-193. In: Jäch M.A. & Ji L. (Eds.): *Water beetles of China*, Vol. 3. Wien: Zoologisch-Botanische Gesellschaft in Österreich and Wiener Coleopterologenverein, vi + 572 pp
- Ghosh, S.K. & Nilsson, A.N. 2012: Catalogue of the diving beetles of India and adjacent countries (Coleoptera: Dytiscidae). *Skorvnopparn Supplement*, **3**: 1-77.
- Jach, M. and Balke, M. 2008. Global diversity of water beetles (Coleoptera) in freshwater. Pp. 419-442. In E.V. Balian, C. Leveque, H. Segers, and K. Martens (guest eds.). *Freshwater Animal Diversity Assessment. Hydrobiologia*, 595.

- Knisch, A. 1924: *Coleopterorum Catalogus*, (Schenkling edited) 14(Pars 79), 306 pp.
- Miller, K.B. 2002: Revision of the genus *Eretes* Laporte, 1833 (Coleoptera: Dytiscidae). *Aquatic Insects*, **24**(4): 247-272.
- Nilsson, A.N. 2011: *A World Catalogue of the family Noteridae*. Version 16.VIII.2011, 54 pp.
- Nilsson, A.N. 2013: *A World Catalogue of the family Dytiscidae*, or the Diving Beetles (Coleoptera, Adephaga). Version 1.I.2013. Umea: distributed electronically as a PDF file by the author, 304 pp.
- Pederzani, F. 1995: Keys to identification of the genera and subgenera of adult Dytiscidae (sensu lato) of the world (Coleoptera: Dytiscidae). *Atti. Acc. Rov. Agiati*, a. 244 (1994), ser. vii, **4**: 5-83.
- Schenkling, S. (ed.) 1910- 40: *Coleopterorum Catalogus*. 31 vol., 170 pars; W. Junk Publ., The Hague.
- Toledo M. 2009: Revision in part of the genus *Nebrioporus* Régimbart, 1906, with emphasis on the *N. laeviventris* group (Coleoptera: Dytiscidae). *Zootaxa*, **2040**: 1-111
- Vazirani, T.G. 1969a: Contribution to the study of aquatic beetles (Coleoptera). 2. A review of the subfamilies Noterinae, Laccophilinae, Dytiscinae and Hydroporinae (in part) from India. *Oriental Insects*, **2**(3 & 4): 221-341.
- Vazirani, T.G. 1969b: Contribution to the study of aquatic beetles (Coleoptera). VI. A review of Hydroporinae: Dytiscidae, in part, from India, *Bull. Mus. Nat. Hist. Nat. Paris* (2) **41**(1): 203-225.
- Vazirani, T.G. 1977: Catalogue of Oriental Dytiscidae. *Rec. zool. Surv. India, Occ. paper*, **6**: 1-111.
- Vazirani, T.G. 1984: *The Fauna of India*. Coleoptera, Gyrinidae and Haliplidae; Zoological Survey of India, Calcutta, Pp. 140.
- Wewalka G. 1975: Revision der Artengruppe des *Hydaticus vittatus* (Fabricius), (Dytiscidae, Col.). *Koleopterologische Rundschau*, **52**: 87-100.
- Wewalka, G. 1979: Revision der Artengruppe des *Hydaticus* (Guignotites) *fabricii* (Mac Leay), (Col., Dytiscidae). *Koleopterologische Rundschau*, **54**: 119-139.
- Zhang, Z.Q. 2011. Animal biodiversity: An introduction to higher-level classification and taxonomic richness. *Zootaxa*, **3148**: 07-12.



SEVEN NEW RECORDS OF FISHES FROM ANDAMAN ISLANDS

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INTRODUCTION

Andaman Nicobar Islands situated in the Bay of Bengal between 6°45' -13 45' N and 92°10' - 94°15' E consist of 352 islands 220 islets and rock. It covers a distance of almost 470 km over North South, with a coastline of 1962 km, and brings in for India an Exclusive Economic Zone (EEZ) of 600 thousand sq km. The coast is under the influence of a diverse set of oceanographic and ecological conditions. The shelf topography of these islands show frequent rises supporting coral reefs, which are characterized as fringing reefs on the eastern side and barrier reefs off west coast; the depressions are known as passages and straits. Besides coral reefs, the shore is composed of rocky and sandy areas and vast stretches of mangrove swamps, also few freshwater rivers and streams.

A comprehensive and authoritative account of fishes of the Indian region including Andaman and Nicobar Islands was published by Francis Day (1870, 1875-78 and 1888). Herre (1941) listed 490 species of fishes. Talwar (1990) prepared a comprehensive list of fishes consisting of 724 species, followed by a supplementary list by Kamla Devi (1991) containing 71 species of fish. The recent developments in the fish taxonomy of these Islands are the works by Kamla Devi and Rajan (1991), Mishra and Krishnan (1992), Krishnan and Mishra (1992), Dhandapani and Mishra (1993), Rajan (2001 a, 2001b, 2003, 2009), Rajan *et al.* (1992, 1993a, 1993b, 2012), Kamla Devi *et al.* (1993), Kamla Devi and Rao (1997, 2003a, 2003b, 2007), Rao *et al.* (1992, 1992a,

1992b, 1994, 1993a, 1993b, 1997, 2000), Rao (2003, 2009), Rao and Kamla Devi (1996, 1997a, 1997b, 1998, 2004), Soundararajan and Dam Roy (2004), Remadevi *et al.* (2010) Rajaram *et al.* (2007), Ramakrishna *et al.*, 2010, Smith-Vaniz, 2011 and Smith-Vaniz and Allen (2012).

MATERIALS AND METHODS

The new records of fishes were made by fish sampling during the field surveys in the coral reef areas, mangrove habitats and freshwater streams. The identified fishes were deposited in the reference collection of Zoological survey of India, Port Blair. Taxonomic classification follows Nelson (2006).

RESULTS AND DISCUSSION

The last few years represent a significant increase of knowledge about the fishes of Andaman and Nicobar Islands. During this study 7 new record of fishes were recorded under 2 orders, 4 families and 7 genera as *Rasbora hobelmani* Kottelat, 1984, *Pogonoperca ocellata* Gunther, 1859, *Apogonichthyoides nigripinnis* (Cuvier, 1828), and the gobies *Acentrogobius janthinopterus* (Bleeker, 1853), *Aulopareia koumansii* (Herre 1937), *Oligolepis acutipennis* (Valenciennes, 1837) and *Psammogobius biocellatus* (Valenciennes, 1837), are associated with coral reef, mangrove and freshwater habitats. With the exception of *Rasbora hobelmani*, collected from North Andaman, all the other species were collected from South Andaman.

SYSTEMATICS

Class ACTINOPTERYGII

Order CYPRINIFORMES

Family CYPRINIDAE

Rasbora hobelmani Kottelat, 1984

Kottelat Rasbora

1984. *Rasbora hobelmani* Kottelat, *Rev. Suisse Zool.*, **91**(3): 718, fig. 1 (Type locality: Chiangmai Province, Thailand).

Material examined: Kalpong River, North Andaman; 1 ex.; 5.5 cm; P.T Rajan.

Diagnostic characters: Dorsal soft rays 10; Anal soft rays 8; Lateral line complete with 25 scales. Body elongate; mouth moderate, obliquely directed upwards; dorsal fin inserted behind base of pelvic fins; caudal fin forked; lateral line complete. Body silvery-brown, more grayish on back and head; a black stripe from upper edge of branchial opening to base of caudal fin, the stripe expanded in an irregularly shaped spot on caudal peduncle, lateral stripe being wider on the body between opercle and vertical of dorsal fin than on the caudal peduncle; crescentic brown basal markings on scales; a black stripe at anal fin base; fins hyaline. Attains 7 cm.

Habitat: Found from midwater to surface in pools of small upland freshwater streams.

Distribution: Asia: eastern Myanmar, northern Thailand and the Mekong basin; North Andaman (Kalpong River), Andaman Islands.

Remarks: First report from India



Rasbora hobelmani (freshly dead specimen)

Order PERCIFORMES

Family SERRANIDAE

Pogonoperca ocellata Gunther, 1859 Bearded Soapfish

1859. *Pogonoperca ocellata*, Gunther, *A. Catalogue of the fishes in the British Museum*, **1**: 169. (Type locality: Mauritius, Mascarenes, southwestern Indian Ocean).

2012. *Pogonoperca ocellata* Allen and Erdmann. *Reef fishes of the East Indies*: 305.

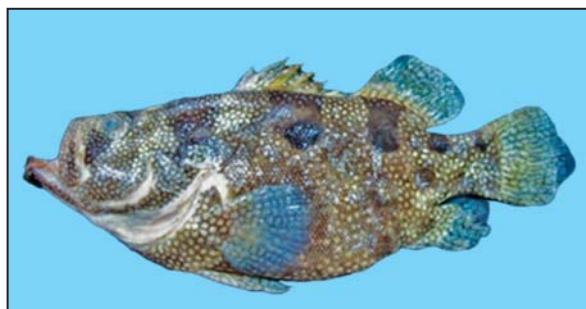
Material examined: Junglighat fish market, South Andaman; 1 ex.; 8.6 cm; P.T Rajan.

Diagnostic characters: Dorsal fin with 8 spines and 12 rays; Anal fin with 3 spines and 8 soft rays; pectoral fin rays 18; pelvic fins short, 1.7 to 2 times in head length; Body oblong, mouth large, the maxilla extending to or slightly beyond a vertical through centre of eye; upper preopercular margin with 3 to 5 short spines; margins of subopercle and interopercle smooth; a flat fleshy flap as large as eye oriented transversely on tip of chin; the spinous portion nearly separated from the soft portion by a deep notch; caudal fin rounded. Colour: brown, somewhat blotched, with numerous dark-edged small white spots on head, body and basally on fins; 4 triangular black saddles on back, the first on nape and the last anteriorly on caudal peduncle.

Habitat: Occurs on coral reefs.

Distribution: Indian Ocean, India, Andaman Islands.

Remarks: First report from India



Pogonoperca ocellata (freshly dead specimen)

Family APOGONIDAE

Apogonichthyoides nigripinnis (Cuvier, 1828)

Bulls-eye Cardinal

1828. *Apogon nigripinnis* Cuvier, in Cuvier & Valenciennes *Histoire naturelle des poissons*, **2**: 152. (Type locality: Java, Indonesia; Puducherry, India).

2010. *Apogonichthyoides nigripinnis* Fraser and Allen. *Zootaxa* No. 2348: 44.

Material examined: Sippyghat, South Andaman; 1 ex.; 5.8 cm; P.T Rajan.

Diagnostic characters: Dorsal fin VIII spines and 9 soft rays; Anal fin II spines and 8 soft rays; Pectoral 15 rays; Lateral line with 28 scales; predorsal scales 2. Low hump above eyes; teeth villiform posteriorly on jaws and vomer, becoming larger and incurved anteriorly; caudal fin truncate. Body with a dark vertical bar under each dorsal and another on caudal base; large ocellus above pectoral; ventral black; pectoral light and other fins dusky to dark. Attains 10 cm.

Habitat: Mud bottoms of estuaries and mangroves.

Distribution: Indo-West Pacific, Red Sea and south to Delagoa Bay; Sippyghat (Andaman Islands).

Remarks: First report from Andaman Islands.



Apogonichthyoides nigripinnis (freshly dead specimen)

***Acentrogobius janthinopterus* (Bleeker, 1853)**
Green-spotted Goby

1853. *Gobius janthinopterus*, Bleeker, *Natuurkundig Tijdschrift voor Nederlandsch Indie* v. 3 (no. 5): 702. (Type locality: Waihai, Ceram, Indonesia).

2012. *Acentrogobius janthinopterus* Allen and Erdmann Reef fishes of the East Indies, Vol. 3: 954.

Material examined: Sippyghat, South Andaman; 1 ex.; 6.2 cm; P.T. Rajan.

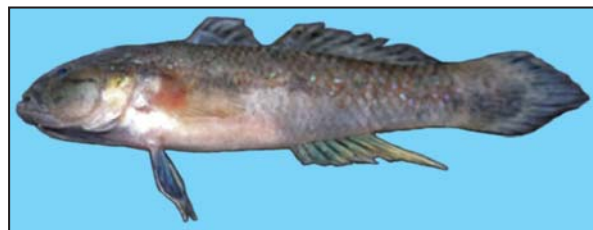
Diagnostic characters: Dorsal fin with VII spines and 10 soft rays; Anal fin with I spine and 10 rays; Pectoral fin 16 rays; Longitudinal scales series 32. Spines of first dorsal fin elongate and filamentous in male; caudal fin rounded, about equal to or slightly longer than head; predorsal scales 2; scales to just behind eyes; upper half of cheek

scaled and opercle fully scaled. Pale grayish to light brown with brown mottling on back, horizontal row of about five brown blotches along midside, scattered iridescent green flecks and submarginal dark band on caudal fin.

Habitat: Mud bottoms of estuaries, mangroves and occasionally in the vicinity of reefs if mangroves nearby.

Distribution: Sumatra to Australia, north to Japan; ranges throughout most of East Indian region; Sippyghat (Andaman Islands).

Remarks: First report from India



Acentrogobius janthinopterus (freshly dead specimen)



Acentrogobius janthinopterus (Preserved specimen)

***Aulopareia koumansii* (Herre 1937)**
Kouman's Goby

1937. *Gnatholepis koumansii*, Herre, in Herre & Myers *Bulletin of the Raffles Museum* No. 13: 39, Pl. 1. (Type locality: Malacca Straits, 100 miles west of Singapore, off the northern coast of Sumatra, Indonesia).

2001. *Aulopareia koumansii*, Larson and Murdy In: Carpenter & Niem, *The living marine resources of the western central Pacific*. Bony fishes part 4 FAO, Rome. v. 6: iii-v; 3595.

Material examined: Sippyghat, South Andaman; 1 ex.; 4.4 cm; P.T. Rajan.

Diagnostic characters: Dorsal fin with VII spines and 10 soft rays; Anal fin I spine and 9 rays; Longitudinal scale series 29; Lateral transverse scales 10; Predorsal scales 16. Body elongate, compressed; eye small; mouth oblique,

lower jaw prominent; teeth in 3-4 rows, outer row enlarged; both the jaws with a canine on each side; isthmus broad; head scaled behind eyes; cheek with 6 longitudinal rows of scales, between which 4 longitudinal mucous canals; opercle scaled; first dorsal fin lower than body, 3rd ray longest; 2nd dorsal and anal fins becoming higher posteriorly. Body pale brownish and each scale bearing a pearl coloured spot; over nape a narrow black stripe; caudal fin dusky and all other fins black.

Habitat: Marine in mangrove creeks.

Distribution: Western Pacific and Sippyghat (Andaman Islands).

Remarks: First report from India.



Aulopareia koumansii (freshly dead specimen)

Oligolepis acutipennis (Valenciennes, 1837)
Sharp-tail Goby

1837. *Gobius acutipennis*, Valenciennes, in Cuvier & Valenciennes *Histoire naturelle des poissons*, 12: 80. (Type locality: Malabar, India).

1991. *Oligolepis acutipennis*, Talwar and Jhingran, *Inland Fishes of India and Adjacent Countries*, 2: 939.

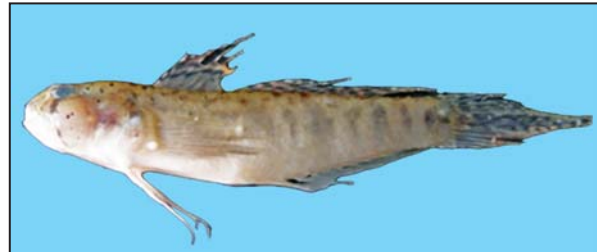
Material examined: Sippyghat, South Andaman; 1 ex.; 8.9 cm; P.T Rajan.

Diagnostic characters: Dorsal fin with VII spines and 10 rays; Anal fin I spine and 10 rays; Pectoral fin 20 rays; Longitudinal scales series 27. Body elongate and compressed; mouth oblique; tongue largely fused to floor of mouth, its tip free; dorsal spines 3rd to 5th prolonged and filamentous in male; predorsal and pectoral fin base scaleless. Body brownish with numerous dark blotches along back and a black blotch at caudal fin base; a black bar from eye to cheek; fins hyaline to dusky, often spotted. Attains 15 cm.

Habitat: Found in muddy estuaries and coastal bays, enters lower reaches of freshwater streams.

Distribution: Indo-West Pacific: Natal, South Africa to Indonesia and the western Pacific; Sippyghat (Andaman Islands).

Remarks: First report from Andaman Islands.



Oligolepis acutipennis (freshly dead specimen)

Psammogobius biocellatus (Valenciennes, 1837) Sleepy Goby

1837. *Gobius biocellatus*, Valenciennes, in Cuvier & Valenciennes *Histoire naturelle des poissons*, 12: 73. (Type locality: Puducherry, India).

2001. *Psammogobius biocellatus*, Larson, and Murdy, In: Carpenter & Niem. *The living marine resources of the western central Pacific*, 6: iii- v. 3599.

Material examined: Sippyghat, South Andaman; 1 ex.; 7.2 cm; P.T Rajan.



Psammogobius biocellatus (freshly dead specimen)

Diagnostic characters: Dorsal fin with VII spines and 9 rays; Anal fin 1 spine and 8 rays; Pectoral with 17 rays; Scales in lateral series 28; lateral transverse scales 8; predorsal scales 15. Body is cylindrical and tapers towards the tail; head is big, triangular at the snout, mouth is large; with the lower jaw slightly longer than the upper jaw; eyes near the top of the head, large and placed close to one another; branchiostegal membranes form a free fold across isthmus. Body dark brown to black, with longitudinal rows of small black spot; 2-3 saddles on back and side; black 1st dorsal fin; dark cross-bands on pelvic fins; iris with a lappet dorsally covering part of pupil. Attains 12 cm.

Habitat: Inhabits intertidal areas, estuaries, lagoons and coastal rivers. Common in the mangroves.

Distribution: Indo-Pacific; Sippyghat (Andaman Islands).

Remarks: First report from Andaman Islands.

CONCLUSIONS

It appears that the Andaman and Nicobar Islands coast has a regular connectivity with the south-eastern coast of Indonesia and north-eastern coast of Burma as observations of tropical affinity species. The fish diversity in these waters also receives special interest in terms of marine zoo-geography because of the confluence of Andaman Sea fishes with Western Pacific and the Eastern Indian Ocean. Long-term monitoring studies will allow a better understanding of distribution patterns along the

coast of Andaman and Nicobar Islands as well as the possible establishment of new populations of species. Review of literature revealed that *Rasbora hobelmani* Kottelat 1984, *Pogonoperca ocellata* Gunther 1859, *Acentrogobius janthinopterus* (Bleeker 1853) and *Aulopareia koumansii* (Herre 1937) are new additions to Indian waters and *Apogonichthyoides nigripinnis* (Cuvier, 1828), *Oligolepis acutipennis* (Valenciennes, 1837) and *Psammogobius biocellatus* (Valenciennes, 1837) are new additions to Andaman Islands. Addition of these seven new records of fishes resulted a total of 1434 species to the fish diversity of Andaman and Nicobar Islands, under 576 genera belonging to 33 orders and 165 families.

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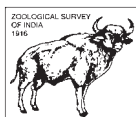
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REFERENCES

- Day, F. 1870. On the fishes of the Andaman and Nicobar Islands. *Proc. Zool. Soc. Lond.*, : 677-705.
- Day, F. 1875-78. The Fishes of India being a natural history of the fishes known to inhabit the seas and freshwaters of India, Burma and Ceylon. 4 pts. London, 778 pp.
- Day, F. 1888. Fishes of India. Supplement. William Dawson, London, : 779-816.
- Devi, K. 1991. Supplementary list to the fishes of Bay Islands. *J. Andaman Sci. Assoc.*, 7(2): 101-103.
- Devi, K. and D.V. Rao, 1997. New records of reef fishes from Andaman waters. *J. Andaman Sci. Assoc.*, 13(1&2): 104-106.
- Devi, K. and D.V. Rao, 2003 a. Poisonous and venomous fishes of Andaman Islands, Bay of Bengal. *Rec. zool. Surv. India, Occ. Paper No.*, 211: 1-71.
- Devi, K. and D.V. Rao, 2007. Mangrove Ichthyofauna of Andaman and Nicobar Islands, Bay of Bengal. Z.S.I., Port Blair, 228 pp.
- Devi, K., and D. V. Rao, 2003 b. A field guide to the fishes of Acanthuridae (Surgeon fishes) and Siganidae (Rabbit fishes) of Andaman and Nicobar Islands. Zoological Survey of India, Kolkata. Pp 42.
- Devi, K., D.V. Rao and P.T. Rajan, 1993. New records of wrasses (Labridae) and parrot fishes (Scaridae) from Andaman Islands. *J. Andaman Sci. Assoc.*, 11(1&2): 76-78.
- Dhandapani, P. and S.S. Mishra, 1993. New records of marine fishes from Great Nicobar. *J. Andaman Sci. Assoc.*, 9(1&2): 58-62.

- Herre, A.W.C.T. 1941. List of the fishes known from the Andaman Islands. *Mem. Indian Mus.*, **13**(3): 331-403.
- Krishnan, S. and S.S. Mishra, 1992. New records of the fishes from Andaman and Nicobar Islands. *J. Andaman Sci. Assoc.*, **8**(1): 82-84.
- Mishra, S.S. and S. Krishnan, 1992. Further new records of fishes from Andaman Islands. *J. Andaman Sci. Assoc.*, **8**(2): 175-177.
- Nelson, J. S. 2006. *The fishes of the world*. John Wiley & Sons, New York, 423pp.
- Rajan, P.T. 2001 a. A field guide to Grouper and Snapper fishes of Andaman and Nicobar Islands. Z.S.I., Port Blair, 103 pp.
- Rajan, P.T. 2001 b. New record of a Jawfish, *Opistognathus nigromarginatus* Ruppell (Perciforms : Opistognathidae) from Andaman and Nicobar Islands. *Geobios*, **28**(23): 171-172.
- Rajan, P.T. 2003. *A field Guide to Marine Food Fishes of Andaman and Nicobar Islands*. Z.S.I., Kolkata, 260 pp.
- P.T. Rajan, 2009. *Guide to Chaetodontidae (Butterflyfishes)) and Scaridae (Parrot fishes) of Andaman and Nicobar Islands*:1-94, (Publishes by the Director, Zoological Survey of India, Kolkata).
- Rajan, P.T., D.V. Rao and K. Devi, 1992. New records of butterfly fishes from Andaman Islands. *J. Andaman Sci. Assoc.*, **8**(2): 172-174.
- Rajan, P.T., D.V. Rao and K. Devi, 1993. New records of fusilier fishes (Family: Caesionidae) from Andaman Sea. *J. Andaman Sci. Assoc.*, **9**: 76-78.
- Rajan, P.T., D.V. Rao, K. Devi and S. Dey, 1993. New records of rare fishes from Andaman Islands. *J. Andaman Sci. Assoc.*, **9**(1&2): 103-106.
- Rajan, P.T., Sreeraj, C.R. and Venkataraman, K., 2012. Diversity and abundance of chondrichthian fishes in Andaman and Nicobar Islands. in K. Venkataraman, Raghunathan, C and Sivaperuman, c. et al. (Eds). *Ecology of faunal communities on the Andaman and Nicobar Islands*. Springer-Verlag Berlin Heidelberg: 117-126.
- Rajaram, R., M. Srinivasan, A.S. Khan, L. Kannan, D.V. Rao and K. Devi, 2007. New records of two eel fishes from Great Nicobar Island, Bay of Bengal. *J. Bombay nat. Hist. Soc.*, **104**: 228-229.
- Ramakrishna, Titus Immanuel. Sreeraj, C.R., Raghunathan, C., Raghuraman, R., Rajan, P.T. and Yogesh Kumar, J.S. 2010. An account of additions to the Ichthyofauna of Andaman and Nicobar Islands. *Records of the Zoological Survey of India, Occasional Paper no. 326*: 1-140 (Published-Director, Zool. Surv. India, Kolkata).
- Rao, D. V., K. Devi and P.T. Rajan, 1997. New records of fishes from Andaman and Nicobar Islands. *Environ. Ecol.*, **15**: 107-112.
- Rao, D.V. and K. Devi, 1996. Notes on rabbit fishes (family: Siganidae) of Andaman and Nicobar Islands. *J. Andaman Sci. Assoc.*, **12**(1&2): 84-88.
- Rao, D.V. and K. Devi, 1997 a. Emperor fishes (Family: Lethrinidae) of Andaman and Nicobar Islands. *Environ. Ecol.*, **15**: 899-903.
- Rao, D.V. and K. Devi, 1997 b. Snappers (Family: Lutjanidae) of Andaman and Nicobar Islands. *Environ. Ecol.*, **15**: 924-931.

- Rao, D.V. and K. Devi, 1998. Fusilier fishes (Family: Caesionidae) of Andaman and Nicobar Islands. *Environ. Ecol.*, **16**: 760-771.
- Rao, D.V. and K. Devi, 2004. A Pictorial Guide to Butterfly and Anemone fishes of Andaman & Nicobar Islands. Z.S.I., Kolkata, 78 pp.
- Rao, D.V., 2003. Guide to Reef Fishes of Andaman and Nicobar Islands. Z.S.I., Kolkata, 555 pp.
- Rao, D.V., 2009. Checklist of fishes of Andaman and Nicobar Islands, Bay of Bengal. *Environ. Ecol.*, **27**(1a): 334-353.
- Rao, D.V., K. Devi and P.T. Rajan 2000. An account of Ichthyofauna of Andaman & Nicobar Islands, Bay of Bengal. *Rec. zool. Surv. India, Occ. Paper No.*, **178**: 1-434.
- Rao, D.V., K. Devi and P.T. Rajan, 1992 a. New records of tetraodontiform fishes from Andaman and Nicobar Islands. *J. Andaman Sci. Assoc.*, **8**(2): 115-120.
- Rao, D.V., K. Devi and P.T. Rajan, 1992 b. Some new records of wrasses (family : Labridae) from Andaman and Nicobar Islands. *J. Andaman Sci. Assoc.*, **8**(1): 43-46.
- Rao, D.V., K. Devi and P.T. Rajan, 1993 a. Addition to the fish fauna to the Andaman and Nicobar Islands. *Environ. & Ecol.*, **11**(4): 882-887.
- Rao, D.V., K. Devi and P.T. Rajan, 1993 b. Further new records of fishes from Bay Islands. *J. Andaman Sci. Assoc.*, **9**(1&2): 50-57.
- Rao, D.V., K. Devi and P.T. Rajan, 1994. Additions to the Ichthyofauna of Bay Islands. *J. Andaman Sci. Assoc.*, **10**(1&2): 28-31.
- Rao, D.V., P.T. Rajan and K. Devi, 1992. New records of groupers (Family : Serranidae) and cardinal fishes (Family : Apogonidae) from Andaman & Nicobar Islands. *J. Andaman Sci. Assoc.*, **8**(1): 47-52.
- Rema Devi, K. 2010. Freshwater fishes of Andaman Islands. In: Ramakrishna, Raghunathan, C and Sivaperuman (Eds), *Recent trends in Biodiversity of Andaman and Nicobar islands*: 329-339. (Published by the Director, Zool. Sur. India, Kolkata).
- Soundarajan, R and S. Dam Roy, 2005. Distributional records and biological notes on two deep sea shark *Centrophorus axis* Garnan and *Squalus megalops* (Macleay) from Andaman waters. *J. Mar. Biol. Assoc. India*, **46**(2). 178-184.
- Smith-Vaniz, W.F. 2011. *Opistognathus albicaudatus*, a new species of jawfish (Teleostei: opistognathidae) from the Andaman Islands. *Zootaxa*, **3085**: 34-40.
- Smith-Vaniz, W. F. & Allen, G. R. 2012. *Alloblennius frondiculus*, a new species of blenny from the Andaman Islands. (Teleostei: Blenniidae: Salariini). *Zootaxa*, **3199**: 60-65.
- Talwar, P.K. 1990. Fishes of the Andaman and Nicobar Islands: A Synoptic analysis. *J. Andaman Sci. Assoc.*, **6**(2): 71-102.



AMPHIBIANS OF THE EASTERN GHATS

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INTRODUCTION

Eastern Ghats mountain ranges are a series of discontinuous low hill ranges along the Bay of Bengal coast running from the Khondamal hills of Odhisa in the north upto the Sirumalai and Karanthamalai hills of Tamil Nadu in the south and forms the eastern edge of the Deccan plateau. The Eastern Ghats mountain ranges cover the States of Odhisa, Andhra Pradesh, Karnataka and Tamil Nadu. The Eastern Ghats are eroded and cut through by the four major rivers of southern India viz., Mahanadi, Godavari, Krishna and Kaveri which cut the Eastern Ghats into various discontinuous hills. The Eastern Ghats are separated from the Bay of Bengal by the coastal plains.

LENGTH AND AREA OF THE EASTERN GHATS

The Eastern Ghats are located between 11°30' and 22°03' N latitudes and 76°50' and 86 ° 30' E longitudes in a north-east to south-west direction. The total extent of the Eastern Ghats is about 1750 kilometers with an average width of 220 km in the north and 100 km in the south. It covers a total area of 75000 sq km.

ELEVATION OF THE EASTERN GHATS

The elevations of the Eastern Ghats are comparatively lower than the Western Ghats. These mountain ranges have an average height of 450 meters and rarely exceed 1200 meters. However, the highest peak is Arma Konda (1680 meters / 5512 feet) in the State of Andhra Pradesh.

AGE OF THE EASTERN GHATS

Comparatively the Eastern Ghats mountain ranges are older than the Western Ghats. The history associated with the origin of this range is complicated and takes off from the disintegration of the ancient super continent of Rodinia and assembly of the Gondwana super continent. Like the Western Ghats, the Eastern Ghats are also of great ecological importance.

GEOGRAPHICAL DISTRIBUTION OF THE EASTERN GHATS – OUR STUDY AREA

The low Sirumalai and Karanthamalai hills are at the southernmost part of the Eastern Ghat mountain ranges in Tamil Nadu. North of the Kaveri river are comparatively higher hills like Kollimalai, Pachaimalai, Shevaroy (Servaroyan), Kalrayan, Chitteri, Palamalai and Mettur hills in north of Tamil Nadu. These higher hill ranges experience a generally cooler and wetter climate than the surrounding plains. These hills harbour several coffee plantations and dry forests. The popular hill station of Yercaud is also situated in the Shevaroy hills. The Biligiri hills which run east from the Western Ghats to the Kaveri river has a wooded ecological strip that connects the Eastern Ghats to the Western Ghats. This region has the second largest wild elephant population in India. Two rivers, Ponnaiyar and Palar Rivers flow from the headwaters on the Kolar Plateau eastward through gaps in the Eastern Ghats to empty into the Bay of Bengal. These two rivers are separated by the Javadi hills. Some isolated areas have waterfalls. The Kiliyur falls is one of them.

Javadi hills rise rather steeply from the plains, constituting an undulating plateau with an average elevation of 800 meters. The highest point is Kambangudi (1166 meters). Cheyyar river, a tributary of the Palar forms the main drainage. Rainfall is fairly distributed in these hills with an average of 850 mm. Pattarikadu and Komatterri Reserve Forests receive the highest rainfall between August to November. The climate is pleasant and cool, the winter months have some frost. The soil types are sandy and red loam. Kollimalai hills comprises of a range of cool and dry hills varying in altitude from 300–1500 meters. To a large extent the area is just steep rocky outcrops covered along the base by medium to dense deciduous forests. However the reaches above 1000 meters and the slopes and valleys therein support a rather unique vegetation, the Sholas, quite resembling the high elevation montane evergreen forests of the Western Ghats in both structure and floristic composition. With an annual average rainfall of 800-900 mm in the Kolli hills, the sholas are certainly very fragile elements in this hilly landscape. Other major elements in the landscape are paddy fields in the valleys, occasional perennial streams, barren and rocky areas, mixed orchards, monoculture of bananas, eucalyptus and silver oak and a variety of crops like pineapple, tapioca and millets. Kolli hills is well known for its fruits and as a summer resort.

Biogeographers like Legris and Meher-Homji (1982) have divided the Eastern Ghats into three sections based on vegetation and bio-climatic aspects. The southern Eastern Ghats is treated as 'dry' reaching an annual rainfall of not more than 1500 mm. The resultant vegetation type is a scrub-thorn forest community. The hills in this area are rocky with large boulders and rainfed seasonal streams. Perennial rivers are few like Palar. The area includes several large reservoirs such as the hydro-electric power generating Stanley Reservoir in Mettur dam and smaller catchments for irrigation and fishery purposes.

North of the Palar river in the State of Andhra Pradesh, the middle section of the Eastern Ghats

comprises two parallel ranges running north-south. The higher Palikonda-Lankamalai-Nallamalai ranges are in the west and the lower Yerramalai-Velikonda ranges are in the east. The Velikonda range eventually descends to the coastal plains in the northern Nellore district while the Nallamalla Range continues to the Krishna River. The Krishna and Godavari rivers are also separated by a range of low hills. To the north of the Godavari, the Eastern Ghats record an unexpected increase in the height acting as a boundary between the States of Andhra Pradesh and Odhisa. The Vizag hills and Araku Valley in this region are quite scenic and hence popular. Moreover this region has very fertile soil. The biggest characteristic of the Eastern Ghats is that it is extremely fertile resulting in better crops. In fact, the Eastern Ghats act as the watershed of many rivers as the northern part of the Eastern Ghats gets high rainfall. The Simlipal Massif is considered the farthest northeast extension of the Eastern Ghats.

The Eastern Ghats is distributed mainly in four States, namely, Odhisa, Andhra Pradesh, Tamil Nadu and Karnataka. The part of Eastern Ghats found in the Odhisa covers 12 districts such as Cuttack, Khurda, Nayagarh, Phulbani, Boudh, Kalahandi, Gajapati, Ganjam, Rayagada, Nawrangpur, Koraput and Malkanagiri. In Andhra Pradesh Eastern Ghats is located in the following 15 districts, namely, Srikakulam, Visakhapatnam, East Godavari, West Godavari, Khammam, Mahaboobnagar, Nalgonda, Guntur, Krishna, Kurnool, Prakasham, Nellore, Cuddapah, Anantapur and Chittoor. Similarly in Tamil Nadu, Eastern Ghats is located in the following 9 districts, namely, Vellore, Erode, Salem, Namakkal, Dharmapuri, Tiruvanamalai, Tiruchirapalli, Pudukkottai, and Villupuram. In Karnataka Eastern Ghats falls in part of Chamrajnagar and Kolar districts.

Some of the peaks of the Eastern Ghats are: Deomali Parvat, Mahendragiri, Malayagiri, Devagiri, Chandragiri, Turiakonda, Dharakonda, Hatimali, Sambari Konda, Nallamalla, Arma Konda, Mettur, Shevaroy, Kalrayan and Pachamalai.

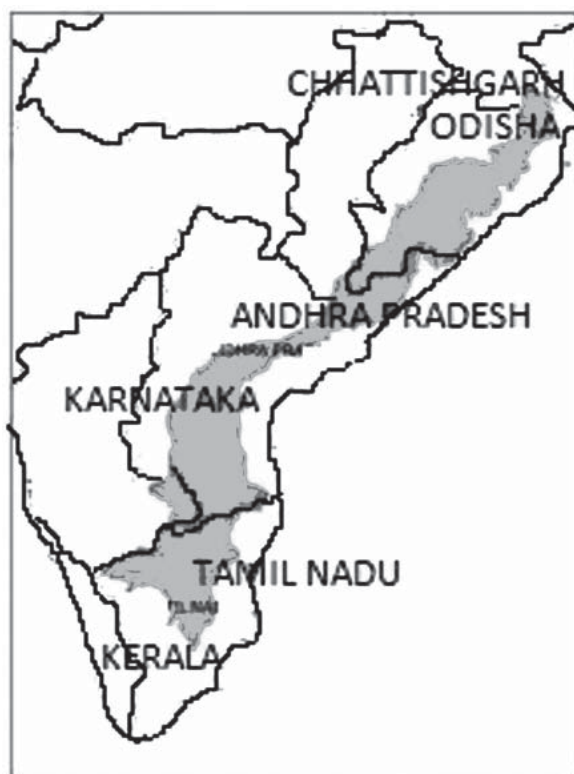


Fig. 1. Map showing Eastern Ghats of India with its states

FAUNA AND FLORA OF THE EASTERN GHATS

The Eastern Ghats are one of the biologically richest biogeographic zones of India (Rodgers *et al.*, 2008). The diversified ecological niches and environmental situations provide habitat for rich fauna. Eastern Ghats is home to large number of Asiatic elephants. Other large animals such as Leopards, Gaur, Sambhar, Barking deer and Niligiri Tahr abound the landscape. Apart from this there is a large variety of bird species. About 40 species of Reptiles and 25 species of Amphibians are now known from the Eastern Ghats. The Eastern Ghats also holds a rich floral ecosystem with a large number of medicinal plants.

METHODOLOGY

To determine the amphibian diversity of the Eastern Ghats, four short surveys were conducted in the Eastern Ghats by a team of three amphibian researchers from Zoological Survey of India, Kolkata. The first survey was conducted from 03.09.2009 to 17.09.2009 in the Vizag hills, Araku

Valley and Vizianagaram areas of northern Andhra Pradesh as well as the Semiliguda area of southern Odhisa; the second survey was conducted from 19.08.2010 to 03.09.2010 in Koraput, Rayagada, Muniguda and Kesinga areas of southern Odhisa; the third survey was conducted from 03.02.2011 to 19.02.2011 in Yercaud area of Shevaroy hills and Javadi hills of Tamil Nadu and the fourth survey was conducted from 16.09.2011 to 03.10.2011 in Renigunta, Tirupati hills (including Sri Venkateswara Wildlife Sanctuary) and Horsley Hill areas of southern Andhra Pradesh. Amphibians were collected by first doing a recce survey of the area during day-time to determine the presence of habitats suitable for amphibians like water-bodies, hill-streams etc. Then in the evening after darkness those habitats were visited with powerful battery-operated torch lights to detect the amphibians present there. Often calls of amphibians led to their micro-habitat and a small AIWA JS-143 stereo cassette recorder with hand-held external microphone was used to record the calls of the amphibians from a distance of 60-90 cm from the calling frog. Most of these amphibians were photographed in the field using a PANASONIC DMC FZ-30 digital camera with a built-in flash. The amphibians collected were killed with chloroform or ethanol, injected with 10% formaldehyde and kept soaked in 10% formaldehyde for 48 hours. Later these were transferred to 70% ethyl alcahol for permanent preservation.

RESULTS

99 specimens of amphibians belonging to 23 species, 11 genera and 5 families were collected from different areas of the Eastern Ghats as mentioned below. The detailed species accounts of these amphibian species are given below along with their scientific names, common names, original citations, measurements with registration numbers and sex, diagnostic features, colour, secondary sexual characters, habitat and status and distribution (remarks) in the Eastern Ghats. This forms the first scientific document of the amphibians of the Eastern Ghats.

SPECIES ACCOUNTS

Family BUFONIDAE

1. *Duttaphrynus melanostictus* (Schneider, 1799)

1799. *Bufo melanostictus* Schneider, *Hist. Amph.*, 1: 216.

Common Name: Common Indian Toad (English).

Specimens Examined: A 11154 from Rayagada, Odhisa (altitude 370 meters above msl) collected on 25.viii.2010, A 11184 from Koraput, Odhisa (altitude 875 meters above msl) collected on 21.viii.2010, A 11185 from Semiliguda, Odhisa (altitude 435 meters above msl) collected on 13.ix.2009 and A 11186 from Araku, Andhra Pradesh (altitude 815 meters above msl) collected on 10.ix.2009. The measurements of the toads as shown in Table 1.

Size: 45-109 mm (Snout-vent length).

Habitat: Found in all areas of the Eastern Ghats over leaf-litter, beside rain-water pools and also along the roadsides. They hide under logs, stones, in moist holes and huddle together in crevices of tree-trunks. Except during the breeding season they spend the day in any convenient cranny which is cool and dark. Once a toad has found a suitable day retreat it will generally use it as its permanent abode for its nightly forays for food.

Remarks: Very common throughout the Eastern Ghats. Terrestrial and nocturnal, they seem to be well-acquainted with their habitat and return to the same site again and again. They have limited powers of hopping and usually walk up to the nearby prey which is detected by sight or sound. They are usually solitary but congregate during the breeding season near water-bodies. They are highly territorial during this time of the year. The species is a prolific breeder laying a few thousand eggs in long translucent strings which is entwined round the stems of grass and aquatic plants. The tadpoles are black and are gregarious and omnivorous. Juveniles wander on land during mornings and afternoons, if the air-temperature is sufficiently low.

2. *Duttaphrynus stomaticus* (Lutken, 1862)

1862. *Bufo stomaticus* Lutken, *Vidensk. Meddr. Dansk. Naturh. Foren.*, 14: 305.

Common Name: Marbled Toad (English)

Specimens Examined: A 11152 from Kesinga, Odhisa (altitude 230 meters above msl) collected on 31.viii.2010 and A 11187 from Semiliguda, Odhisa (altitude 435 meters above msl) collected on 13.ix.2009. The measurements of the toads as shown in Table 2.

Table 1 : Measurements of the toads collected (in millimeters)

Reg No & Sex	Snout-vent length	Head length	Head width	Snout length	Eye-nostril length	Eye diameter	Inter-orbital length	Tympanum diameter	Tibial length
11154 female	65.48	13.43	23.16	8.53	5.23	5.48	6.62	3.70	23.46
11184 male	48.34	9.56	17.65	6.87	4.87	4.87	5.35	2.10	17.87
11185 male	52.74	10.65	18.56	7.28	5.12	4.97	5.64	2.37	18.74
11186 female	76.47	14.63	24.43	9.75	7.56	6.12	7.54	4.87	25.94

Table 2 : Measurements of the toads collected (in milimeters)

Reg No & Sex	Snout-vent length	Head length	Head width	Snout length	Eye-nostril length	Eye diameter	Inter-orbital length	Tympanum diameter	Tibial length
11152 female	66.67	14.85	22.07	8.73	5.18	6.29	5.48	4.62	25.55
11187 male	51.64	9.25	17.76	6.24	5.32	4.97	5.63	2.57	17.84

Size: 38-76 mm (Snout-vent length).

Habitat: Drier and semi-arid regions of the Eastern Ghats. Dry scrub forest areas preferred but are seen near water bodies especially during the breeding season. Often found in association with Common Indian toads in the same habitat.

Remarks: The species is uncommon in most areas of the Eastern Ghats. They are terrestrial and nocturnal. However during the breeding season they can be seen moving around during the day. In areas of scanty rainfall like in the Kalahandi and Rayagada districts of Odhisa they were seen to aestivate during the summer. In this season, they burrow in sandy soil and are found under stones and crevices of tree-trunks. Breeding occurs between June and August and the call of the male is distinctive and can be easily distinguished from that of the Common Indian Toad. The eggs are laid in translucent strings and are pale yellowish green in colour. The tadpoles are small and black with shiny silver spots on the body.

3. *Duttaphrynus scaber* (Schneider, 1799)

1799. *Bufo scaber* Schneider, *Hist. Amph.*, 1: 219.

Common Name: Rough Dwarf Toad (English)

Specimens Examined: A 11330 from Renigunta, Andhra Pradesh (altitude 129 meters above msl)

collected on 20.ix.2011. The measurements of the toad as shown in Table 3.

Size: 49 mm (Snout-vent length).

Habitat: Drier as well as humid areas of the southern Eastern Ghats.

Remarks: The species is uncommon in the Eastern Ghats. It burrows well and is fond of feeding on termites. It can walk with its body lifted above the ground like a garden lizard. Tadpoles are smaller than those of the Common Indian Toad but have larger nostrils and are brownish instead of black.

Family MICROHYLIDAE

4. *Microhyla ornata* (Dumeril & Bibron, 1841)

1841. *Engystoma ornatum* Dumeril & Bibron, *Erp. Gen.*, 8: 745.

Common Name: Ornate narrow-mouthed frog (English).

Specimens Examined: A 11180 – A 11183 from Karlapat, Odhisa (altitude 785 meters above msl) collected on 08.ix.2009, A 11189 from Damanjodi, Odhisa (altitude 895 meters above msl) collected on 22.viii.2010, A 11190 from Muniguda, Odhisa (altitude 355 meters above msl) collected on 28.viii.2010 and A 11335 from Renigunta, Andhra Pradesh (altitude 129 meters above msl) collected on 20.ix.2011. The measurements of the frogs as shown in Table 4.

Table 3 : Measurements of the toads collected (in milimeters)

Reg No & Sex	Snout-vent length	Head length	Head width	Snout length	Eye-nostril length	Eye diameter	Inter-orbital length	Tympanum diameter	Tibial length
11330 male	49.37	12.64	17.06	6.57	4.77	4.47	4.31	3.30	17.85

Table 4 : Measurements of the frogs collected (in milimeters)

Reg No & Sex	Snout-vent length	Head length	Head width	Snout length	Eye-nostril length	Eye diameter	Inter-orbital length	Tympanum diameter	Tibial length
11180 male	20.39	5.18	6.52	3.53	1.80	2.31	2.05	hidden	10.26
11181 male	21.31	4.36	6.55	3.25	1.54	2.48	2.00	hidden	10.64
11182 male	21.00	4.26	6.52	3.27	1.70	2.05	2.13	hidden	10.03
11183 male	20.80	4.95	5.96	3.30	2.36	2.38	2.05	hidden	8.35
11189 female	23.67	5.82	7.53	4.35	2.48	2.25	2.60	hidden	11.93
11190 female	23.43	5.64	7.63	4.71	2.62	2.51	2.48	hidden	11.51
11335 male	17.50	3.83	5.33	2.41	1.32	1.42	2.10	hidden	8.91

Size: 17-26 mm (Snout-vent length).

Habitat: Found among moist leaf-litter all over the Eastern Ghats. It is found throughout the year in areas with adequate cover and moisture. Juveniles are seen in dried up beds of temporary rain-water pools well after the monsoon season.

Remarks: Very common throughout the Eastern Ghats. Can call very loudly and jump tremendously when compared to its small size. Breeding commences just after the arrival of the monsoon rains. Several males can be heard calling from evening near temporary rain-water pools. However the call is ventriloquistic and makes location of the small frog sitting in the midst of grass quite difficult. The male remains stationary and is located by the female by its call. About

200 eggs are laid in mucilaginous masses floating in water. The tadpoles are transparent and have a golden-coloured diamond-shaped mark on the head. Their head and body are large but the tail is small ending in a flagellum. The tadpoles are microphagous and move in shoals just below the water surface.

5. *Microhyla rubra* (Jerdon, 1854)

1854. *Engystoma rubrum* Jerdon, *J. Asiat. Soc. Beng.*, 22: 462-479.

Common Name: Red narrow-mouthed frog (English).

Specimens Examined: A 11376 – A 11377 from Renigunta, Andhra Pradesh (altitude 129 meters above msl) collected on 20.ix.2011. The measurements of the frogs as shown in Table 5.

Table 5 : Measurements of the frogs collected (in milimeters)

Reg No & Sex	Snout-vent length	Head length	Head width	Snout length	Eye-nostril length	Eye diameter	Inter-orbital length	Tympanum diameter	Tibial length
11376 male	27.99	6.24	8.45	3.91	2.94	3.32	2.97	hidden	13.61
11377 male	21.00	4.82	7.41	3.14	2.31	2.61	2.20	hidden	10.99

Size: 21-29 mm (Snout-vent length).

Habitat: Sandy beds of streams, forests as well as suburban areas. Adults are attracted to lamps at night and also wander into homes in search of insects. They do not leap as much as the Ornate narrow-mouthed frog.

Remarks: A more burrowing species than *Microhyla ornata* and so is not much seen except during the breeding season. The species is not uncommon in the southern part of the Eastern Ghats. A breeding pool attracts a large number of adults who stay crouched on the wet mud and call. The call is similar to the chirping of crickets but is interrupted and not continuous. Breeding season coincides with the monsoons and extends from June to November. However the actual time the males call and pairs mate do not last more than a

day or two. Mounted pairs can be seen swimming and inflating in water at this time. Eggs are laid in rain-water pools and float in flat transparent masses as in *Microhyla ornata* but are larger in size.

6. *Kaloula taprobanica* Parker, 1934

1934. *Kaloula pulchra taprobanica* Parker, *Trust. Brit. Mus. London*: 86-87.

Common Name: Painted Frog, Indian Painted Frog, Painted Kaloula (English).

Specimens Examined: A 11175 – A 11176 from Sunabeda, Odhisa (altitude 467 meters above msl) collected on 14.ix.2009 and A 11191 – A 11194 from Karlapat, Odhisa (altitude 785 meters above msl) collected on 07.ix.2009. The measurements of the frogs as shown in Table 6.

Table 6 : Measurements of the frogs collected (in milimeters)

Reg No & Sex	Snout-vent length	Head length	Head width	Snout length	Eye-nostril length	Eye diameter	Inter-orbital length	Tympanum diameter	Tibial length
11175 male	45.82	9.37	14.85	5.46	3.25	4.24	4.52	hidden	18.59
11176 juvenile	34.01	6.83	10.13	4.57	2.76	3.17	3.86	hidden	13.33
11191 female	52.93	9.16	16.38	5.56	3.63	5.20	5.76	hidden	17.72
11192 male	49.30	7.41	14.65	5.00	3.75	4.08	5.13	hidden	14.83
11193 male	40.08	6.90	10.59	4.47	2.99	3.63	3.75	hidden	12.54
11194 female	50.59	8.43	13.36	5.10	2.81	4.59	4.52	hidden	14.17

Size: 27-58 mm (Snout-vent length).

Habitat: Open forests at the edge of forests. Breeds in dirty ponds and pools.

Remarks: Uncommon in the Eastern Ghats. The species is very colourful. They are terrestrial, burrowing and nocturnal, emerging from their burrows during the monsoon, sometimes even during the day and are often seen to climb up trees, where they are found in holes in tree-trunks, infested with termites, about one and a half meters above the ground.

7. *Uperodon globulosus* (Gunther, 1864)

1864. *Cacopus globulosum* Gunther, *Rept. Brit. India*: 416.

Common Name: Balloon Frog (English).

Specimens Examined: A 11167 from Karlapat, Odhisa (altitude 785 meters above msl) collected on 09.ix.2009 and A 11195 from Rayagada, Odhisa (altitude 370 meters above msl) collected on 26.viii.2010. The measurements of the frogs as shown in Table 7.

Size: 40-64 mm (male) and 60-84 mm (female).

Habitat: Mixed scrub forest with loose sand and soft gravel, littered with piles of decaying logs infested with termites and ground-dwelling ants. Also found on stream-beds having damp soil.

Remarks: Uncommon and fossorial, emerging from the under ground only during the breeding season in early monsoon. Occasionally seen in the Eastern Ghats in areas with termites and ground-dwelling ants. They are excellent burrowers using their powerful metatarsal tubercles quickly disappear underground. While burrowing the soil is dislodged by sideways movements of the legs, the frog subsides down into the ground, the eyes disappearing last. The globular shape is due to its enormously distensible lungs. They are feeble swimmers and move on land by a slow walk. Breed in dirty pools of water and drains. The call is a loud grunting *oink*.

8. *Uperodon systoma* (Schneider, 1799)

1799. *Rana systoma* Schneider, *Hist. Amph.*, 1: 144.

Common Name: Marbled Balloon Frog (English).

Specimens Examined: A 11168 – A 11169 from Karlapat, Odhisa (altitude 785 meters above msl) collected on 08.ix.2009 and A 11178 – A 11179 from Sunabeda, Odhisa (altitude 467 meters above msl) collected on 14.ix.2009. The measurements of the frogs as shown in Table 8.

Size: 30-55 mm (Snout-vent length).

Habitat: Scrub and deciduous forests, often found under stones and logs.

Table 8 : Measurements of the frogs collected (in milimeters)

Reg No & Sex	Snout-vent length	Head length	Head width	Snout length	Eye-nostril length	Eye diameter	Inter-orbital length	Tympanum diameter	Tibial length
11168 female	51.89	7.72	13.23	6.29	2.92	4.67	6.75	hidden	18.49
11169 male	31.06	5.74	8.40	3.73	2.33	3.20	3.32	hidden	10.92
11178 juvenile	22.42	4.08	7.23	3.20	1.98	2.33	2.99	hidden	8.61
11179 juvenile	19.43	3.91	5.23	3.47	1.44	2.05	2.59	hidden	6.75

Remarks: Not uncommon in the Eastern Ghats but emerges only during the breeding season with the advent of the rainy season. Calls like the bleating of a goat. Adults feed mainly on termites.

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9. *Euphlyctis cyanophlyctis* (Schneider, 1799)

1799. *Rana cyanophlyctis* Schneider, *Hist. Amph.*, **1**: 137.

Common Name: Skittering Frog, Skipping Frog, Skipper Frog, Water frog (English).

Specimens Examined: A 11150 – A 11151 from Kesinga, Odhisa (altitude 230 meters above mean sea level) collected on 01.ix.2010, A 11160 from Muniguda, Odhisa (altitude 355 meters above mean sea level) collected on 29.viii.2010, A 11197 – A 11199 from Semiliguda, Odhisa

(altitude 435 meters above msl) collected on 13.ix.2009, A 11211 – A 11212 from Rayagada, Odisha (altitude 370 meters above msl) collected on 26.viii.2010 and A 11331 from Renigunta, Andhra Pradesh (altitude 129 meters above msl) collected on 20.ix.2011. The measurements of the frogs as shown in Table 9.

Size: 30-70 mm (Snout-vent length).

Habitat: Found in all types of water-bodies in the Eastern Ghats especially the permanent ones with standing water. The species is also seen in rain-pools and puddles. They are active throughout the year and are both nocturnal as well as diurnal. They spend most of their time in the water or in the vicinity of water-bodies but may migrate for a long distance onto land in the summer months when the temporary pools of water dry up.

Table 9 : Measurements of the frogs collected (in milimeters)

Reg No & Sex	Snout-vent length	Head length	Head width	Snout length	Eye-nostril length	Eye diameter	Inter-orbital length	Tympanum diameter	Tibial length
11150 male	41.30	13.36	15.21	6.78	4.08	4.36	1.93	3.14	19.50
11151 male	42.74	12.06	13.89	6.88	4.34	4.41	2.13	3.14	19.50
11160 male	33.35	9.57	11.09	5.89	2.61	3.65	3.50	2.76	20.06
11197 female	70.00	19.73	23.26	9.04	5.53	6.68	5.56	5.38	32.02
11198 male	41.45	10.66	13.41	5.89	3.78	4.90	2.26	3.96	20.72
11199 male	42.44	10.33	14.12	5.63	3.65	4.36	3.02	3.78	20.54
11211 male	41.50	9.80	13.66	5.61	3.60	4.57	3.09	3.88	21.53
11212 male	38.07	10.00	13.13	5.41	3.60	4.21	2.99	3.58	20.11
11331 female	52.09	16.17	17.93	7.67	4.31	5.91	2.74	5.10	24.79

Remarks: One of the commonest frogs of the Eastern Ghats. They float passively in water with only the nostrils projecting above the surface but when disturbed, can skip smoothly over the water for some distance and then float above the surface with the hind legs held parallel. While calling, the inflated bluish-white vocal sacs of the male project through slits on the floor of the mouth. The call is distinctive and can be heard throughout the year. The eggs are laid in a frothy mass in standing water.

10. *Euphlyctis aloysii* (Joshy *et al.*, 2009)

2009. *Euphlyctis aloysii* Joshy, Alam, Kurabayashi, Sumida & Kuramoto, *Alytes.*, **26**: 101.

Common Name: Aloysi Skittering Frog (English).

Specimens Examined: A 11340 – A 11343 from Horsley Hill, Andhra Pradesh (altitude 1236 meters above msl) collected on 24.ix.2011. The measurements of the frogs as shown in Table 10.

Size: 32-36 mm (Snout-vent length).

Habitat: Caverns and pot-holes on exposed rocky plateau with weedy vegetation. The frogs hide among this weed vegetation floating in water during the day but emerge at night to feed on insects.

Remarks: The collected specimens constitute the first record of this species from Andhra

Pradesh. It was known only from Mudigere in Karnataka and thus this is a range extension of about 200 km to the east.

11. *Fejervarya keralensis* (Dubois, 1980)

1980. *Fejervarya keralensis* Dubois, *Bull. Mus. Natl. Hist. Nat. Paris.*, **4**(2): 928-929.

Common Name: Kerala Warty Frog (English).

Specimens Examined: A 11344 from Horsley Hill, Andhra Pradesh (altitude 1236 meters above msl) collected on 24.ix.2011 and A 11378 from Yercaud, Tamil Nadu (altitude 985 meters above msl) collected on 10.ii.2011. The measurements of the frog as shown in Table 11.

Size: 37-55 mm (Snout-vent length).

Habitat: Forest, streams and wet seepage areas in the hills but also seen in roadside ditches and canals.

Remarks: One of the common species of the southern Eastern Ghats, where they are seen in the Shevaroy and Javadi hills. They remain partly buried in mud or sand in wet shaded areas beside small streams, where it is hard to locate them due to their camouflaging colour. They are not very active and do not leap high when disturbed. They dive into water but emerge after a few seconds. They mostly feed on the land and congregate around small rain-water puddles.

Table 10 : Measurements of the frogs collected (in millimeters)

Reg No & Sex	Snout-vent length	Head length	Head width	Snout length	Eye-nostril length	Eye diameter	Inter-orbital length	Tympanum diameter	Tibial length
11340 male	33.78	12.24	12.77	5.81	3.58	3.65	2.76	3.17	17.93
11341 female	35.99	11.96	13.15	6.68	3.83	4.11	2.56	3.07	19.15
11342 male	34.11	11.83	12.36	5.68	3.45	3.55	2.64	3.14	17.95
11343 male	34.41	12.54	12.67	5.81	3.88	3.68	2.74	2.87	17.37

Table 11 : Measurements of the frogs collected (in millimeters)

Reg No & Sex	Snout-vent length	Head length	Head width	Snout length	Eye-nostril length	Eye diameter	Inter-orbital length	Tympanum diameter	Tibial length
11344 juv	21.71	6.90	7.97	4.39	2.51	2.10	3.60	1.70	12.31
11378 male	33.26	9.72	11.36	5.68	2.17	3.53	3.76	2.18	19.64

12. *Fejervarya orissaensis* (Dutta, 1997)

1997. *Limnonectes orissaensis* Dutta, *Hamadryad.*, 22(1): 1-8.

Common Name: Orissa Cricket Frog (English).

Specimens Examined: A 11200 – A 11202 from Kesinga, Odhisa (altitude 230 meters above msl) collected on 31.viii.2010 and A 11334 from Renigunta, Andhra Pradesh (altitude 129 meters above msl) collected on 20.ix.2011. The measurements of the frogs as shown in Table 12.

Size: males (36 – 47 mm), females (34 – 53 mm).

Diagnostic features: Medium-sized Ranid frog with interrupted longitudinal folds on dorsum, smooth ventrum, wider & longer inner metatarsal tubercle and relatively pointed snout. Shorter hind limbs, more rounded finger and toe tips and a greater degree of webbing on the toes.

Head longer than wide, depressed. Snout pointed, extending beyond the mouth, internarial distance broader than the interorbital width. Narial openings are dorsolateral. Tympanum distinct, rounded, diameter less than eye diameter with supratympanic fold extending from posterior corner of eye to forelimbs. Vomerine teeth is distinct.

Finger and toe tips rounded, slightly swollen. First finger is longer than the second, third equal to or slightly longer than first. Subarticular tubercles rounded. Fingers not webbed. Hind limbs moderately long, with two metatarsal tubercles. Inner metatarsal tubercle is oval and larger than the outer metatarsal tubercle. Longitudinal ridges extend from anterior border of outer metatarsal tubercle to tip of fifth toe. Subarticular tubercles rounded, similar to those on fingers. Webbing of fourth extends less than half way between distal and penultimate subarticular tubercles, but that on fifth toe extends beyond distal subarticular tubercle.

Table 12 : Measurements of the frogs collected (in millimeters)

Reg No & Sex	Snout-vent length	Head length	Head width	Snout length	Eye-nostril length	Eye diameter	Inter-orbital length	Tympanum diameter	Tibial length
11200 male	43.38	13.10	14.75	7.87	4.44	4.36	3.55	3.32	25.52
11201 female	46.05	13.18	16.07	7.44	4.01	5.38	3.32	3.65	24.46
11202 female	41.55	11.63	12.82	7.39	4.01	4.85	2.26	3.25	25.73
11334 male	45.23	13.38	14.83	6.80	4.24	5.15	2.51	3.12	21.66

Skin on dorsum of head smooth but body covered with interrupted, longitudinal ridges with small rounded ridges towards posterior border of body. Skin on flanks and chin smooth. Skin on belly and proximal ventral surfaces of thigh is smooth.

Colour: Dorsum brown, grey or brick red. A V-shaped marking between eyes which is interrupted by a vertebral band, with or without yellowish narrow or wide vertebral band extending from tip of snout to vent. An X-shaped black patch on middle of body, limbs with complete or incomplete dark cross bars. The sides of the thighs are yellowish white with black speckles. Margins of jaws are with black vertical bars.

Habitat: Found during monsoon on grassy lands near water pools.

Remarks: The species is very common in the Eastern Ghats. When disturbed jump into water but immediately return to the edges. They are

active at night and hide in grass, below rocks or in small holes near water during the day. Eggs are laid in open temporary rain-water pools, the larvae are free-swimming. The specimen from Renigunta constitutes the first record from Andhra Pradesh State.

13. *Fejervarya syhadrensis* (Annandale, 1919)

1919. *Rana syhadrensis* Annandale, *Rec. Ind. Mus.*, 6: 121-125.

Common Name: Small Cricket Frog (English).

Specimens Examined: A 11161 – A 11162 from Muniguda, Odhisa (altitude 355 meters above msl) collected on 28.viii.2010, A 11163 – A 11165 from Koraput, Odhisa (altitude 875 meters above msl) collected on 21.viii.2010, A 11203 – A 11207 from Araku valley, Andhra Pradesh (altitude 815 meters above msl) collected on 10.ix.2009. The measurements of the frogs as shown in Table 13.

Table 13 : Measurements of the frogs collected (in milimeters)

Reg No & Sex	Snout-vent length	Head length	Head width	Snout length	Eye-nostril length	Eye diameter	Inter-orbital length	Tympanum diameter	Tibial length
11161 male	30.50	7.41	8.73	5.13	2.99	3.47	2.18	1.90	14.88
11162 juvenile	22.04	6.27	7.01	3.83	2.08	2.61	2.08	1.32	10.18
11163 male	31.34	6.95	8.76	4.54	2.36	3.47	3.22	1.39	15.97
11164 male	27.55	6.83	7.77	4.52	2.36	2.94	2.10	1.67	14.93
11165 female	29.23	7.01	8.02	4.29	2.26	3.07	2.56	1.70	16.40
11203 male	31.41	6.95	9.09	5.00	2.74	3.63	2.56	2.33	14.70
11204 male	31.80	7.16	8.86	4.74	2.89	2.97	2.48	1.93	13.86
11205 male	30.68	7.13	8.50	4.80	2.26	3.27	2.13	2.08	16.07
11206 female	36.04	8.30	9.90	5.35	3.07	3.12	2.20	2.03	17.93
11207 female	33.57	8.43	9.39	5.35	3.14	3.60	2.28	2.10	19.45

Size: Snout-vent length: 27-32 mm (males) and 29-40 mm (females).

Habitat: Prefers vicinity of water without being really aquatic. They can be encountered far away from water-bodies under trees in Sal forests, near brooks, in open grassland, pools and ditches.

Remarks: One of the commonest species found throughout the Eastern Ghats. Partly diurnal but only calls nocturnally. During the dry winter months hides in leaf-litter of woods or between buttresses of trees. Males call in the evening and night and are easy to locate.

14. *Hoplobatrachus crassus* (Jerdon, 1853)

1853. *Rana crassa* Jerdon, *J. Asiat. Soc. Beng.*, 22: 531.

Common Name: Jerdon's Bull Frog (English).

Specimens Examined: A 11155 from Rayagada, Odhisa (altitude 370 meters above msl) collected on 26.viii.2010, A 11196 from Kesinga, Odhisa (altitude 230 meters above msl) collected on 31.viii.2010 and A 11328 from Renigunta, Andhra Pradesh (altitude 129 meters above msl) collected on 20.ix. 2011. The measurements of the frogs as shown in Table 14.

Size: 40-86 mm (Snout-vent length).

Habitat: They spend the day hiding inside crevices on elevated banks of ponds and ditches. They are found during breeding season in temporary rain-water pools.

Remarks: The species is quite common in the Eastern Ghats, found along with the Indian Bull

frogs. They are terrestrial, nocturnal and also burrow in the ground.

15. *Hoplobatrachus tigerinus* (Daudin, 1803)

1803. *Rana tigerina* Daudin, *Hist. Nat.*, 1: 42.

Common Name: Bull Frog, Indian Bull Frog (English).

Specimens Examined: A 11157 from Rayagada, Odhisa (altitude 370 meters above msl) collected on 25.viii.2010, A 11208 from Semiliguda, Odhisa (altitude 435 meters above msl) collected on 15.ix.2009 and A 11329 from Renigunta, Andhra Pradesh (altitude 129 meters above msl) collected on 20.ix. 2011. The measurements of the frogs as shown in Table 15.

Size: 50-144 mm (Snout-vent length).

Habitat: Found among grasses, bushes and on the leaf-litter. Hide inside hollows at the edge of ponds and ditches. Aestivate inside burrows or under heaps of leaves. Seen frequently on the edges of ponds during breeding season into which they leap headlong at the least sign of danger.

Remarks: Very common species in the Eastern Ghats. They are solitary creatures, which aggregate only during the breeding season. In the non-breeding season, they are silent and difficult to locate but with the appearance of the rainy season their highly resonant call can be heard throughout the night. Croaking loudly the males await the arrival of the females which are fought for among potential competitors by kicking strongly with their hind legs. The eggs are laid in ponds and pools where they float first but sink later. The tadpoles are bottom-feeders.

Table 14 : Measurements of the frogs collected (in milimeters)

Reg No & Sex	Snout-vent length	Head length	Head width	Snout length	Eye-nostril length	Eye diameter	Inter-orbital length	Tympanum diameter	Tibial length
11155 female	76.14	23.97	25.47	12.11	7.13	6.95	3.98	5.28	32.79
11196 male	56.75	19.36	21.74	11.96	5.76	5.45	3.27	4.61	28.56
11328 female	93.75	31.57	38.04	15.72	8.07	11.09	3.45	8.10	43.78

Table 15 : Measurements of the frogs collected (in millimeters)

Reg No & Sex	Snout-vent length	Head length	Head width	Snout length	Eye-nostril length	Eye diameter	Inter-orbital length	Tympanum diameter	Tibial length
11157 male	54.12	15.41	16.84	9.62	5.25	5.66	2.51	3.35	29.64
11208 female	93.62	30.17	31.67	19.32	10.59	8.25	6.40	7.39	54.99
11329 male	85.64	28.27	31.44	14.90	7.36	10.03	3.86	6.90	38.98

16. ***Sphaerotheca breviceps*** (Schneider, 1799)
1799. *Rana breviceps* Schneider, *Hist. Amph.*, 1: 140.

Common Name: Indian Burrowing Frog (English).

Specimens Examined: A 11139 from Phurlijharan, Orissa (altitude 260 meters above msl) collected on 24.viii.2010, A 11153 from Rayagada, Odhisa (altitude 370 meters above msl) collected on 26.viii.2010 and A 11170 – A 11171 from Karlapat, Odhisa (altitude 785 meters above msl) collected on 09.ix.2009. The measurements of the frogs as shown in Table 16.

Size: 38-56 mm (Snout-vent length).

Habitat: Terrestrial and subterranean, found near water-bodies only during the early part of the rainy season for short periods of time, often

in association with the Balloon frogs (*Uperodon sp.*).

Remarks: Although the species is not very uncommon in the Eastern Ghats, they are seen only at the onset of the monsoon when they come out of their burrows and the males croak near temporary pools of water, usually after a heavy shower. The call is a soft *owing* which can be heard from a good distance. There is no particular breeding site. Tadpoles are bottom-feeders. Juveniles are commonly seen after they metamorphose, hopping around the pools from which they emerged.

17. ***Sphaerotheca rolandae*** (Dubois, 1983)

1983. *Tomopterna rolandae* Dubois, *Alytes.*, 2(4): 163-170.

Common Name: Roland's Burrowing Frog (English).

Table 16 : Measurements of the frogs collected (in millimeters)

Reg No & Sex	Snout-vent length	Head length	Head width	Snout length	Eye-nostril length	Eye diameter	Inter-orbital length	Tympanum diameter	Tibial length
11139 male	42.54	10.61	18.33	7.21	4.14	6.73	3.12	3.73	18.49
11153 male	50.46	12.47	17.88	6.93	2.87	2.99	2.69	3.65	19.45
11170 female	55.06	14.40	20.80	9.08	7.39	6.52	4.64	4.06	23.82
11171 female	52.80	12.64	20.26	8.86	7.74	6.75	4.08	4.26	23.74

Specimens Examined: A 11148 –A 11149 from Kesinga, Odhisa (altitude 230 meters above msl) collected on 31.viii.2010, A 11172 – A 11174 from Tiiri, Odhisa (altitude 828 meters above msl) collected on 23.viii.2010, A 11177 from Semiliguda, Odhisa (altitude 435 meters above msl) collected on 13.ix.2009 and A 11332 - A11333 from Renigunta, Andhra Pradesh (altitude 129 meters above msl) collected on 20.ix.2011. The measurements of the frogs as shown in Table 17.

Size: 24-45 mm (Snout-vent length).

Habitat: Wet stream beds where it buries itself in the sandy bank. Calling males stay close to the water.

Remarks: Common but secretive species in the Eastern Ghats, spending most of its time underground. They are mostly seen during the nights, especially after the rains. Prefer ants and beetles as food.

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18. *Hylarana malabarica* (Tschudi, 1838)

1838. *Rana malabarica* Tschudi, *Classif. Batrachia.*, 3: 80.

Common Name: Fungoid Frog (English).

Specimens Examined: A 11166 from Karlapat, Odhisa (altitude 785 meters above msl) collected on 08.ix.2009. The measurements of the frog as shown in Table 18.

Size: 55-71 mm (Snout-vent length).

Habitat: Found in Sal forests where it hides under leaf-litter but is to some extent semi-arboreal. Nocturnal, in summer months a large number may gather in moist areas. Terrestrial and reluctant to enter water except for breeding. Breeds in rain-water pools preferring shallow pools holding weeds or grass in forest. The breeding call can be syllabilized as *wuck, wuck, wuck* like drops of falling water.

Table 17 : Measurements of the frogs collected (in millimeters)

Reg No & Sex	Snout-vent length	Head length	Head width	Snout length	Eye-nostril length	Eye diameter	Inter-orbital length	Tympanum diameter	Tibial length
11148 male	36.62	9.49	12.47	4.97	3.12	4.08	2.76	2.20	13.86
11149 juvenile	28.90	6.88	9.82	4.85	2.64	3.60	2.05	1.47	11.35
11172 female	42.54	10.61	18.33	7.21	4.14	6.73	3.12	3.73	18.49
11173 female	42.21	9.04	14.24	6.90	2.94	5.48	3.37	3.02	15.29
11174 female	38.58	10.18	14.55	6.14	3.09	5.13	2.81	2.13	15.51
11177 male	24.96	7.56	10.08	4.39	2.61	4.36	2.61	1.80	10.94
11332 male	39.59	12.11	14.17	6.93	4.19	4.77	3.25	2.51	14.83
11333 female	40.91	12.54	16.71	7.03	4.11	5.48	4.21	2.94	16.05

Table 18 : Measurements of the frogs collected (in millimeters)

Reg No & Sex	Snout-vent length	Head length	Head width	Snout length	Eye-nostril length	Eye diameter	Inter-orbital length	Tympanum diameter	Tibial length
11166 male	59.10	15.67	19.07	8.99	5.28	6.68	5.91	6.65	29.08

Remarks: Species is uncommon in the Eastern Ghats. The crimson colour on the back resembles red bark fungus hence the name fungoid frog. Obliterative pattern of the rest of the body breaks the outline, merging the frog into the background. A powerful fungoid odour is also given out under excitement, which smells like burnt rubber.

19. *Hylarana temporalis* (Gunther, 1864)

1864. *Rana temporalis* Gunther, *Rept. Brit. India*: 444 pp.

Common Name: Bronze Frog (English).

Specimens Examined: A 11373 – A 11375 from Yercaud, Shevaroy hills, Tamil Nadu (altitude 985 meters above msl) collected on 08.ii.2010. The measurements of the frogs as shown in Table 19.

Size: 35-82 mm (Snout-vent length).

Habitat: Wet, exposed rocks in small hill-streams shaded by bushes and small trees. Rarely

found in leaf litter on forest floors they feed on ground insects and other small frogs.

Remarks: The species is common in the southern part of the Eastern Ghats. It adopts an upright posture at rest while on rocks, litter or fallen logs. It is quite agile both in water and on land. It leaps for a considerable distance into water of hill-streams when disturbed only to swim across and surface again closeby. Call starts with a guttural croak followed by a series of loud *wak*. It calls both during day and night. Eggs are attached few centimeters below water in rock pools.

20. *Hylarana* sp

Specimens Examined: A 11336 – A 11337 from Tirumala, Sri Venkateswara Wildlife Sanctuary, Tirupati hills, Chittoor district, Andhra Pradesh (altitude 896 meters above msl) collected on 21.ix.2011. The measurements of the frogs as shown in Table 20.

Size: 40-46 mm (Snout-vent length).

Table 19 : Measurements of the frogs collected (in millimeters)

Reg No & Sex	Snout-vent length	Head length	Head width	Snout length	Eye-nostril length	Eye diameter	Inter-orbital length	Tympanum diameter	Tibial length
11373 female	46.63	15.26	13.51	8.05	5.48	5.94	4.24	3.93	26.28
11374 male	42.24	13.51	12.62	7.46	4.82	5.41	4.11	3.78	24.28
11375 male	37.13	12.49	12.36	8.05	4.72	5.61	4.80	3.63	21.56

Table 20 : Measurements of the frogs collected (in milimeters)

Reg No & Sex	Snout-vent length	Head length	Head width	Snout length	Eye-nostril length	Eye diameter	Inter-orbital length	Tympanum diameter	Tibial length
11336 male	46.88	13.91	13.10	8.83	5.20	5.94	4.87	5.10	27.33
11337 male	40.74	11.35	10.89	8.17	4.90	4.62	3.98	3.45	23.54

Diagnostic features: Body elongated and torpedo-shaped with a relatively narrow waist. Head pointed, slightly longer than broad. Nostrils oval, dorso-laterally positioned, nearer to tip of snout than to eye. Eyes large, its diameter slightly more than the eye-nostril distance. Pupil rounded. Inter-orbital distance greater than upper eyelid width. Inter-orbital distance less than eye diameter. Inter-orbital space flat. Tympanum very distinct and round. Tympanum diameter less than eye diameter. Supra-tympanic fold absent. Mouth extending to posterior corner of eye, tongue oval and bifurcate, free posteriorly. A large rictal gland present. A very broad dorso-lateral fold starting from behind the eye to the inguinal region. Dermal fold on flank from rictal region to inguinal region. Vocal sacs paired but internal. Skin structure smooth. Skin on belly and abdomen smooth.

Arm short and thin. No dermal flap along forearm. Presence of a flat humeral gland on upper arm. Fingers long and thin, lacking webbing. Relative length of fingers: $3 > 1 > 4 > 2$. Tips of fingers swollen without distinct grooves. Subarticular tubercles on fingers unique and rounded. Hindlimbs relatively long and stout. Toes long and thin. Relative length of toes: $4 > 3 > 5 > 2 > 1$. Webbing on toes moderate, webbing on toe IV reaches between basal and distal subarticular tubercle. Tips of toes swollen without distinct grooves. There is a slight dermal fringe on toe V. Subarticular tubercles on toes rounded. Inner and outer metatarsal tubercle small but distinct.

Colour: Dorsum yellowish-brown with a thin bluish-black mid-dorsal line from back of forehead continuing down the mid-dorsum and diverging on the sacrum and continuing separately

to the groin. A similar bluish-black line from tip of snout to eye. Flanks from eye to groin light brownish-grey including the tympanum which is yellowish-brown. A white lateral line below the flanks including the rictal gland. Limbs yellow spotted with bluish-black. Fingers and toes yellow without spots. Eyes black with upper portion golden-yellow.

Habitat: The species was collected from dry leaf-litter on a dry stream bed among rocky outcrops

Remarks: The species is not uncommon in the Tirupati hills of southern Andhra Pradesh. As it seems to be a new species to science, it is being described separately elsewhere.

FAMILY: RHACOPHORIDAE

21. *Polypedates maculatus* (Gray, 1834)

1834. *Hyla maculata* Gray, *Indian Zoology*, 1: 82.

Common Name: Common Tree Frog, Common Indian Tree frog (English).

Specimens Examined: A 11156 & A 11158 from Rayagada, Odhisa (altitude 370 meters above msl) collected on 26.viii.2010 and A 11209 – A 11210 from Damanjodi, Odhisa (altitude 895 meters above msl) collected on 22.viii.2010. The measurements of the frogs as shown in Table 21.

Size: Snout-vent length: 35-55 mm (male), 50-75 mm (female).

Habitat: Moist deciduous forest in trees, bushes, shrubs and in the breeding season sometimes on the ground beside ponds, ditches etc. Enters houses where it finds the moist atmosphere of bathrooms very congenial.

Table 21 : Measurements of the frogs collected (in millimeters)

Reg No & Sex	Snout-vent length	Head length	Head width	Snout length	Eye-nostril length	Eye diameter	Inter-orbital length	Tympanum diameter	Tibial length
11156 male	48.46	11.58	15.64	7.77	5.38	5.10	5.23	3.75	22.98
11158 male	45.54	11.81	14.65	7.51	4.26	4.85	4.72	3.32	21.18
11209 female	72.41	19.98	23.49	11.07	7.84	7.69	9.82	6.04	39.31
11210 male	45.84	11.96	13.99	7.79	5.30	5.20	5.25	4.16	26.69

Remarks: A very common tree-frog in the Eastern Ghats seen on trees and bushes about 1-6 meters above the ground in all areas of the Eastern Ghats. When resting all four legs are tucked in well under the body. Lays eggs in pendulous foam-nests over hanging water in which the tadpoles fall and develop. These foam-nests measure 7-11 cm in diameter.

22. *Raorchestes sanctisilvaticus* (Das & Chanda, 1997)

1997. *Philautus sanctisilvaticus* Das & Chanda, *Hamadryad*, 22(1): 21-27.

Common Name: Sacred Groves Bush Frog (English).

Specimens Examined: 12 specimens (11 males and 1 female) from Araku valley, Andhra Pradesh (altitude 815 meters above msl) collected on 11.ix.2009. The measurements of the frogs as shown in Table 22.

Size: 21-25 mm (male) and 24 mm (female).

Diagnostic features: Small-sized, relatively robust looking with a narrow waist. Head is short but wider than long, snout flattened, obtusely pointed and projecting beyond mandible. Eyes are large but tympanum is extremely small almost concealed. Nostril is closer to the eye than the tip of the snout. A supratympanic fold commences from posterior corner of eye, passing over the

tympanum and dipping down to cross over at the insertion of the forelimb.

Tips of fingers dilated into large, rounded and flattened disks with distinct circum-marginal grooves. The largest digital disk is on Finger III. Fingers are not webbed. Tibia is long. Tips of toes dilated into flattened disks with circum-marginal grooves. Disks on toes are as large as those on the fingers. Webbing on toes is less. Toe I with rudimentary webbing, outer side without a dermal fringe. Webbing on toe II is up to distal subarticular tubercle on outer and inner fringes. Webbing on toe III is up to basal subarticular tubercle on outer edge, reaching the base of the disks on both sides. Webbing on toe IV is up to basal subarticular tubercle on inner and distal on outer side, reaching base of disks as a narrow sheath. Webbing on toe V is up to distal subarticular tubercle as a broad web, reaching disk base as a narrow sheath on inner side. Outer metatarsal tubercle is absent but there is a small elongated inner metatarsal tubercle.

Dorsum of body with plenty of small irregular tubercles. A narrow median dermal fold is present along the dorsum. Upper eyelids are tuberculate too. Throat, abdominal region and undersurface of thighs are also with large and flattened tubercles. Cloacal opening directed postero-ventrally, slightly below upper level of thighs.

Table 22 : Measurements of the frogs collected (in milimeters)

Reg No & Sex	Snout-vent length	Head length	Head width	Snout length	Eye-nostril length	Eye diameter	Inter-orbital length	Tympanum diameter	Tibial length
11119 male	24.07	6.14	7.79	3.14	1.80	2.81	2.74	1.47	10.64
11120 male	21.94	6.24	7.97	2.99	2.00	2.92	3.27	1.19	10.28
11121 male	25.29	5.71	7.46	3.04	1.82	2.71	2.69	1.32	8.99
11122 male	22.12	5.35	7.84	3.12	1.72	2.87	2.76	1.32	9.88
11123 male	24.10	6.14	7.28	3.37	2.00	2.81	2.87	1.06	11.45
11124 male	22.02	5.56	7.28	3.02	1.34	2.79	2.87	1.54	9.22
11125 male	22.70	6.14	7.95	3.04	2.20	3.14	3.12	1.42	9.90
11126 male	21.94	6.01	7.77	3.37	1.77	2.64	2.48	1.21	10.08
11127 male	24.91	6.27	7.92	3.27	1.95	2.61	2.23	1.39	10.46
11128 male	23.11	5.23	7.77	3.17	2.03	2.64	2.76	1.57	9.80
11129 male	24.73	6.24	8.45	3.63	2.46	2.92	3.42	1.57	11.32
11130 female	24.00	5.38	7.41	2.76	1.95	2.71	2.69	1.47	10.41

Colour: Dorsum is deep brownish, unpatterned but fore-head is slightly darker than the rest of the body. Throat is light brown. The fore and hind limbs are banded with dark brown. Tips of digits of fore and hind limbs are pale yellow. Area between axilla and groin with deep yellow and cream reticulations.

Habitat: Found on bushes (*Lantana camara*, *Ipomea carnea*, *Chromolaena odorata* and *Solanum verbascifolium*) about 1.2-1.5 meters above the ground beside roadsides, hill-streams and in forested patches.

Remarks: A common bush frog inhabiting the northern part of the Eastern Ghats beside roadsides, hill-streams, in forested patches etc. Call is typical of other *Raorchestes* sp consisting of several tik-tik-tik sounds emitted at regular intervals.

The species was described from Sacred Groves of Kapildhara Falls, Amarkantak, Madhya Pradesh and last collected in 1962. IUCN considers the species as Critically Endangered due to its restricted distribution. However, we found the species to be common at Araku Valley, Andhra Pradesh on bushes 1.2-1.5 meters above ground level. This

is a range extension of the species by 600 km south-east of its known area of occurrence.

23. *Raorchestes* sp

Specimens Examined: 2 specimens (A 11338 – A 11339) from Tirupati hills, Andhra Pradesh (altitude 898 meters above msl) collected on 22.ix.2011. The measurements of the frogs as shown in Table 23.

Size: 21 mm (male).

Diagnostic features: Small-sized frogs with a robust body and a narrow waist. Head is broader than long. Snout is rounded, projecting slightly beyond the mouth. Snout length is one and a half times the diameter of the eye. The nostrils are closer to the tip of the snout than the eyes. Eyes are not very large but round with well-developed upper eyelids. Intra-orbital length is greater than the eye diameter. Tympanum is small, flattened and two-third the diameter of the eye. There is no supra-tympanic fold. Fore and hind limbs are long and slender. Thighs are well-developed. Fingers and toes are with large, rounded and flattened disks with distinct circum-marginal grooves. Discs on the fingers are larger than on the toes. Fingers are without any webbing. Toes are minutely webbed with two phalanges of the fourth toe free and one phalange of the other toes free of webbing. Skin is smooth on the dorsum and on the chin and throat but granular on the belly and under the thighs.

Colour: Dorsum is chocolate or deep brown with hardly any markings except a light X-shaped

marking on the back. There are some indistinct cross-bars on the thighs. Iris is black.

Habitat: Found on dry leaf-litter on the floor of a dried up stream among rocky outcrops.

Remarks: The species is quite common in the Tirupati hills where they call by sitting on the ground among the fallen leaf litter.

24. *Raorchestes terebrans* (Das & Chanda, 1998)

1998. *Philautus terebrans* Das & Chanda, *J. South Asian. Nat. Hist.*, 3(1): 103-112.

Common English Name: Boring Bush Frog.

Specimens examined: None (reported from literature from paratypes collected in 1877).

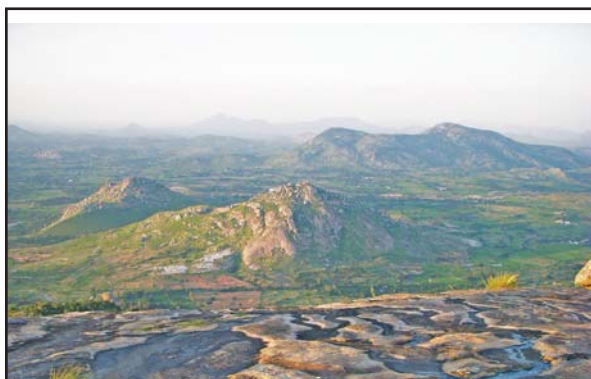
Size: Snout-vent length is 14.8-21.6 mm (male) and 12.8-16.2 mm (female).

Diagnostic Features: Small body-size, body robust with a narrow waist, head wider than long, snout flattened and obtusely pointed, projecting a little beyond mandible. Nostrils are closer to the tip of the snout than the eye. Eyes large, their diameter greater than the eye-nostril distance. Inter-orbital width slightly less than twice the width of the upper eyelid. Inter-narial region narrow. A supra-tympanic fold commences from posterior corner of eye, crossing over the tympanum and dipping down to cross over insertion of fore-limb. Tympanum small, flattened and less than diameter of eye. Nostrils laterally oriented and oval in shape. Vomerine teeth absent. Tongue large, elongate and bifid.

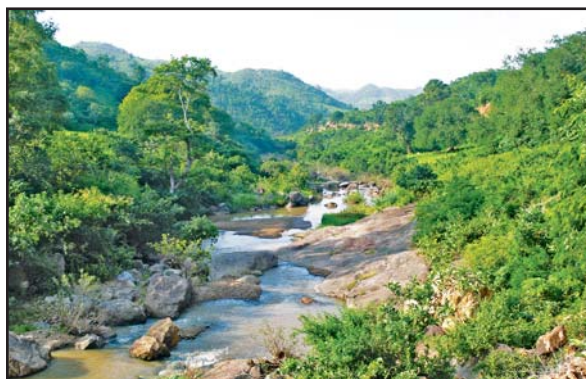
Table 23 : Measurements of the frogs collected (in millimeters)

Reg No & Sex	Snout-vent length	Head length	Head width	Snout length	Eye-nostril length	Eye diameter	Inter-orbital length	Tympanum diameter	Tibial length
11338 male	21.20	6.40	8.05	4.14	2.94	2.18	3.12	1.62	11.60
11339 male	21.53	6.57	8.10	4.19	3.02	2.46	3.22	1.67	12.34

PLATE I



1. Eastern Ghats from Horsley Hill, Andhra Pradesh



2. Forested area in Eastern Ghats with stream



3. Common Indian Toad (*Duttaphrynus melanostictus*)



4. Marbled Toad (*Duttaphrynus stomaticus*)



5. Rough Dwarf Toad (*Duttaphrynus scaber*)



6. Ornate narrow-mouthed Frog (*Microhyla ornata*)



7. Red narrow-mouthed Frog (*Microhyla rubra*)



8. Painted Frog (*Kaloula taprobanica*)

PLATE II

9. Ballon Frog (*Uperodon globulosus*)10. Marbled Balloon Frog (*Uperodon systoma*)11. Skittering Frog (*Euphlyctis cyanophlyctis*)12. Aloysi Skittering Frog (*Euphlyctis aloysii*)13. Small Cricket Frog (*Fejervarya syhadrensis*)14. Kerala Warty Frog (*Fejervarya keralensis*)

15. A hill-stream in Eastern Ghats



16. Collection of amphibians

PLATE III



17. Jerdon's Bull Frog (*Hoplobatrachus crassus*)



18. Indian Bull Frog (*Hoplobatrachus tigerinus*)



19. Burrowing Frog (*Sphaerotheca breviceps*)



20. Roland's Burrowing Frog (*Sphaerotheca rolandae*)



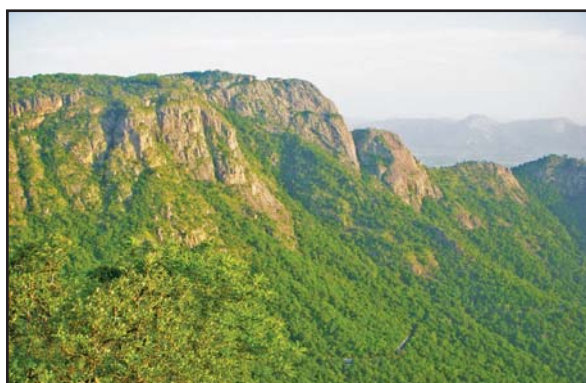
21. Fungoid Frog (*Hylarana malabarica*)



22. Bronze Frog (*Hylarana temporalis*)



23. *Hylarana* sp from Tirupati



24. Tirupati hills in Eastern Ghats

PLATE IV

25. Common Tree-frog (*Polypedates maculatus*)

26. Collection of Bush Frogs

27. Sacred Groves Bush Frog (*R. sanctisilvaticus* calling)28. Sacred Groves Bush Frog (*Raorchestes sanctisilvaticus*)29. Boring Bush Frog (*Raorchestes cf terebrans*)30. Ground-dwelling Bush Frog (*Raorchestes* sp)

Tips of fingers dilated into large, rounded and flattened disks with distinct circum-marginal grooves. A smooth pale nuptial pad on dorsal surface of the first finger. The largest digital disk is on the third finger which is equal to the horizontal diameter of tympanum. Fingers are not webbed. Tibia long, tips of toes strongly dilated into flattened disks with circum-marginal grooves. Disks on toes are as large as those on the fingers. Reduced webbing on toes. The first toe with rudimentary webbing, outer side without a dermal fringe. Webbing on the second toe up to distal subarticular tubercle on outer and rudimentary webbing on inner edge. Webbing on the third toe is up to distal subarticular tubercle on the outer edge and distal subarticular tubercle on the inner edge. Webbing on the fourth toe is between the distal and basal subarticular tubercle on both sides. Webbing on the fifth toe is to distal subarticular tubercle as a broad web, reaching disk base as a narrow sheath on inner side. Outer side of the fifth toe without a dermal fringe. Tarsal fold absent. A small elongated inner metatarsal tubercle and a larger oval outer metatarsal tubercle.

Dorsum of body with uniformly scattered white-tipped pustules. Upper eyelids smooth. Throat, abdominal region as well as undersurface of thighs coarsely granular. Undersurface of forelimbs weakly tuberculate. Cloacal opening directed postero-ventrally, slightly below upper level of thighs.

Colour: Unpatterned brownish-grey dorsally, fore and hind limbs banded with dark brown. A dark inter-orbital bar present. Tips of digits of fore and hind limbs cream-coloured. Throat brownish, abdominal region with brown variegations. An elongated cream patch on inguinal region, anterior to which are two cream spots.

Remarks: Collected long back in 1877 from Peddavalasa (altitude about 1000 meters), Golconda hills, Vishakapatnam district of the Eastern Ghats of Andhra Pradesh. We could not locate this species as it remained elusive.

SUMMARY

The amphibian fauna of the Eastern Ghats was found to be quite rich with at least 24 species belonging to 11 genera and 5 families of Anurans (3 species of Bufonidae, 5 species of Microhylidae, 9 species of Dicroglossidae, 3 species of Ranidae and 4 species of Rhacophoridae). We could collect 23 of these species but the Boring Bush Frog (*Raorchestes terebrans*) which was collected in 1877 from the Vizag hills remained elusive. However, our collection of 12 specimens of the Sacred Groves Bush Frog (*Raorchestes sanctisilvaticus*) from Araku Valley of Andhra Pradesh in September, 2009 is a re-discovery of the species after its original collection in 1962 from Kapildhara waterfalls, Amarkantak, Madhya Pradesh and is a range extension of the species by a distance of about 600 km to the south-east. IUCN considers this species as Critically Endangered due to its previously known restricted distribution and it was considered as one of the Lost Amphibians of India.

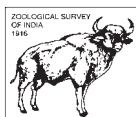
Collections of the Aloysi Skittering Frog (*Euphylyctis aloysii*) from Horsley Hill, Andhra Pradesh in September, 2011 and of the Orissa Cricket Frog (*Fejervarya orissaensis*) from Renigunta, Andhra Pradesh also in September, 2011 are new records for the State of Andhra Pradesh. Our collection of a species of *Hylarana* from Tirupati hills, Andhra Pradesh in September, 2011 is of a new species to science which is being described elsewhere.

ACKNOWLEDGEMENTS

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REFERENCES

- Daniel, J.C. 2002. The Book of Indian Reptiles and Amphibians. *Bombay Natural History Society and Oxford University Press*, 238 pp.
- Daniels, R.J.R. 2005. Amphibians of Peninsular India. Universities Press (India) Private Limited. 268 pp.
- Daniels, R.J.R. & Ishwar, N.M. 1994. Rarity and the herpetofauna of the southern Eastern Ghats, India. *Cobra*, **16**: 2-12.
- Daniels, R.J.R. & Ravikumar, M.V. 1998. Amphibians and reptiles of Kolli hills. *Cobra*, **31**: 3-5.
- Das, I & Chanda, S.K. 1997. *Philautus sanctisilvaticus* (Anura: Rhacophoridae), a new frog from the sacred groves of Amarkantak, Central India. *Hamadryad*, **22**(1): 21-27.
- Das, I & Chanda, S.K. 1998. A new species of *Philautus* (Anura: Rhacophoridae) from the Eastern Ghats, south-eastern India. *J. South Asian nat. Hist.*, **3**(1): 103-112.
- Dutta, S.K. 1988. First records of *Bufo stomaticus* and *Bufo fergusonii* (Anura: Bufonidae) from Orissa, with comments on their distribution. *J. Bombay nat Hist. Soc.*, **85**(2): 439-441.
- Dutta, 1990. Ecology, natural history and conservation of herpetofauna of Orissa, India. *Tigerpaper.*, **17**: 20-28.
- Dutta, S.K. 1991. An overview of the amphibian fauna of Orissa. *Herpeton.*, **4**: 7-8.
- Dutta, S.K. & Acharjyo, L.N. 1993. Addition to the herpetofauna of Orissa. *The Snake*, **25**: 149-150.
- Dutta, S.K. & Acharjyo, L.N. 1997. Further additions to the herpetofauna of Orissa, India. *Cobra*, **30**: 1-8.
- Dutta, S.K. 1997. A new species of *Limnonectes* from Orissa, India. *Hamadryad.*, **22**(1): 1-8.
- Dutta, S.K. 2003. A new species of Rhacophorid frog from Simlipal Biosphere Reserve, Orissa, India. *Russian. J. Herpetol.*, **10**(1): 25-32.
- Legrís, P. & Meher-Homji, V.M. 1982. The Eastern Ghats: vegetation and bio-climatic aspects, pp 1-17. In: National Seminar on Resources Development and Environment of the Eastern Ghats (24-27 March, 1982), Waltair. Andhra University Press, pp 232.
- Pillai, R.S. & Ravichandran, M.S. 1992. Amphibia of Javadi hills, North Arcot District (Tamil Nadu). *Cobra*, **7**: 5-7.
- Sarkar, A.K. 1993. Amphibia In: Ghosh, A.K. (ed.). *Fauna of Orissa, State Fauna Series*, **4**(Part-1): 39-49, Zoological Survey of India, Calcutta.
- Sarkar, A.K., Chandra, P.K & Ray, S. 1993. Amphibia In: Ghosh, A.K. (ed.). *Fauna of Andhra Pradesh, State Fauna Series*, **5**(Part-1): 65-87, Zoological Survey of India, Calcutta.



NEW SPECIES OF *INDOTRITIA* JACOT, 1929 (ACARINA : ORIBATIDA) FROM LAKSHADWEEP, INDIA

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ABSTRACT

Lakshadweep is one of the smallest Union Territories of India. The first ever study of soil inhabiting oribatid mites from Lakshadweep revealed one new species under the genus *Indotritia* Jacot, 1929. Only two species of *Indotritia* were reported so far from India (Uttar Pradesh, West Bengal and Kashmir). The family and genus are reported here for the first time from Lakshadweep.

The new species *Indotritia lakshadweepensis* (Acarina: Oribatida) can be distinguished readily from all other known species in its possession of faint, wavy, longitudinal and vertical lineation in the proximal part of notogaster, single solenidia in genu I and absence of any solenidia in genu IV.

INTRODUCTION

The cryptostigmatid or oribatid mites (Acarina : Oribatida) are commonly found to inhabit soil and litter with rich organic matter. These mites are numerically the most abundant soil acarina constituting about 80% of the soil fauna. The oribatids are economically very important to man because of their direct and indirect effect on human beings and other animals.

Lakshadweep, one of the smallest Union Territories of India, consists of 12 atolls, three

reefs and five submerged banks with 10 of its 36 Islands (area 32 sq.km.) being inhabited. Though the islands are unique in their ecosystem, no extensive faunal survey has yet been undertaken. Considering the fact, a survey was undertaken in Agatti Island, Lakshadweep for short duration and collected insects and oribatid mites. The study of soil inhabiting mites revealed one species which is described and illustrated in the present paper as new to science under the genus *Indotritia* Jacot, 1929.

The genus *Indotritia* includes 37 species (Subias, 2009), of which 2 were recorded previously from India (*Indotritia propinqua* Niedbala (2000) from Uttar Pradesh and West Bengal and *Indotritia undulata* Bayoumi and Mahunka (1979) from Kashmir).

Eight specimens of the new species *Indotritia lakshadweepensis* were collected from the soil of Lakshadweep during a survey tour conducted by the first author in July, 2011. The family and genus are reported for the first time from Lakshadweep.

MATERIAL AND METHODS

The soil samples were collected from a garden having semidecomposed banana plants and a few wild herbs in the Agricultural Office Campus at Agatti Island, Lakshadweep, India. The mites

were extracted from the soil samples with the help of a modified Tullgren dry funnel extraction apparatus. Specimens were cleared in lactic acid. For microscopic observations temporary mounting method was followed. Mite specimens were placed on a slide containing a small amount of lactic acid as mounting medium, covered by a small piece of cover slip and necessary microscopic observations were done. A total of eight specimens under the genus *Indotritia* were identified by following Balogh (1972). The measurements provided in the text were taken with the help of ocular and stage micrometers. The measurements of the specimens have been given in micron (μm).

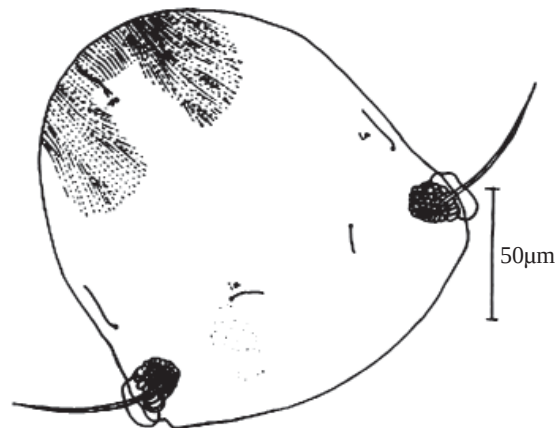
Holotype: Female: India, Lakshadweep, Agatti Island, Soil, 2-vii-2011, coll. A. K. Sanyal (Registration No. 4256/17); **Paratypes:** 7 Female: data same as for holotype (Registration No. 4257/17) were deposited in the National Zoological Collection, Zoological Survey of India, Kolkata.

RESULTS

Indotritia lakshadweepensis sp. nov.

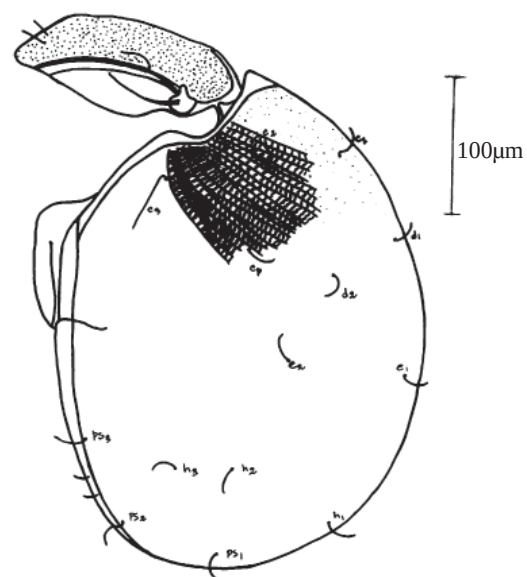
(Figs. 1-6)

Aspis: Length of Aspis- 400.08; Breadth of Aspis- 368.88. Length / breadth ratio of aspis 1.08. Aspis with two pairs of lateral carinae, one pair on each side; upper carinae well developed and larger than lower carinae and reaches almost the end of the rostrum. Anterolateral margin of aspis in dorsal view not smoothly rounded, but rostrum weakly protruding. A weak swelling exists on the anterior part behind rostral setae. Rostral, lamellar and interlamellar setae smooth. Lamellar setae (57.90) thin, long and directed anteriorad, parallel with the surface of prodorsum, longer than rostral setae. Rostral setae (42.03) originating from a small papillae, longer than interlamellar setae (32.35), extends beyond the margin of the rostrum. Exobothridial setae vestigial. Sensillus (157.31) smooth, setiform, pointed. Anterior margin of aspis with fine lineation. Irregular granulation in aspis. Bothridial squama prominent and situated above bothridium (Fig. 1).



Figs. 1. Aspis in dorsal view of *Indotritia lakshadweepensis* sp. nov.

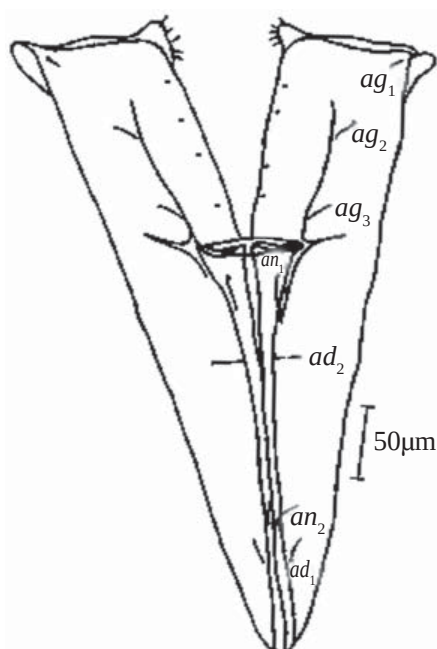
Notogaster: Length of notogaster-848.29; breadth of notogaster- 696.30. Strongly arched in lateral view. Length / breadth ratio of notogaster 1.22. 14 pairs of notogastral setae smooth, fairly strong, sickle shaped. Setae c_3 (128.06) inserted close to the anterolateral margin of notogaster and longer than other setae. Anterior part of notogaster sculptured with longitudinal lineation with vertical wavy furrows in between two successive longitudinal lines. Lineations originate from anterolateral margin of notogaster and extend upto notogastral setae cp . Irregular granulations present in notogaster. Lyrifissures ia , im , ip , ips , ih present (Fig. 2).



Figs. 2. Lateral view of body of *Indotritia lakshadweepensis* sp. nov.

Epimere: Epimeral setal formula 3-0-3-3.

Genito-Anal Region : Length of genital plate-227.92; length of progenital plate-30.8; length of anal plate-412.81. Genital and aggenital plate incompletely separated by genito-aggenital suture. Genito-aggenital suture (141.77) reaching up to the middle of g_6 and g_7 and bent inward. Genital setae 9 pairs among which 5 pairs located on progenital plate and 4 pairs on genital plate. Aggenital region bear 3 pairs of setae; ag_1 located near anterolateral corner of the region; ag_2 parallel with g_7 and ag_3 parallel with g_9 . Each anal plate and adanal plate bears 2 pairs of setae (Fig. 3).



Figs. 3. Ano-genital region of *Indotritia lakshadweepensis* sp. nov.

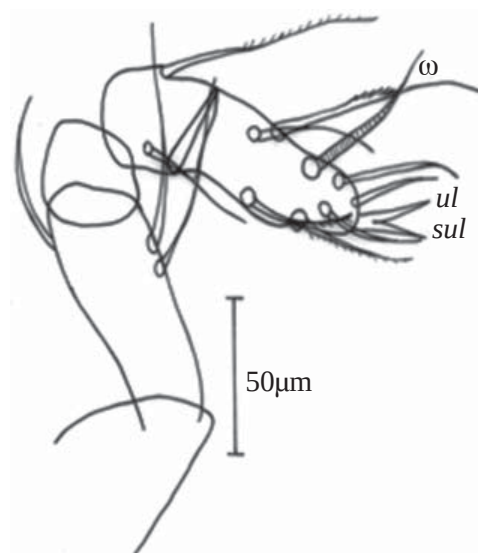
Length of aggenital and genital setae: ag_1 -20.44, ag_2 -28.57, ag_3 -28.18, genital setae-9.67, progenital setae-8.98.

Length of anal and adanal setae: an_1 -28.38, an_2 -23.32, ad_1 -20.78, ad_2 -18.20.

Palp : Palp five segmented with setal formula: 0-3-0-2-10 and one solenidia on the tarsus. Femur and genu distinguishable but immovably articulated. Eupathidia ul' and sul fused basally (Fig. 4).

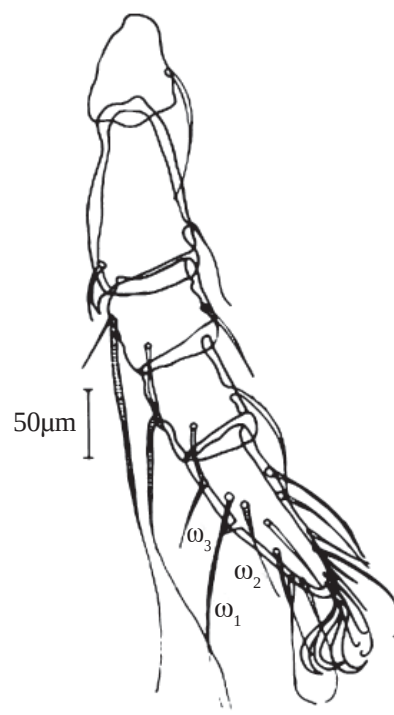
Legs : Chaetotaxy of the legs mentioned below. Anteriodorsal spine of femora I stout

and hooked. A small setae present on tarsus I immediately below ω_2 . All solenidia on genu and tibia accompanied each by a short setae. Tarsi of legs tridactylous (Figs. 5 & 6).



Figs. 4. Palp of *Indotritia lakshadweepensis* sp. nov.

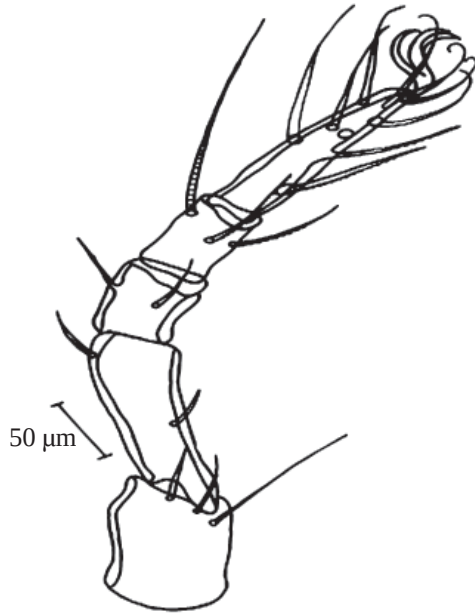
Leg Setae: Total setae: I(1-3-5-4-22); II(1-4-4-4-16); III(0-2-4-4-12); IV(3-2-2-3-11); solenidia: I(1-1-3); II(1-1-2); III(1-1-2); IV(0-1-0).



Figs. 5. Leg I of *Indotritia lakshadweepensis* sp. nov.

Distribution : India: Lakshadweep (Agatti Island).

Etymology: The new species is named after the name of the collection locality, Lakshadweep Islands.



Figs. 6. Legs IV of *Indotritia lakshadweepensis* sp. nov.

DISCUSSION

The new species is related with *I. acanthophora* Markel, 1964 described from Peru. Similarities with the new species are in presence of setiform sensillus, well developed upper carinae, number of genital, aggenital, anal and adanal setae, c_3 longer than other, fine striations in the anterior margin of aspis, presence of acanthophore in femur I. But the species *I. lakshadweepensis* shows dissimilarities in granulations in aspis, longitudinal lineation with vertical wavy furrows in notogaster which originate from the anterior margin of notogaster and run backward, an_2 and ad_2 are very minute in *I. acanthophora* whereas in the new species the length of an_2 and ad_2 more or less same with an_1 and ad_1 respectively. Other most important dissimilarities are presence of single solenidia in genu I and no solenidia in genu IV of new species whereas 2 in genu I and 1 in genu IV of *I. acanthophora* (Table-I).

Table-I : Characters showing similarities and dissimilarities between *I. acanthophora* and *I. lakshadweepensis*

Characters	<i>I. acanthophora</i>	<i>I. lakshadweepensis</i>
Acanthophore in leg I	Prersent	Present
Lineation in aspis	Present	Present
Shape of sensillus	Setiform, pointed	Setiform, pointed
Solenidia in genu I	2	1
Solenidia in genu IV	1	0
Lineations in notogaster	Absent	Present
Notogaster length (μm)	790	848.29
Notogaster Breadth (μm)	580	696.30
Aspis length (μm)	415	400.08
Aspis breadth (μm)	365	368.88
Length of genital plate (μm)	210	258.72
Length of Anal Plate (μm)	365	412.81
Length of Sensillus (μm)	140	157.31
Length of c_3 (μm)	115	128.06

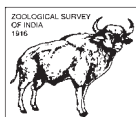
ACKNOWLEDGEMENTS

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REFERENCES

- Balogh, J. 1972. *The oribatid genera of the world*: 1-359. Published by Akad. Kiado, Budapest, Hungary.
- Bayoumi, B. M. and Mahunka, S. 1979. Ergebnisse der Bhutan- Expedition 1972 des Naturhistorischen Museums in Basel, Acari: Oribatida (Part I). *Entomologica Basiliensia*, **4**: 13-24.
- Jacot, A. P. 1929. New Oribatoid Mites. *Psyche*, **35**: 213-215.
- Markel, K. 1964. Die Eupthiracaridae Jacot, 1930, Und Ihre Gattungen (Acari, Oribatei). *Zool. Verh.*, **67**: 1-78.
- Niedbala, W. 2000. *The Ptyctimous Mites Fauna of the Oriental and Australian Regions and their Centers of Origin (Acari: Oribatida)*: 116. Published by Polskie Towarzystwo Taksonomiczne (Polish Taxonomical Society), Wroclaw, Poland.
- Subías, L. S. 2009. Listado sistemático, sinónimo y biogeográfico de los ácaros oribátidos (Acariformes: Oribatida) del mundo (Excepto fósiles). *Publicado originalmente en Graellsia* **60** (número extraordinario): 3-305 (2004). Actualizado en junio de 2006, en abril de 2007, en mayo de 2008 y en abril de 2009. 1-547.



STUDIES OF HEMATOLOGY AND HISTOLOGY IN *LABEO ROHITA* INFECTED WITH CUTANEOUS COLUMNARIS DISEASE

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INTRODUCTION

Bacterial disease is extremely common in freshwater fishes caused by primary or obligate pathogens. Most bacterial infections are caused by gram negative and systematic or ulcer forming bacteria seriously through genera *Aeromonas*, *Vibrio*, *Edwardsiella*, *Pseudomonas*, *Flavobacterium* and others. Columnaris disease is also commonly known as saddle back disease, cotton wool disease, cotton mouth disease and fin rot. Columnaris disease has been reported worldwide in most species of freshwater fishes with rare infections reported in marine fishes (Tripathi et al., 2003). The etiologic agent of columnaris disease is a long thin, gram-negative, gliding rod that has recently been reclassified as *Flavobacterium columnare* (Bernardet et al., 1996). Natural infections with *F. Columnare* may occur frequently at > 20°C water temperature. Such disease outbreaks are associated with high mortality that may reach 100%. Columnaris disease has also been reported in coldwater fish at normal environmental temperatures ranging from 6 to 12°C (Tripathi et al., 2003).

The pathogenesis of columnaris disease is not well understood. In addition, most of these studies focused on gill lesions, Skin. This study was conducted to detect skin infections, to assess the bacteriostatic effects of cutaneous mucus and to evaluate hematologic and biochemical changes during disease.

MATERIALS AND METHODS

One hundred clinically healthy rohu (*Labeo rohita*), with a mean length of 12-18 cm and an average weight of 150 gram were obtained from Kushinagar hatchery plant. These fish were maintained in stocking tanks with a flow-through water system. The photoperiod of 12 hr of light was provided, and the fish were fed a commercial feed once daily. In addition, the fishes were observed twice daily for clinical signs of disease or mortality during the study period.

Twenty clinically healthy rohu were chosen at random and assigned to infected or control group. The fish were anesthetized in aerated water. Anesthetized fish were quickly laid on flat surface and their right side was wiped gently Kim knife containing a 10-fold dilution of detergent. The fish in the infected group were immersed for 1 hr in a bacterial culture of *F.columnare* (106–107 CFu/Me of inoculam) with 0.35% Saline of 2 gallon volume. The control group was immersed in aerated 0.35% saline containing a similar volume.

Tissue imprint preparations were made from skin and gill lesions. These specimens were air-dried, stained with wright-Leishman stain and examined for presence of characteristic long, thin bacilli suggestive of *F. Columnare*.

Fifteen healthy acclimatized rohu were randomly divided into an infected group (x=10) and

a control group ($x=5$). The fish were anesthetized and blood specimens collected from the caudal vein for baseline hematology and biochemical heparin anticoagulant. Smears of heparinized blood were prepared for leukocyte differential counts, and the remaining blood specimens were refrigerated immediately. The determinations included PCV, total and differential leukocyte counts, erythrocyte counts with calculation of erythrocyte indices, and morphologic examination of leukocytes, erythrocytes of erythrocyte indices, and morphologic examination of leukocytes, erythrocytes and thrombocytes. For biochemical parameters, blood was collected without anticoagulant, placed in sterile glass tubes and allowed to clot for 15 min at room temperature. The serum was separated by centrifugation and analyzed. During the course of the experiment any mortality was recorded and dead fish were discarded.

Data of various hematologic and biochemical parameters were compared in the same group of fish before and after infection with *F. Columnare* to minimize the effect of individual variations. Means of all parameters were analyzed and comparison were made by t-test at a significant level of $P=0.05$. Similar comparisons were made in the uninfected control group to exclude the effect of handling.

RESULTS AND OBSERVATIONS

In 3 separate trials, the mortality rate ranged from 80% to 100% in the infected group as compared with 0% to 20% in the uninfected control groups. Initial infection showed cotton-wool like bacterial growth on the skin from right side of the fish where mucus had been removed with detergent, but the contra-lateral side of the fish remained normal (Fig. 1a and 1b). These fish also had clinical signs of disease, including lethargy, depression, and anorexia. Deep skin ulcers were ultimately observed in the *rohu* from the infected group. Neither clinical signs nor skin lesions were observed in the uninfected control group.



Fig. 1a and 1b. Control and infected fish with bacterial treatment.

Wright-Leishman stained cytology imprints of cutaneous lesion contained a homogenous population of slender, elongate bacilli (Fig. 2).

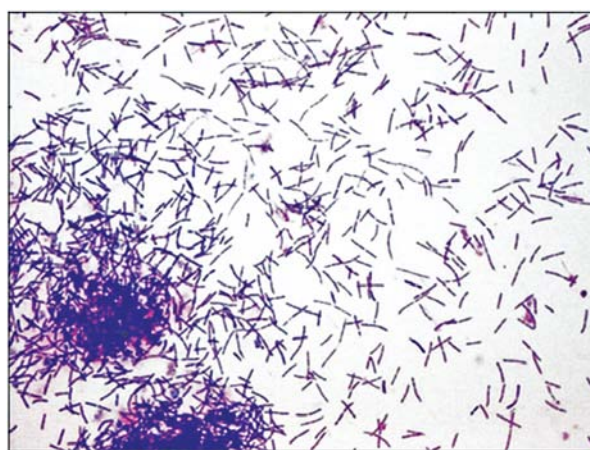


Fig. 2. Cytological preparation stained with Wright-Leishman reagent of *Flavobacterium columnare* (0.5-10 μ m) from cutaneous ulcer of infected fish.

Histopathologic study indicated that *F. Columnaris* infection in *rohu* was primarily

associated with Skin and finuleers; gill necrosis was rarely observed. Large numbers of *F. Columnare* were observed in the Skin ulcers and attached to the exposed layers of the Skin and dermis. The cutaneous ulcers extended to the deep dermis and underlying skeletal muscle in Occasional cases. Necrosis of Skin and muscle was accompanied by infiltrates of neutrophils (Fig. 3) Bacteria usually were not observed associated with fin lesions and were probably lost during tissue processing. Neither bacilli nor microscopic lesions were observed in internal organs including liver, spleen and anterior Kidney.

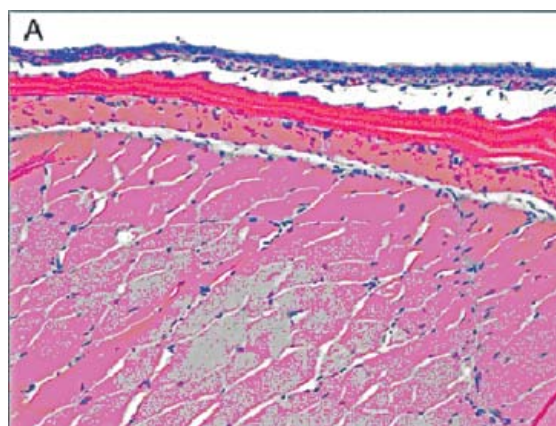


Fig. 3A. Normal skin showing the epidermis, scale, dermis and underlying skeletal muscle.

Pre-and post infection values of biochemical parameters are presented in Table 1. Marked hyponatremia and hypochloridemia were observed,

but minor decline was observed in calcium and magnesium concentration. The increase in anion gap was minimal. Mild decreases were observed in total serum protein and albumin like protein concentrations. A significant hyperglycemia was observed after infection with *F. Columnare*. Alkaline phosphatase (ALP), aspartate aminotransferase (AST), Lactate dehydrogenase (LDH) and creative kinase (CK) activities were significantly increased. In contrast, insignificant changes were observed in alanine aminotransferase (ALT) and sorbitol dehydrogenase (SDH) content. Significant changes were not observed in the uninfected control group (Table 2).

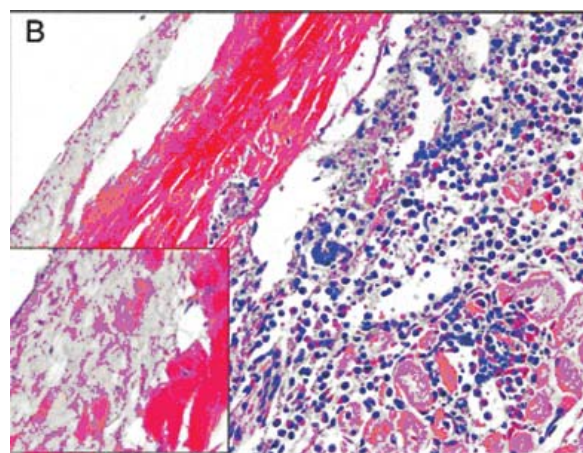


Fig. 3B. Infected skin with bacteria has epidermal ulceration and necrosis with scale loss and a severe dermal infiltrate of neutrophils.

Table-1. Change in hematology parameters in *Labeo rohita* to control and post-infection.

Parameter	N	Mean Healthy	Post infection	Chronic infection
PCV%	10	36.84	24.56	21.31
Hb (g/de)	10	9.21	6.73	153.6
MCV	10	185.6	169.3	153.6
MCH (pg)	10	42.23	37.30	33.42
MCHC (g/dl)	10	23.56	23.11	21.64
WBC($10^3/\mu\text{l}$)	10	31.4	19.82	16.89
RBC ($10^3/\mu\text{l}$)	10	2.11	1.72	1.49
Lymphocyte($10^3/\mu\text{l}$)	10	22.6	8.87	6.11
Monocyte ($10^3/\mu\text{l}$)	10	1.62	2.83	3.34
Neutrophil ($10^3/\mu\text{l}$)	10	6.73	7.55	8.27
Basophil ($10^3/\mu\text{l}$)	10	1.21	1.34	1.42

Table-2. Various hematologic parameters of a control group of *Labeo rohita* .

Parameter	N	Mean Healthy	Post infection	Chronic infection
PCV%	10	36.84	34.94	21.31
Hb (g/dl)	10	9.01	8.24	4.87
MCHC (g/dl)	10	23.56	24.12	21.64
RBC (10 ³ /μl)	10	2.11	2.19	1.37
Lymphocyte(10 ³ /μl)	10	21.6	21.2	6.11
Monocyte (10 ³ /μl)	10	1.30	1.39	2.97
Neutrophil (10 ³ /μl)	10	6.73	5.68	8.27
Basophil (10 ³ /μl)	10	1.44	1.46	1.87

Table-3. Changes observed in biochemical parameters of *Labeo rohita* in control and post-infection with *Flavobacterium columnare* (N=10).

Parameters	Mean		SE	P
	Healthy	Post infection		
Alanine aminotransferase (U/liter)	47.81	76056	14.57	0.05
Albumin (g/dl)	1.20	1.07	0.06	0.04
Alkaline Phosphate(U/liter)	8.11	47.11	13.54	0.01
Aspartate aminotransferase(U/liter)	150.4	96.6	227.9	0.002
Bile Acids (μmole/liter)	21.5	18.7	10.5	0.79
Total Bilirubin (mg/dl)	0.1	0.1	0	
Total Calcium (mg/dl)	10.93	8.43	0.57	0.0002
Chloride (m mol/liter)	114.4	55.7	8.1	0.0001
Cholestral (mg/dl)	237.7	206.4	42.3	0.46
Creatine Kinate (U/liter)	10623	49514	8643	0.0004
Creatinine (mg/dl)	0.14	0.24	0.03	0.002
Globalin (g/dl)	1.49	1.20	0.87	0.002
Glucose (mg/dl)	71.41	225.11	32.6	0.0002
Lactate dehydrogenase (μmole/liter)	376.11	1602.0	383.0	0.005
Phoyphorus (mg/dl)	5.63	6.09	0.74	0.54
Potassium (m mol/liter)	2.23	3.3	0.46	0.01
Sodium (m mol/liter)	140.7	92.3	6.97	0.0001
Sorbitol dehydration (μmole/liter)	0.41	3.0	1.2	0.04
Total protein (g/dl)	2.73	2.30	0.13	0.002
Urea nitrogen (mg/dl)	4	6.06	0.704	0.006

DISCUSSIONS

Bacterial skin infection in rohu induced by *Flavobacterium columnare* was studied using an experimental model of disease. This model was based on the surface mucus layer is part of the innate host resistance of fish to disease and that its removal would promote the establishment of bacterial infection. A previous study demonstrated that flexibacter columnaris infection was not transmitted in healthy Atlantic salmon with infarct skin, but infection did occur after a breach in the Skin surface (Morrison *et al.*, 1981). In this study, *F. Columnare* infection performed with cotton wool type bacterial colony attachment to skin on the right side of infected fish where the mucus layer had been removed but these lesions were absent on the contra-lateral side. These primary lesions subsequently developed into extensive ulcers on the right side of the fish.

The present study showed visible lesions were restricted primarily to the skin and fins; gill involvement was rare. This pattern of lesion may be explained because bacterial infection was established only on the skin and fins where the protective mucus layer was compromised and not on the gills where the mucus layer was undisturbed. A previous study of experimental columnaris disease in salmonids also demonstrated primarily skin disease with inconsistent gill necrosis (Morrison *et al.*, 1981). The duration of *F. columnare* infection was approximately 5-7 days until the fish died. In early researches of columnaris disease, the condition was less and had lower mortality when experimentally transmitted (Davis HS, 1922). However, gill necrosis is the major lesion in most natural outbreaks of columnaris disease, and death may occur before cutaneous lesions are evident (Decostere *et al.*, 1999). The antibacterial properties of mucus have also been demonstrated previously in carp and other fishes (Ebran *et al.*, 1999). Two hydrophobic proteins (27 and 31 KD) have been isolated from the mucus of carp. Both proteins had pore-forming activities correlated with strong antibacterial activity against several gram-negative and gram-

positive bacteria (Ebran *et al.*, 1999). Spear *et al.* (1992) also observed a damaged mucus coat in association with skin ulcers in fronts infected by *F. columnaris*. Bacteria are frequently observed on the infected skin surface and not in the internal organs. However, organisms may be washed from the surface of some lesions during routine tissue processing.

The hematologic changes in *F. Columnaris* infected *rohu* included the development of a microcytic, normochromic, non-regenerative anemia. However, mild regeneration was observed in a few blood smears. In *rohu*, microcytosis may reflect an impending regenerative response because erythrocytic precursors in fish are smaller in size than mature erythrocytes as environmental stress may also cause microcytic, normochromic anemia (Graff *et al.*, 1999). The WBC count usually indicated a leukopenia with lymphopenia, mild neutrophilia and monocytosis. Hematologic changes are more pronounced in fish with extensive skin ulcers. Leukopenia was lymphocyte as predominant circulating leukocyte (Latimer *et al.*, 2003). In fish, leukopenia associated with lymphopenia and neutrophilia is a classical response of stress to leukocyte as in mammals. The exact mechanism of lymphopenia is not clear, but it may be similar to redistribution of lymphocytes induced by corticosteroid level as occur in mammals (Latimer *et al.*, 2003). The mild neutrophilia and monocytosis probably occurs in response to tissue demand for these cells as observed in histological sections. Leukopenia with lymphopenia, neutrophilia and occasional monocytosis is frequently observed also in viral and other gram-negative bacterial disease of fish (Noga EJ, 2000).

Biochemical testing indicated hyponatremia and hypochloridemia with minimal decrease in magnesium and calcium concentration. Under stressful conditions, gill perfusion is increased in fish and allows passive diffusion of sodium and chloride ions from gills into the aquatic medium. Also, more water diffuses into the body of fish during stress and subsequently into the tissue fluid.

This process is certain contributor to severity of hyponatremia and hypochloridemia (Graff *et al.*, 1999). Finally the loss of sodium and chloride ions probably occurs through a disrupted skin barrier. Decreased total calcium and magnesium content may be associated with proteinemia because a considerable portions of these ions is bound to serum proteins. Total serum protein and albumin content were moderately decreased might be suggested that plasma protein was lost through skin ulcers or that excess water was being observed by infested fish to resulting in slight hemodilation. Marked hyperglycemia as usually caused by a glycogenolytic effect of catecholamine in acute stress. The corticosteroids maintain this effect in long-term stress by stimulation of hepatic gluconeogenesis or by suppression of glycogen assimilation. Freshwater fish have a hyper osmotic environment inside their body compared with that of aquatic medium. Therefore any damage to the skin barrier allows massive diffusion of water into the body of the fish, resulting in disturbed osmotic regulation and electrolytic homeostasis. The enzymes as ALP, AST, CK and LDH activity were increased markedly, whereas ALT and SDH activities were relatively constant. Previous studies have shown that the increased activity of AST, CK and LDH are associated

with venipuncture, which is done through the musculature of caudal peduncle. The enzymes like Sorbitol dehydrogenase and ALT appear to be low content in skeletal muscle and may be better indicators of hepatic cell damage (Tripathi *et al.*, 2003). These data generally indicate that there was no substantial damage to live in infected fish.

SUMMARY

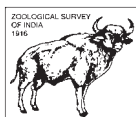
The bacterial skin disease was studied to investigate the alteration on hematological and histological levels in freshwater fish, *Labeo rohita*. During infection, lesions were usually restricted to skin and fin with inconsistent gill necrosis.

The bacteria in group were readily detected in skin specimens from infected fish; however the bacterium was occasionally detected in specimens of liver, kidney and spleen. These observations suggest that columnaris disease generally presents as a cutaneous disease and unrelated with systematic infection. Hematologic studies indicated that most infected *rohu* developed microcytic, normochromic, non-regenerative anemia and leukopenia characterized by lymphopenia, mild neutrophilia and monocytosis. Biochemical changes in fish included significant hyperglycemia, hyponatremia and hypochloridemia.

REFERENCES

- Berrardet JF, Segers P, Vancanney M (1996). Cutting a Gordian knot: Embedded classification and description of genus *Flavobacterium*, emended description of the family Flavobacteriaceae and proposal of *Flavobacterium hydatis*, *Int. J. syst. Bacteriol.*, **46**: 128-148.
- Davis HS (1992). A new bacterial disease of freshwater fishes. *Bull US Bureau Fish (DOC, 924)*: 262-280.
- Decostere A, Ducatelle R, Haesenbroek F (2002). *Flavobacterium Columnare* associated with severe gill necrosis in Koi Carp (*Cyprinus carpio*). *Vet. Rec.*, **150**: 694-695.
- Ebran N, Julien S., Orange N. *et al.*, (1999). Pore-Forming properties and antibacterial activity of protein extracted from epidermal mucus of fish. *Comp. Biochem. Physiol.*, **122**: 181-189.
- Graff JM and Zink JH (1999). Hematology and clinical chemistry of cyprinid fish. *Vet. Clin. N. Am. Exotic. Anim. Pract.*, **2**: 741-746.
- Latimer KS and Frasse KS (2003). Leukocytes (In : Duncan & Frasse's veterinary laboratory medicine : Clinical Pathology). Ed. Latimer KS, Mahaffey EA, Prassikw, 4th Ed. pp : 46-79, IOWA state university press, America.

- NOGA, ET (2000). Fish leukocyte responses (In:Schalm's veterinary hematology, Ed. Feldman BF, Zinkl JA, Jain NC, 5th ed.). pp 433-439. Lippincott Williams and Wilkins, Baltimore, MD.
- Speare, DJ, Mir Salimi, SM (1992). Pathology of the mucus coat of trout skin during an erosive bacterial dermatitis, a technical advance in mucus coat stabilization for ultrastructural examination. *J comp. pathol.*, **106**: 201-211.
- Tripathi, NK, Latimer, KS, Lewis, TL and Burnley, VV (2003). Biochemical reference intervals for Koi (*Cyprinus Carpio*) *Comp. Clin. Pathol.*, **12**: 160-165.
- Tripathi, NK, Latimer, KS and Rakich, PM (2003). Columnaris disease in freshwater fish. *Comp. Cont. Educ. Vet.*, **25**: 528-536.



FIRST RECORD OF FREE-LIVING MARINE MEIOBENTHIC NEMATODE *ONCHOLAIMELLUS CALVADOSICUS* DE MAN 1890 (ENOPLIDA: ONCHOLAIMIDAE) FROM NORTHERN-EAST COAST OF INDIA

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INTRODUCTION

The taxonomic work on free-living marine Nematodes in Indian subcontinent is very scanty. Apart from the works by Timm (1956, 1961 & 1967) from the seas around the Indian waters, Gerlach (1962) from Maldives Islands and Warwick (1973) from Indian Ocean, not much published work were available on marine free-living nematode systematics. All together Timm (1956, 1961 & 1967), Gerlach (1962) and Warwick (1973) described more than 130 species from Indian Ocean around this country. Except the work of Timm (1961, 1967) the coastal part of West Bengal is almost untouched for marine free-living nematodes taxonomic work. There are ten valid species belonging to genus *Oncholaimellus* recorded worldwide (Deprez *et al.*, 2012) among which only two species i.e *Oncholaimellus calvadosicus* De Man 1890 and *Oncholaimellus carlbergi* Allgen 1947 (Sebastian 2003) were recorded from the Indian subcontinent. *Oncholaimellus calvadosicus* De Man 1890 was recorded previously from the southern part of India (Shivaji *et al.*, 2010; Ansari *et al.*, 2012). Till date no species of the genus *Oncholaimellus* De Man 1890 is reported from the intertidal zone of Northern East coast. The present paper deals with the first record of free-living meiobenthic nematode *Oncholaimellus calvadosicus* De Man 1890 from Northern-East coast of India.

MATERIALS AND METHODS

(a) Collection sites

The specimen were collected from the intertidal areas of Digha, West Bengal (Fig. 1) located from 21°37' to 21°40' N and 87°30' to 87°33' E.

(b) Sampling Protocol

Sediment samples were collected in three replicate from randomly selected intertidal stations around the coast. Each core sample was taken from 15 cm deep into the sediment with the help of a hand corer of 7 cm inner diameter.

Samples were collected during June 2011 to May 2012 in four quarters viz. Summer (March -May), Monsoon (June - August), Postmonsoon (September - November) and Winter (December - February). Samples were kept overnight with habitat water and then sediments were sieved with two brass sieves, upper one of 500 µ mesh and lower one of 63µ mesh size. The sieved samples were preserved in 5% neutral formalin solution in wide mouth Tarson plastic vials. Then the Nematodes were separated with the help of compound microscope and again put back into separate vials containing 5% neutral formalin solution. Permanent slides were prepared by anhydrous glycerin in paraffin wax. Olympus CH20i was used for morphometric measurements for identifying the specimens. Specimens were

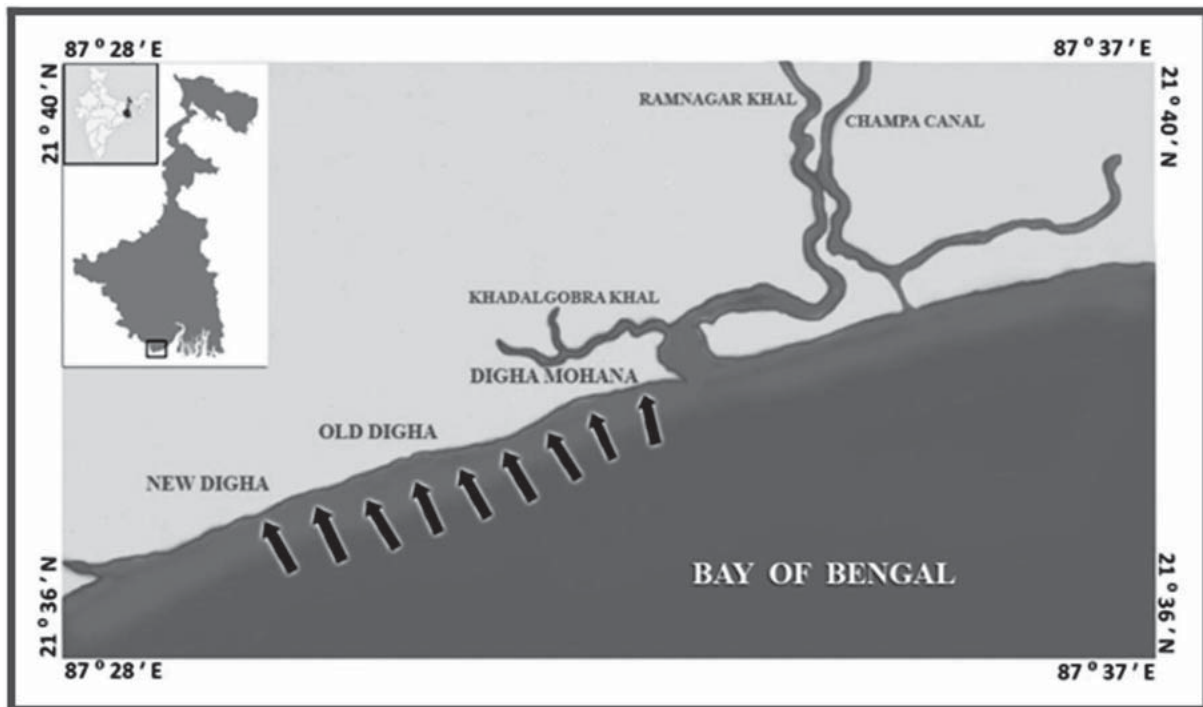


Fig. 1. Collection sites around the Digha coastal area. Arrows indicating the different collection sites (map not in scale)

deposited to Marine Aquarium and Regional Centre, Zoological Survey of India, Digha with registration number N2847 (i-vi).

Identification and classification of the specimen is as per Hodda (2011), Keppner & Tarjan (1989) and Wieser (1953).

Phylum NEMATODA Cobb, 1932

Class ENOPLEA Inglis, 1983

Subclass ENOPLIA Pearse, 1942

Order ENOPLIDA Filipjev, 1929

Suborder ENOPLINA Chitwood & Chitwood, 1937

Superfamily ONCHOLAIMOIDEA Filipjev, 1916

Family ONCHOLAIMIDAE Filipjev, 1916

Subfamily ONCHOLAIMELLINAE Filipjev, 1916

Genus *Oncholaimellus* De Man, 1890

Oncholaimellus calvadosicus De Man, 1890

1890. *Oncholaimellus calvadosicus* De Man, *Soc. Zool. Fr.*, 3: 169-194.

1929. *Oncholaimellus littoralis* Allgén, *Abteilung Fuer Systematic Oekologie und Geographie Dek Tiere*, 57: 431-496.

Description: Identification was done on the basis of six specimens (3-males and 3-females). The whole body of the specimen is slender. One whole mounted specimen is given in Fig. 2a. Cuticle is smooth and simple without any striation. Males are smaller and thinner than females (Table.1). Amphids indistinct. Six low rounded lips each with a papilliform sensillum. Male with six long and four short cephalic setae. In case of females all ten setae are equal in size. A few short setae in anterior oesophageal region but otherwise somatic setae are absent. Head is constricted just behind cephalic setae. The genus is characterized by a massive right subventrolateral tooth (Fig. 2 b) and a transverse band dividing the buccal cavity into two halves. Buccal cavity in two parts, separated by cuticularised band; three teeth are present in posterior part whereas the right subventrolateral being the biggest. Oesophagus cylindrical. Tail is conico-cylindrical with swollen tip or clavate type. In case of female the tip is less swollen than male (Fig. 2 c, d). Caudal glands

Table 1. Measurements (in μm) of three males and three females of *Oncholaimellus calvadosicus* De Man 1890 are given. Mean and Standard deviation of each criterion is given in bracket with its minimum and maximum values.

Abbreviations used for De Man's ratio in the table:

a: total body length / maximum body diameter ; **b:** total body length / oesophagus length ; **c:** total body length / tail length ; **c':** tail length / anal body diameter ; **v :** position of vulva as a percentage of the body length from the anterior body end.

Measurements / Proportions	3 Males	3 Females
total body length	1121-1515 (1261.8 $\pm$ 219.7)	1212-1616 (1432.7 $\pm$ 204.6)
maximum body diameter	23-33 (27.1 $\pm$ 5.5)	28-38 (32.9 $\pm$ 5.1)
oesophagus length	238-304 (268.2 $\pm$ 33.2)	253-278 (269.9 $\pm$ 14.6)
tail length	46-66 (58.2 $\pm$ 11)	46-61 (52.3 $\pm$ 7.7)
anal body diameter	13-16 (13.7 $\pm$ 1.8)	13-23 (16 $\pm$ 5.8)
head length	20-25 (21.9 $\pm$ 2.9)	18-28 (23.6 $\pm$ 5.3)
head diameter	15 (15.1 $\pm$ 0.1)	13-19 (15.6 $\pm$ 3.2)
mouth opening diameter	8 (7.6 $\pm$ 0.1)	8-13 (9.8 $\pm$ 2.5)
right subventrolateral tooth length	13-19 (14.8 $\pm$ 3.6)	10-22 (17.3 $\pm$ 6.2)
right spicule length	33-68 (47 $\pm$ 18.2)	—
Left spicule length	25-62 (40.3 $\pm$ 19.5)	—
a	44-50 (46.8 $\pm$ 3.3)	43-45 (43.6 $\pm$ 1.1)
b	4-6 (4.8 $\pm$ 1.0)	4-6 (5.3 $\pm$ 0.8)
c	18-25 (22 $\pm$ 3.9)	27-29 (27.4 $\pm$ 1.4)
c'	4-5 (4.3 $\pm$ 0.7)	3-4 (3.4 $\pm$ 0.7)
v	—	44-47 (45 $\pm$ 1.4)

extends well anterior to anus. Spicules are two in numbers and present only in males. Spicules unequal in length. The right one is longer than the left (Fig. 2. e-g). Right spicule about 3-5 of anal body diameter whereas left spicule about 3 times of anal body diameter (Table 1). Gubernaculum absent. Copulatory bursa present consisting of two longitudinal wings of cuticle occupying anterior third of tail. Paired setae present at both ends of bursa and a pair of supporting rods about one-third of its length from cloaca. Vulva (Fig. 2. h) present almost half of the body length of female. Two opposed, reflexed ovaries in females.

These specimens were found in all sampling seasons and generally associated with upper sediment layer. Their availability lowers with the depth.

Distribution: India: Chennai, Tamil Nadu; **Elsewhere:** Panama, Chile, Ireland, England, Belgium, France, Norway, Western Scheldt, North Sea, European waters, North Atlantic, Adriatic Sea, Kara sea (Deprez *et al.*, 2012).

Remarks: The present species differs from the other species of the same genus *Oncholaimellus carlbergi* Allgen 1947 reported from Indian coast by the appearance of amphid, comparatively smaller tail and by the length of cephalic seta. In the present study it was found that length of right spicule varies significantly from the length of left spicule within the population in males.

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REFERENCES

- Ansari, K.G.M.T., Manokaran, S., Raja, S., Khan, S.A. & Lyla, S. 2012. Checklist of Nematodes (Nematoda : Adenophorea) from Southeast Continental Shelf of India. *Check List*, **3**: 414-420.
- Cobb, N.A. 1917. Notes on Nemas. Intra Vitam color reactions in nemas. *Contribution to the society of Nematology*, **5**: 120-124.
- De Grisse, A.T. 1969. Redescription ou modification de quelques techniques utilisées dans l'étude des nematodes phytoparasitaires. *Mededelingen Rijksfakulteit Landbouwwetenschappen Gent*, **34**: 351-369.
- De Man, J.G. 1890. Quatrième note sur les nématodes libres de la mer du Nord et de la Manche. *Mém. Soc. Zool. Fr*, **3**: 169-194.
- Deprez, T. et. al., Ne Mys (2012), www. <http://nemys.ugent.be/start.asp?group=2&c=31&a=1&p=1>-
Date of Access: 12.12.12.
- Gerlach, S.A. 1962. Freilebende Meeresnematoden von Malediven. *Kieler. Meeresforsch.*, **18**: 81-108.
- Hodda, M. 2011. Phylum Nematoda Cobb 1932. In: Z.Q., Zhang (Eds.) Animal biodiversity: An outline of higher-level classification and survey of taxonomic richness. *Zootaxa*, **3148**: 64-95.
- Keppner, E.J. & Tarjan, A.C. 1989. Illustrated Key to the Genera of Free-Living Marine Nematodes of the Order Enoplida. *Florida Agricultural Experiment Station Journal Series No. 8673. NOAA Technical Report NMFS*, **77**: 1-26. Published by U. S. Department of Commerce.
- Sebastian, S. 2003. *Meiobenthos of the shelf waters of west coast of India with special reference to free-living marine Nematodes*: 1-248. Ph. D thesis, Cochin University of Science and Technology, Department of Marine Biology, Microbiology and Biochemistry.
- Shivaji, A., Sanjeevan, V.N., Saravanane, N., Shunmugaraj, T. & Gupta, G.V.M. 2010. Achievements of FORV Sagar Sampada 1997-2010, *Centre for Marine Living Resources and Ecology, Ministry of earth Sciences, Kochi*.
- Timm, R.W. 1956. Marine nematodes from the Bay of Bengal, I-Phasmidea. *J. Bombay. nat. Hist. Soc.*, **54**.1.
- Timm, R.W. 1961. The Marine Nematodes of the Bay of Bengal, *Proc. Pakist. Acad. Sci.*, **1**: 1-88.
- Timm, R.W. 1967. Some estuarine nematodes from Sunderban, *Proc. Pakist. Acad. Sc.*, **4**: 1-13.
- Warwick, R. M. 1973. Free-living marine nematodes from Indian Ocean. *Bulletin. Br. Mus. Nat. Hist. (Zool.)*, **25**: 87-117.
- Wieser, W. 1953. Free-living marine Nematodes I: Enoploidea. *Lunds Universitets Arsskrift, NY Följd Avdelning.*, **2**, **49**(6): 1-155.

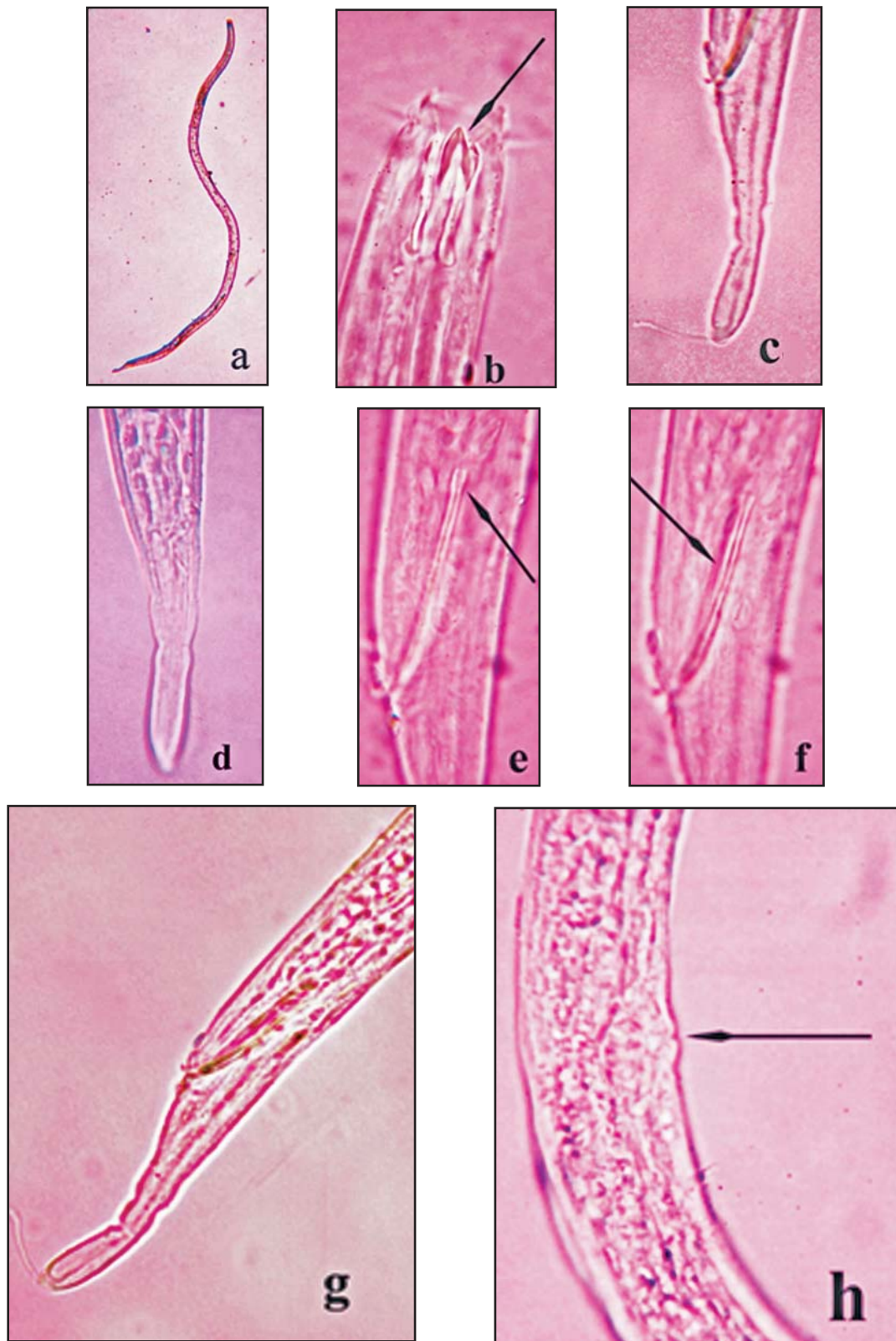
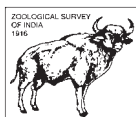


Fig. 2. Different body parts of *Oncholaimellus calvadosicus* De Man 1890; a. complete stretched specimen (male); b. massive subventral tooth; c. tail end with swollen tip (male); d. tail end of female showing less swollen tip.; e. position of right spicule (separate focusing); f. position of left spicule (separate focusing); g. typical male tail end with focusing two spicules; h. vulva of female



POPULATION DENSITY, DIVERSITY AND DISTRIBUTIONAL PATTERN OF GRASSHOPPER FAUNA (ACRIDIDAE: ACRIDOIDEA: ORTHOPTERA) IN CENTRAL AND EASTERN UTTAR PRADESH, INDIA

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INTRODUCTION

Uttar Pradesh is bounded by Nepal on the North, Uttarakhand on the north-east, Himachal Pradesh on the north-west, Haryana on the west, Rajasthan on the south-west, Madhya Pradesh on the south and south-west, Chhattisgarh and Jharkhand on south and Bihar on the east. Situated between 23°52'N and 31°28'N latitudes and 77°3' and 84°39'E longitudes, it is the fifth largest state in the country in terms of area, and the first in terms of population and can be divided into three regions, Eastern, Central and Western Uttar Pradesh. The eastern Uttar Pradesh having twenty-five districts, located between 24.0 to 27.340 N latitudes and 81.130 to 84.110 E longitudes, has been divided into three agro-climatic zones namely, North Eastern Plain Zone, Eastern Plain Zone and Vindhyan Zone. Although, the average annual rainfall in eastern U.P. is around 1100 mm, it is quite erratic and confined to July-September (85-90%). The water table varies from 1 to 14.5 m during pre-monsoon and 0.5 to 7.5 m during post monsoon. Central Uttar Pradesh having twenty-one districts including Lucknow and Kanpur situated on 26.30 & 27.10 North latitude and 80.30 & 81.13 East longitude. Climate is warm humid subtropical with cool, dry winters from December to February and dry, hot summers from April to June. The rainy season is from mid-June to mid-September. In winter the maximum temperature is

around 25°C and the minimum is 7-9°C. Fog is quite common from late December to late January. Summers are extremely hot with temperatures rising to the 40 to 45°C.

Orthoptera is one of the largest Orders of insects having suborder Caelifera (short horned grasshoppers and Ensifera (long horned grasshoppers)). Caelifera comprises eight super families and out of them Acridoidea and Pyrgomorphoidea are commonly found in India. Out of eleven families of Acridoidea, Acrididae, Pamphagidae, Romaleidae and Tristidae commonly distributed in India, known as grasshoppers and locust. Acrididae are the predominant family of grasshoppers and shows maximum diversity, comprising about 10,000 of the entire 11,000 species of suborder Caelifera all over the world (<http://en.wikipedia.org/wiki/Acrididae>). Shishodia *et. al.* (2010) reported about 285 species belonging to 135 genera from India. Grasshoppers are of great economic importance, they constitute an important group of pests and pose a constant threat to cereal crops, pulses, vegetables, orchards, grasslands and forest plantations all over the world. Grasshoppers cause significant damage to tree seedlings and agricultural crops (Joshi *et al.*, 1999), hence considered as oligophagous and according to host preferences classified as graminivorous, forbivorous and ambivorous or mixed feeders (Mulkern, 1967). Various

studies have been done on different aspects of grasshoppers across India, viz. Mondal and Shishodia (1982), Julka *et al.* (1982), Tandon & Khera (1978) studied their ecological aspects; Dey & Hazra (2003) studied both Taxonomy as well as ecology of grasshopper fauna of Greater Kolkata. Information on population of particular species of *Acrida exaltata* and *Oedaleus abruptus* was added by Susanta & Halder (1998) and Khan & Aziz (1973) respectively whereas Azim *et al.* (2010) added the information regarding seasonal variation of three grasshopper species of Kashmir.

METHODOLOGY

Surveys were carried out during 2010-2012 from forty five districts of Central and Eastern Uttar Pradesh during post monsoon season to collect the grasshoppers. Sampling was done randomly during morning hours (6.00 AM to 11.00 AM) and evening hours (3.00 PM to 6.00 PM). Specimens were collected through net sweeping and hand picking method, and then transferred in bottles containing cotton soaked with ethyl acetate covered with paper for killing. Then specimens were first relaxed, pinned, labeled, stretched on stretching board and left for 72 hours to prevent decomposition. Grasshoppers were identified by using their morphological as well as genitalic characters. For the purpose of correct identification, the grasshoppers were examined under stereo microscope (Nikon SMZ1500). For a detailed study of the various components of genitalia, the permanent slides were prepared and examined under the microscope. Drawings were made with the help of a camera lucida. Diversity of grasshoppers were calculated by using formula provided by Shannon & Wiener (1963) with the help of SPECDIV software.

RESULTS

During the present study, two thousand four hundred sixty five specimens of grasshoppers belonging to the family Acrididae were collected from 45 districts of Central and Eastern Uttar Pradesh having 48 species of grasshoppers

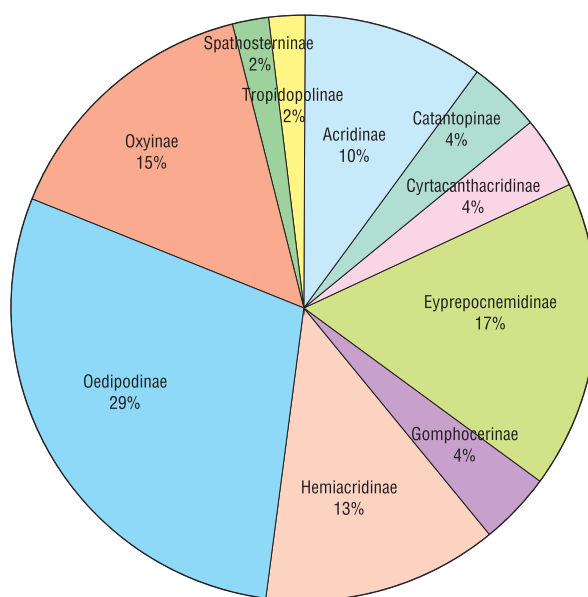


Fig. 1: Species accumulation chart of grasshoppers with reference to their subfamilies in Central and Eastern Uttar Pradesh

representing 28 genera, 16 tribes and 10 subfamilies (Table 1 & 2). Maximum diversity of species have been recorded from district Mau (17 species) followed by Ambedkar Nagar and Azamgarh (16 species), Lucknow, Raebareilly and Varanasi (15 species) while a minimum from district Faizabad (4 species) (Table 1 & 3). Maximum abundance of grasshoppers population was recorded from district

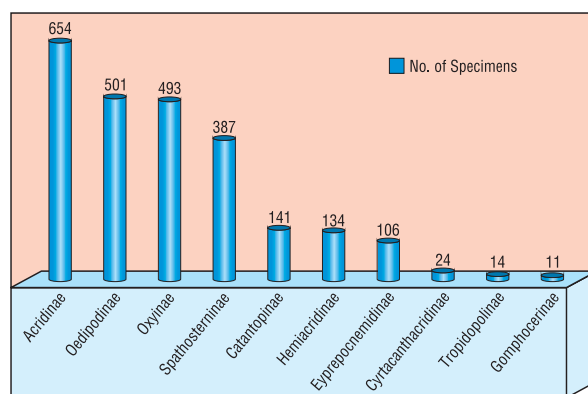


Fig. 2: Abundance of Acridid pests in Central and Eastern U. P.

Faizabad (116) followed by Deoria (101) and Raebareilly (90) and minimum from Pilibhit (15). Subfamily Oedipodinae imparts 29% of the total species and were followed by Eyprepocnemidinae 17%, Oxyinae 15%, Hemiacridinae 13%, Acridinae 10%, Catantopinae, Cyrtacanthacridinae and

Gomphocerinae 4%, while least by Spathosterninae and Tropidopolinae 2% respectively (Figure 1). As per the number of specimens concerned maximum shown by subfamily Acridinae with least in case of Gomphocerinae (Figure 2). This result is par with the result of Akhtar *et al.* (2012), who reported 26 species of grasshoppers from rice ecosystem of Uttar Pradesh and Usmani *et al.* (2012) who reported 34 species of grasshoppers from pulses and paddy of Bihar and Jharkhand, India but is in conformity with Nayeem and Usmani (2012) who described 41 species of grasshoppers from Jharkhand and 37 species from Bihar respectively. The value of the Shannon Diversity index (2.88 bits) shows that the grasshopper population is moderately diverse in this region.

DISCUSSION

Grasshoppers are polyphagous insect since they damage the agricultural crops, non-agricultural areas and grasslands, hence considered as pest and its distribution depends upon abiotic factors mainly temperature, humidity and rainfall as well as biotic factors such as predators and parasites. During early showers of rain, egg hatches and nymph emerges and starts feeding. However, no detailed work on the distribution of grasshoppers in Central and Eastern Uttar Pradesh has been done till date; keeping in view this fact, here an attempt has been made to explore the grasshopper fauna of the area. Earlier Usmani *et al.* (2010) have explored 33 species of locusts and grasshoppers from Western Uttar Pradesh. 14 species from pulses and 26 species from Aligarh Fort of Uttar Pradesh were recorded by Usmani *et al.* (2012), whereas ecological study of grasshopper fauna of Aligarh Fort has been done by Akhtar *et al.* (2012).

During the survey it was observed that species richness is highest in district Mau while lowest in Faizabad but on the other hand highest abundance of grasshopper population was recorded from district Faizabad and lowest from Pilibhit (as shown in Table 3). Acridinae, Oedipodinae and Spathosterninae are dominating subfamilies in

this area collected from almost all habitats of districts of Central and Eastern U.P. Among species *Spathosternum prasiniferum prasiniferum* is dominating over all other species followed by *Acrida exaltata*, *Oxyahylahyla* and *Acrida gigantea* in all habitats. Species of subfamily Oxyinae and Hieroglyphinae were reported as major pests of paddy crop. The large sized grasshoppers such as *Hieroglyphus* sp. *Choreodocus* sp., *Locusta migratoria*, *Gastrimargus africanus* are usually found in large grasses or in bushes near agricultural and non-agricultural areas which were less interfered by humans. Therefore, it is desirable to take up a detailed study on the succession of insect pest complexes under the agroclimatic conditions prevailing in this area. The investigations have a great importance from the point of view of both applied and fundamental knowledge to forecast the pest incidence and suggest measure for its control.

SUMMARY

Locusts and grasshoppers constitute an important group of pests and pose a constant threat to agriculture all over the world. An attempt was made to study the population density, diversity and distribution of these pest in Central and Eastern U.P. Forty eight species of grasshoppers representing twenty eight genera, sixteen tribes and ten subfamilies have been recorded for the first time from forty five districts of Central and Eastern Uttar Pradesh during the survey of 2010-2012. Maximum diversity of species was recorded from Mau district (seventeen species) while a least (four species) from Faizabad, whereas maximum numbers of specimens were collected from the same district. Subfamily Oedipodinae constitutes a maximum (fourteen) species followed by Eyprepocnemidinae (eight species), Oxyinae (seven species), Hemiacridinae (six species), Acridinae (five species), Catantopinae, Cyrtacanthacridinae and Gomphocerinae (two species each) while the least of only one by Spathosterninae and Tropidopolinae. Species diversity index was also calculated by using Shannon Diversity index.

Table 1(a). Distribution of grasshoppers in some districts of eastern and central Uttar Pradesh during the year 2010-11.

Sl. No	Acridid Species	1. Balrampur	2. Basti	3. Deoria	4. Barabanki	5. gorakhpur	6. Faizabad	7. Gonda	8. Hamirpur	9. Kanpur (rural)	10. Kannauj	11. Unnao	12. Hardoi	13. Lalitpur	14. Sultanpur	15. Jhansi	16. Jalaun	17. Lucknow	18. Kushinagar	19. Mahoba	20. Sitapur	21. Santkabirnagar	22. Siddharthnagar
	1. Subfamily: Acridinae																						
1.	<i>Acrida exaltata</i>	+	+	+	+	+	-	+	-	+	+	+	+	+	+	-	+	+	+	-	+	+	+
2.	<i>Acrida gigantea</i>	+	+	+	+	+	-	+	+	+	+	+	+	+	+	+	+	+	+	-	+	+	+
3.	<i>Phlaeoba infumata</i>	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-
4.	<i>Phlaeoba pantali</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	+	-	-	-	-	-
	2. Subfamily: Catantopinae																						
5.	<i>Xenocatantops karnyi</i>	-	-	+	-	-	-	-	-	+	-	+	-	-	-	+	-	-	-	+	-	-	-
6.	<i>Diabolocatantops pinguis innotabilis</i>	-	-	-	-	-	-	-	+	+	-	+	-	+	-	+	-	-	-	-	-	-	-
	3. Subfamily: Cyrtacanthacridinae																						
7	<i>Cyrtacanthacris tatarica</i>	-	-	-	-	-	-	-	+	+	-	+	-	-	-	-	+	-	-	-	-	-	-
8	<i>Schistocerca gregaria</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	4. Subfamily: Eyprepocnemidinae																						
9	<i>Eyprepocnemis alacris</i>	+	-	-	+	-	-	-	+	-	-	+	-	+	+	-	+	-	+	-	+	-	+
10	<i>Eyprepocnemis bhaduri</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11	<i>Eyprepocnemis rosae</i>	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-
12	<i>Heteracris nobilis</i>	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-
13	<i>Choroedocus illustris</i>	-	-	+	-	+	-	-	-	+	-	-	-	-	-	+	-	-	-	-	-	-	-
14	<i>Choroedocus robustus</i>	-	-	+	-	-	-	-	-	-	+	-	-	-	-	-	-	+	-	-	-	-	+
15	<i>Tylotropidius varicornis</i>	-	-	+	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-
16	<i>Cataloipus indicus</i>	-	-	-	-	-	-	-	+	+	-	-	-	-	-	-	-	-	-	+	-	-	-
	5. Subfamily: Gomphocerinae																						
17.	<i>Aulacobothrus luteipes luteipes</i>	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	+	-	-	-	-	-
18.	<i>Leva indica</i>	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	6. Subfamily: Hemiacridinae																						
19.	<i>Hieroglyphus banian</i>	-	-	-	-	-	-	-	-	-	-	-	+	+	-	-	-	-	+	+	-	-	-
20.	<i>Hieroglyphus niegrepletus</i>	-	-	-	+	-	-	-	+	+	+	+	+	+	-	+	-	-	-	-	-	-	-

Table 1(b). Distribution of grasshoppers in some districts of Eastern and central Uttar Pradesh during 2011-12.

Sl. No.	Acridid Species	1. Allahabad	2. Ambedkar Nagar	3. Auraiya	4. Azamgarh	5. Ballia	6. Banda	7. Behraich	8. Chandauli	9. Fatehpur	10. Ghazipur	11. Jaunpur	12. Kaushambi	13. Lakhimpur kheri	14. Maharajganj	15. Mau	16. Mirzapur	17. Pilibhit	18. Pratapgarh	19. Rae Bareilly	20. Sant ravidas nagar	21. Shravasti	22. Sonbhadra	23. Varanasi
	1. Subfamily: Acridinae																							
1.	<i>Acrida exaltata</i>	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
2.	<i>Acrida gigantea</i>	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
3.	<i>Phlaeoba infumata</i>	-	+	-	+	-	-	+	+	-	+	+	-	+	-	+	+	-	+	-	+	-	+	+
4.	<i>Phlaeoba pentali</i>	+	+	-	+	-	-	-	+	-	+	-	-	-	-	+	-	-	+	-	-	-	-	+
5.	<i>Orthocha indica</i>	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	2. Subfamily: Catantopinae																							
6.	<i>Diabolocatantops pinguis innotabilis</i>	-	+	+	-	-	-	-	-	-	-	+	-	-	-	+	-	+	-	-	-	-	-	+
7.	<i>Xenocatantops karnyi</i>	-	-	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-
	3. Subfamily: Cyrtacanthacridinae																							
8.	<i>Cyrtacanthacris tatarica</i>	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	+	-
	4. Subfamily: Eyprepocnemidinae																							
9.	<i>Choroedocus illustris</i>	-	-	+	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-
10.	<i>Choroedocus robustus</i>	-	-	+	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-
11.	<i>Eyprepocnemis alacris</i>	-	-	-	+	-	-	+	-	-	-	-	-	-	+	+	-	+	-	+	+	+	+	+
12.	<i>Heteracris nobilis</i>	-	-	-	-	+	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	+
	5. Subfamily: Gomphocerinae																							
13.	<i>Aulacobothrus luteipes luteipes</i>	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	+	+	+	+
	6. Subfamily: Hemiacridinae																							
14.	<i>Hieroglyphus annulicornis</i>	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
15.	<i>Hieroglyphus banian</i>	-	+	+	+	-	-	+	+	-	+	-	-	-	-	+	+	-	-	+	-	-	-	+

Table 2. Grasshoppers recorded from Central and Eastern Uttar Pradesh during 2011 & 2012

Sl. No.	Acridid Species	Total	Subfamily	Tribe
1.	<i>Acrida gigantea</i>	239	Acridinae	Acridini
2.	<i>Acrida exaltata</i>	334	Acridinae	Acridini
3.	<i>Phlaeoba pantali</i>	26	Acridinae	Phlaeobini
4.	<i>Phlaeoba infumata</i>	54	Acridinae	Phlaeobini
5.	<i>Orthoctha indica</i>	1	Acridinae	-
6.	<i>Diabolocatantops pinguis innotabilis</i>	100	Catantopinae	Catantopini
7.	<i>Xenocatantops karnyi</i>	41	Catantopinae	Catantopini
8.	<i>Schistocerca gregaria</i>	1	Cyrtacanthacridinae	Cyrtacanthacridini
9.	<i>Cyrtacanthacris tatarica</i>	23	Cyrtacanthacridinae	Cyrtacanthacridini
10.	<i>Choroedocus illustris</i>	10	Eyprepocnemidinae	-
11.	<i>Choroedocus robustus</i>	15	Eyprepocnemidinae	-
12.	<i>Eyprepocnemis alacris</i>	43	Eyprepocnemidinae	Eyprepocnemidini
13.	<i>Eyprepocnemis bhaduri</i>	3	Eyprepocnemidinae	Eyprepocnemidini
14.	<i>Eyprepocnemis rosae</i>	3	Eyprepocnemidinae	Eyprepocnemidini
15.	<i>Heteracris nobilis</i>	22	Eyprepocnemidinae	Eyprepocnemidini
16.	<i>Tylotropidius varicornis</i>	2	Eyprepocnemidinae	-
17.	<i>Cataloipus indicus</i>	8	Eyprepocnemidinae	-
18.	<i>Aulacobothrus luteipes</i>	10	Gomphocerinae	Arcypterini
19.	<i>Leva indica</i>	1	Gomphocerinae	-
20.	<i>Hieroglyphus annulicornis</i>	1	Hemiacridinae	Hieroglyphini
21.	<i>Hieroglyphus banian</i>	63	Hemiacridinae	Hieroglyphini
22.	<i>Hieroglyphus concolor</i>	4	Hemiacridinae	Hieroglyphini
23.	<i>Hieroglyphus niegrorepletus</i>	62	Hemiacridinae	Hieroglyphini
24.	<i>Hieroglyphus oryzivorus</i>	3	Hemiacridinae	Hieroglyphini
25.	<i>Hieroglyphu indicus</i>	1	Hemiacridinae	Hieroglyphini
26.	<i>Aiolopus simulatrix</i>	133	Oedipodinae	Epacromiini
27.	<i>Aiolopus thalassinus thalassinus</i>	55	Oedipodinae	Epacromiini
28.	<i>Aiolopus t. tamulus</i>	36	Oedipodinae	Epacromiini
29.	<i>Acrotylus humbertianus</i>	1	Oedipodinae	Acrotylini
30.	<i>Chloeobora marshalli</i>	1	Oedipodinae	-
31.	<i>Ditopternis venusta</i>	1	Oedipodinae	-
32.	<i>Gastrimargus africanus</i>	9	Oedipodinae	Locustini

Table 2. *contd.*

Sl. No.	Acridid Species	Total	Subfamily	Tribe
33.	<i>Locusta migratoria</i>	14	Oedipodinae	Locustini
34.	<i>Oedaleus abruptus</i>	51	Oedipodinae	Locustini
35.	<i>Oedaleus senegalensis</i>	4	Oedipodinae	Locustini
36.	<i>Oedipoda miniata</i>	30	Oedipodinae	Oedipodini
37.	<i>Ceracris nigricornis</i>	1	Oedipodinae	Parapleurini
38.	<i>Trilophidia annulata</i>	154	Oedipodinae	Trilophidiini
39.	<i>Trilophidia repleta</i>	11	Oedipodinae	Trilophidiini
40.	<i>Oxya chinensis</i>	1	Oxyinae	Oxyini
41.	<i>Oxya fuscovittata</i>	103	Oxyinae	Oxyini
42.	<i>Oxya hylahyla</i>	311	Oxyinae	Oxyini
43.	<i>Oxya hylaintricata</i>	10	Oxyinae	Oxyini
44.	<i>Oxya japonica japonica</i>	48	Oxyinae	Oxyini
45.	<i>Oxya velox</i>	18	Oxyinae	Oxyini
46.	<i>Oxya grandis</i>	2	Oxyinae	Oxyini
47.	<i>Spathosternum prasiniferum</i>	387	Spathosterninae	Spathosternini
48.	<i>Tristria pulvinata</i>	14	Tropidopolinae	Tristriini
	Total	2465	Shanon Diversity Index: 2.88	

Table 3. Host Plants, Species Richness and Abundance of grasshoppers' fauna in Central and Eastern Uttar Pradesh.

Sl. No.	Districts	Hosts plants	Total no. of specimens	No. of Species	No. of Genera	No. of subfamilies
1.	Balrampur	Grasses	76	7	5	5
2.	Basti	Paddy	69	7	5	4
3.	Deoria	Paddy	101	14	8	6
4.	Barabanki	Paddy	78	9	6	6
5.	Gorakhpur	Paddy	47	9	7	6
6.	Faizabad	Paddy	116	4	1	1
7.	Gonda	Paddy	26	6	4	4
8.	Hamirpur	Grasses	42	9	9	7
9.	Kanpur	Paddy	84	13	11	7
10.	Kannauj	Paddy	46	10	8	7
11.	Unnao	Grasses/Bushes	38	11	10	6
12.	Hardoi	Paddy	35	8	5	5

Table 3. contd.

Sl. No.	Districts	Hosts plants	Total no. of specimens	No. of Specie	No. of Genera	No. of subfamilies
13.	Lalitpur	Paddy	18	11	8	8
14.	Sultanpur	Harvested paddy	38	10	7	5
15.	Jhansi	Grasses/Bushes	84	10	9	7
16.	Jalaun	Oilseeds	27	7	5	5
17.	Lucknow	Grass	79	13	9	6
18.	Kushinagar	Paddy	44	7	5	5
19.	Mahoba	Grasses/Bushes	40	5	5	4
20.	Sitapur	Paddy	66	13	9	5
21.	SantKabir Nagar	Paddy	64	10	4	3
22.	Siddharth Nagar	Paddy	62	11	5	4
23.	Allahabad	Grasses	54	7	6	4
24.	Ambedkarnagar	Grasses	69	16	11	6
25.	Auriya	Grasses	67	13	9	8
26.	Azamgarh	Grasses/Bushes	82	16	11	6
27.	Ballia	Grasses	53	7	7	4
28.	Banda	Grasses	42	10	7	4
29.	Behraich	Grasses/Bushes	48	10	9	5
30.	Chandauli	Paddy field/Grass	56	10	8	5
31.	Fatehpur	Grasses	19	8	7	4
32.	Ghazipur	Grasses/bushes	44	10	7	5
33.	Jaunpur	Grasses	46	11	9	5
34.	Kaushambi	Grasses	23	6	5	3
35.	Lakhimpurkheri	Grasses/Bushes	39	6	6	4
36.	Maharajganj	Paddy /Grasses	56	10	5	4
37.	Mau	Paddy /Grasses	57	17	13	8
38.	Mirzapur	Grasses	68	7	7	5
39.	Pilibhit	Grasses	15	5	5	3
40.	Pratapgarh	Grasses	86	13	8	4
41.	Rae Barelli	Grasses	90	15	13	8
42.	SantRavidas Nagar	Grasses	34	8	8	6
43.	Shravasti	Grasses	28	5	5	4
44.	Sonbhadra	Grasses	54	10	9	7
45.	Varanasi	Paddy /Grasses	55	15	13	9

ACKNOWLEDGEMENTS

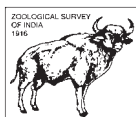
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Acridoidea) with observations on their natural enemies in Uttar Pradesh”. Authors are thankful to Prof. Irfan Ahmad, Chairman, Department of Zoology, Aligarh Muslim University, Aligarh for providing necessary facilities.

REFERENCES

- Akhtar, M.H. Usmani, M. K. Nayeem, M.R. and Kumar, H. 2012. Species Diversity and abundance of Grasshopper fauna (Orthoptera) in rice ecosystem. *Ann. of Biol. Res.*, **3**(5): 2190-2193.
- Akhtar, M.H. Usmani, M.K. Andnayeem, M.R. 2012. Impact of Abiotic Factors on Population of Acridoid Fauna (Orthoptera) in Aligarh Fort, Uttar Pradesh, India. *Tre. in Biosc.*, **5**(1): 17-19.
- Azim, M.N. Reshi, S.A. and Rather, A.H. 2010. Observation on the seasonal variation in population of three species of grasshoppers (Orthoptera : Acrididae) of Kashmir Himalaya. *J. of Ent. Res.*, **34**(4): 259-264.
- Dey, A. and Hazra, A.K. 2003. Diversity and distribution of grasshopper fauna of Greater Kolkata with notes on their ecology. *Memoirs*, **19**(3): 1-118.
- Joshi, P.C. Lockwood, J.A. Vashishth, N. and Singh, A. 1999. Grasshopper (Orthoptera: Acridoidea) community dynamics in a moist deciduous forest in India. *J. of Orth. Res.*, **8**: 17-23.
- Julka, J.M. Tandon, S.K. Halder, P. and Shishodia, M. S. 1982. Ecological observation on grasshoppers (Orthoptera: Acridoidea) at Solan, Himachal Pradesh, India. *Ori. Ins.*, **16**(1): 63-75.
- Khan, H.R. and Aziz, S.A. 1973. Observation on seasonal variation in population of hoppers and adults of *Oedaleus abruptus* (Thunberg) (Orthoptera : Acrididae). *Ind. J. of Ent.*, **35**(4): 300-305.
- Mulkern, G.B. 1967. Food selection by grasshoppers. *Ann. Rev. of Ent.*, **12**: 59-78.
- Mondal, S.K. and Shishodia, M.S. 1982. Population fluctuation of grasshopper fauna in a field near Culcutta. *Pro. Symp. Ecol. Anim. Popul. Zool. Surv. India*, **3**: 127-132.
- Nayeem, M.R. and Usmani, M.K. 2012. Taxonomy and field observations of grasshopper and locust fauna (Orthoptera: Acridoidea) of Jharkhand, India. *Mun. Ento. & Zool*, **7**(1): 391-417.
- Shishodia, M.S. Chandra, K. and Gupta, S.K. 2010. An annotated checklist of Orthoptera (Insecta) from India. *Occasional Paper No. 314*: 366 Zoological survey of India.
- Susanta, N. and Halder, P. 1998. Population dynamics of the grasshopper *Acrida exaltata* (Walker) in the arid zone of West Bengal. *Ind. J. of Inter.*, **2**(1-2): 51-53.
- Tandon, S.K. and Khera, P. 1978. Ecology and distribution of grasshoppers (Orthoptera: Acridoidea) in Arunachal Pradesh, India and impact of human activities on their ecology and distribution. *Mem. of the School of Ent. Agra*, **6**: 73-92.
- Usmani, M.K. and Nayeem, M.R. 2012. Studies on taxonomy and distribution of Acridoidea (Orthoptera) of Bihar, India. *J. of Threat. Taxa*, **4**(13): 3190–3204
- Usmani, M.K. Khan, M.I. and Kumar, H. 2010. Studies on Acridoidea (Orthoptera) of Western Uttar Pradesh. *Biosystematica*, **4**(1): 39-58

- Usmani, M.K. Akhtar, M.H. and Nayeem, M.R. 2012. Diversity and taxonomic studies of acridoid pests (Acridoidea: Orthoptera) of pulses from Uttar Pradesh, India. *Mun. Ento. & Zool.*, **7**(2): 837-846
- Usmani, M.K. Akhtar, M.H. Andnayeem, M.R. 2012. Diversity, distribution and taxonomic studies of Acridoid fauna (Orthoptera) of Aligarh Fort, Uttar Pradesh, India. *Adv. in Lif. Sci.*, **1**(1): 36-40.
- Usmani, M.K. Nayeem, M.R. Andakhtar, M.H. 2012. Field observations on the incidence of Grasshopper fauna (Orthoptera) as a pest of Paddy and pulses. *Eur. J. of Exp. Bio.*, **2**(5):1912-1917.



ON THE IDENTITY OF BLUE STRIPED SNAPPERS (PISCES: PERCIFORMES: LUTJANIDAE) OF INDIA

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INTRODUCTION

The snappers (Perciformes: Lutjanidae) are known to be represented by 9 genera and 41 species in India (Talwar, 1991), while 17 genera with about 105 species are recognized in the world (Nelson, 2006). The genus *Lutjanus* Bloch is represented by 68 species (Froese and Pauly, 2013), of which a few species are characterized in having pale or yellowish ground colour with 4 to 8 blue longitudinal stripes (brownish in preservative). Such blue striped snappers are namely, *L. bengalensis* (Bloch, 1790), *L. coeruleolineatus* (Ruppell, 1830), *L. kasmira* (Forsskal, 1775), *L. notatus* (Cuvier, 1828), *L. quinquelineatus* (Bloch, 1790) and *L. viridis* (Valenciennes, 1846) (Allen, 1985). The last named species is known from eastern Pacific Ocean from Mexico to Ecuador, including offshore islands like Galapagos Island, while other five are having distribution in Indo-Pacific region. While *L. notatus* is known only from Mozambique, Natal in South Africa, Madagascar, Réunion and Mauritius in the south-west Indian Ocean, *L. coeruleolineatus* occurs in seas around Arabian Peninsula (Allen, 1985).

The review of snappers of India was last made by Talwar and Kacker (1984), wherein they recognized only one blue-striped species, i.e., *L. kasmira*, from Indian waters while other known species with blue stripes were treated as synonym of this. Fischer and Bianchi (1984) stated the distribution of *L. coeruleolineatus* along Red Sea, Gulf of Aden and Arabian Sea, but the map

therein shows its occurrence along west coast of India too. In the given circumstance, it is required to examine the Indian blue striped snappers to confirm their identities and distribution along the coasts of India. It is, therefore, an attempt has been made to examine the specimens present in the National Zoological Collections, Zoological Survey of India, Kolkata to confirm their specific identity with their distribution in our coast. The diagnoses of these species characterized in having conspicuous blue lateral bands on light ground colour; scales above lateral line obliquely slanting to dorsal profile and with a crescentic vomerine tooth patch without posterior extension are provided hereunder with a key to identification of the blue striped snappers. The key characters are mainly following Allen (1985).

Key to the blue striped species of the genus *Lutjanus* Bloch

- 1a. Dorsal fin with XI or XII spines 2
- 1b. Dorsal fin with X spines 3
- 2a. Gill rakers on lower limb of first arch 17 to 20; no black spot on lateral line below anterior soft part of dorsal fin..... *L. bengalensis*
- 2b. Gill rakers on lower limb of first arch 10 to 13; a black spot usually on lateral line below anterior soft part of dorsal fin.....*L. notatus*
- 3a. Cheek with 5 to 8 rows of scales..... 4
- 3b. Cheek with 10 or 11 rows of scales 5

- 4a. Body with 4 stripes on sides; cheek scales in 5 or 6 rows; upper edge of pectoral fin distinctly darker.....*L. kasmira*
- 4b. Body with 5 stripes on sides; cheek scales in 7 or 8 rows; pectoral fin uniform, upper edge of pectoral fin not darker.....*viridis*
- 5a. Preopercular notch and knob well developed; body with 5 lateral stripes; snout and cheek without spots or broken narrow bands
.....*L. quinquelineatus*
- 5b. Preopercular notch and knob absent or poorly developed; body with 7 to 8 lateral stripes; snout and cheek with spots and broken narrow bands*L. coeruleolineatus*

MATERIAL AND METHODS

As a part of the programme on 'the study of Snappers of India' the Lutjanid collections of the National Zoological Collections, Zoological Survey of India (ZSI), Kolkata have been carefully examined. Materials present at Marine Biological Regional Center (MBRC), Z.S.I., Chennai are also included for the purpose. Further, the authors have specially visited several fish landing centers (survey tours), mostly along west coast of India and the lutjanid specimens in the landing center itself were examined, although those could not brought to the laboratory as being commercial food fishes and large in size. The observations in the field and laboratory are now put together to distinguish the blue striped snappers of the genus *Lutjanus* Bloch found along coasts of India. Identification of the specimens is following the key given above.

Materials examined: *L. bengalensis*: ZSI 1706 (Original of pl. 10, fig. 4 of Day, 1875), 1 ex., 160 mm SL; Madras (Tamil Nadu), Dr. F. Day, undated.

***L. kasmira*:** ZSI F 10634/2, 1 ex., 104 mm SL, Lakshadeep Island, Ch. Satyanarayana & party, 31.01.2008; ZSI F 10634/2, 2 ex., 165-175 mm SL, Port Blair, Andaman, Dr. K.K. Tiwari (purchased), 03.03.1959; ZSI F 2744/2, 2 ex., 165-175 mm SL, Port Blair, Andaman, Dr. K.K. Tiwari

(purchased), 03.03.1959 (labeled as *L. spilurus*), ZSI F 4355/2, 1 ex., 175 mm SL, Port Blair, Andaman, H.C. Ray, 15.03.1952; ZSI F 10748/2, 3 ex., 145-200 mm SL, Cochin Fishing harbour, Cochin, Kerala, R.P. Barman, 30.10.2012.

***L. quinquelineatus*:** ZSI/MBRC/F 546, 2 ex., 85-100 mm SL, Eravadi, Chennai, Tamil Nadu, C. Venkataraman & party, 29.09.2010; ZSI/MBRC/F 1007, 1 ex., 95 mm SL, Hut Bay, Little Andaman, S. Krishnan & party, 24.10.1991; ZSI/MBRC/F 1008, 1 ex., 85 mm SL; Hut Bay, Little Andaman, S. Krishnan & party, 24.10.1991; ZSI/MBRC/F 3648, 1 ex., 123 mm SL, Nagapattinam, Tamil Nadu, M. Srinivasan & party, 24.02.1991.

RESULTS AND DISCUSSION

Systematic account of *L. bengalensis*, *L. coeruleolineatus*, *L. kasmira* and *L. quinquelineatus* with their diagnosis and distribution has been furnished below for easy identification. Although the authors could not examine any specimen of *L. coeruleolineatus*, it is included here for a species has been recorded by Day (1889) with this name and details are after Allen (1985).

1. *Lutjanus bengalensis* (Bloch, 1790) (Bengal snapper)

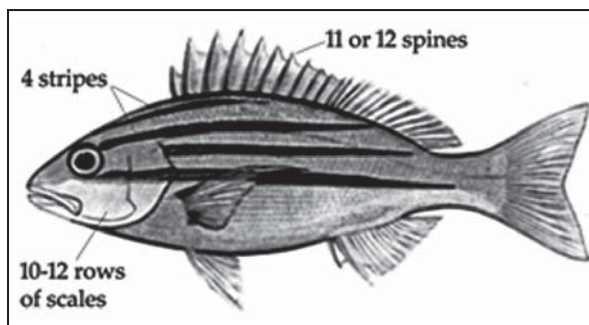
1790. *Holocentrus bengalensis* Bloch, *Naturges. ausland. Fische*, 4: 102, pl. 246, fig. 2 (Bengalen [Bengal, Bay of Bengal, eastern Indian Ocean]).

1985. *Lutjanus bengalensis*, Allen, *FAO Fish. Synop.*, (125) 6: 61-62, pl.12, fig.45.

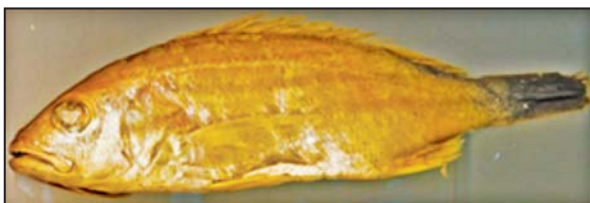
Diagnosis: D XI-XII, 13-14; A III, 8; P 16-17; V I, 5; LL 47-48. Body fusiform, its depth 2.92 to 3.20 in standard length. Head greater than body depth, its length 2.67 to 2.73 in standard length. Dorsal head profile convex. Eye diameter 4.57 to 4.62 in head length. Preorbital space (distance below upper jaw and eye) 7.5 to 8.0 in headlength (3.3 to 8.9 in head length in Allen, 1985). Preorbital space relatively narrow, its width usually less than eye diameter; 1.63 to 1.75 in eye diameter. Preopercular notch and knob well developed. Tongue smooth without teeth. Pectoral fin thoracic, inserted behind first

dorsal fin spine. Preopercle/cheek with 10-12 rows of scales (counted from eye to angle of preopercle). Caudal fin truncate or emarginate. Body usually bright yellow on upper half of body and abdomen whitish. Upper side with a series of 4 blue horizontal stripes. The upper first and second stripes extend from upper posterior border of eye to base of middle of spinous part of dorsal fin and base of soft part of dorsal respectively. The third stripe extends from superior angle of gill openings to base of the last dorsal fin rays and the fourth or lowermost stripe extending from below posterior margin of eye to middle of caudal peduncle. Upper pectoral fin rays dusky. Dorsal, anal, pectoral and pelvic fins whitish.

Distribution: India: Andaman and Nicobar Islands, Maharashtra, Karnataka and West Bengal. **Elsewhere:** Sri Lanka, Red Sea, Indian Ocean: East Africa, Gulf of Oman, Seychelles, Madagascar and western Mascarenes east to Sumatra (Indonesia).



Out lined diagram of *L. bengalensis*



L. bengalensis: Original of pl. 10, fig. 4 of Day, 1875

2. *Lutjanus coeruleolineatus* (Ruppell, 1830) (Blue lined snapper)

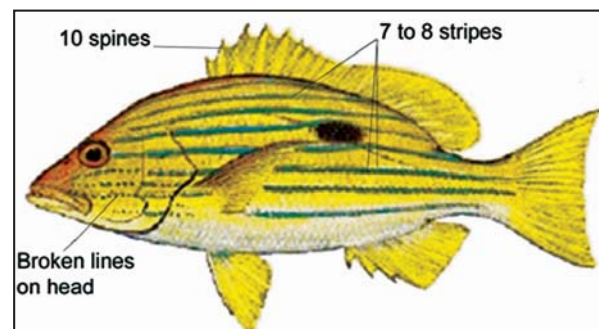
1838. *DiaCOPE coeruleo-lineata* Ruppell, Neve, Wirbelth., *Fische*: 93 (Massaua and Djedda Sea).

1985. *Lutjanus coeruleolineatus*, Allen, *FAO Fish. Synop.*, (125) **6**: 70-71, pl.13, fig.51.

Diagnosis: D X, 12-14; A III, 8-9; P 16-17; V I, 5; LL 46-49. Body somewhat deep, its depth 2.4 to 2.6 in standard length. Snout more or less pointed. Dorsal profile of head somewhat sloped. Preorbital space almost equal or slightly narrower than eye diameter. Preopercular notch and knob poorly developed or absent. Longitudinal scale rows above lateral line rising obliquely. Scale rows on cheek 10 or 11. Caudal fin truncate or emarginate. Gill rakers on first arch, lower 14-15+ upper 7-8, total 21-23. Tongue smooth without teeth. Pectoral fins thoracic originated ahead of first dorsal fin spine. Dorsal surface of body brownish, sides yellow and abdomen whitish. Body with 7 to 8 blue stripes on sides, upper four or five lateral stripes extending to base of dorsal fin and lower three stripes extending from ahead of eye to base of caudal fin. A round dark spot in between fourth and fifth lateral stripes below anterior part of soft dorsal fin rays above lateral line present. Numerous blue spots or broken thin bands present below eye on head. Fins yellowish.

Distribution: Seas surrounding the Arabian Peninsula except northern Red Sea and the Gulf.

Remarks: *L. coeruleolineatus* is unlikely to occur along Indian coast. It is given here for this name is used by Day (1889) to describe one blue striped species from Indian coast. Further discussions are given below.



L. coeruleolineatus (after Allen, 1985)

3. *Lutjanus kasmira* (Forsskal, 1775) (Common blue stripe snapper)

1775. *Sciaena kasmira* Forsskal, *Descript. Animal*, **11**: 46 (Arabia)

1985. *Lutjanus kasmira*, Allen, *FAO Fish. Synop.*, (125) 6: 96-97, pl.17, fig.63.

Diagnosis: D X, 14-15; A III, 7-8; P 15-17; V I, 5; LL 48-51. Body fusiform, its depth 2.74 to 3.27 in standard length. Head length 2.43 to 2.92 in standard length. Eye diameter 3.68 to 4.13 in head length. Preorbital space (distance below upper jaw and eye) wider, 5.50 to 5.85 in head length (3.3 to 8.9 in head length in Allen, 1985). Preorbital width shorter than eye diameter, 1.36 to 1.73 in eye diameter. Longitudinal scale rows on back rising obliquely above lateral line. Preopercle/cheek with 5 or 6 scale rows. Gill rakers 13-14 on lower arm of 1st gill arch, total 20-22. Preopercular notch and knob well developed. Tongue smooth without teeth. Pectoral fin thoracic ahead of dorsal fin spine. Body with 4 blue horizontal blue stripes on sides, upper 3 horizontal stripes extending from preopercular region to base of dorsal fin and fourth stripe extending from almost tip of snout to near base of caudal fin; a short lateral line stripe also present on head below fourth stripe. A dark blotch present in between second and third lateral stripes below almost two-third of body. A series of pale dusky stripes on lower most part of side. Upper part of pectoral fin rays darkish.

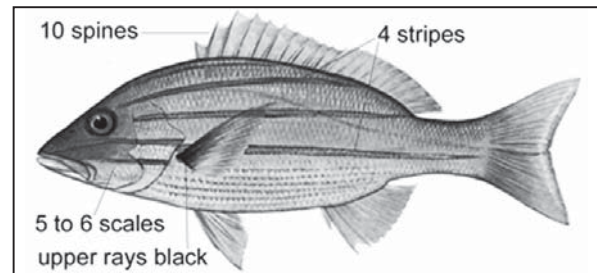
Distribution: India: Andaman & Nicobar Island, Odisha, Gujarat, Maharashtra, Karnataka, Kerala, Tamil Nadu, Lakshadweep Island. **Elsewhere:** Widespread in the Indo-Pacific from the Marquesas and Line Islands to East Africa and from Australia to southern Japan.



A huge landing of *L. kasmira* Cochin fishing harbour



L. kasmira (Fresh specimen)



Out lined diagram of *L. kasmira*

Remarks: Allen (1985) described preorbital width usually greater than eye diameter but sometimes less in small specimens, but the present study shows that preorbital width is shorter than eye diameter, 1.36 to 1.73 in eye diameter in the specimens measuring 140 to 190 mm standard length. During a recent survey (October, 2012) along the coastal belt of Cochin, a huge collection of the common blue stripe snappers was observed in the landing center of Cochin harbour.

4. *Lutjanus quinquelineatus* (Bloch, 1790) (Five-lined snapper)

1790. *Holocentrus quinquelineatus* Bloch, *Naturges. ausland. Fische*, 4: 84 (Japan)

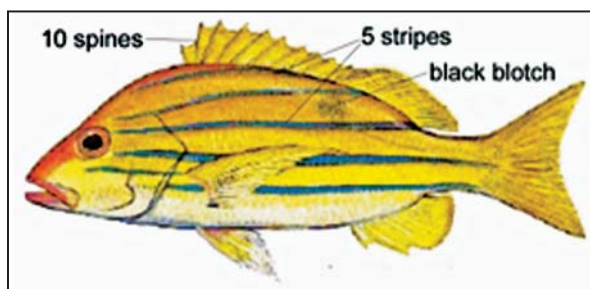
1985. *Lutjanus quinquelineatus*, Allen, *FAO Fish. Synop.*, (125) 6: 111-112, pl.19, fig.73.

Diagnosis: D X, 13-14; A III, 8; P 16-17; V I, 5; LL 47-50 Body somewhat deep, its depth 2.30 to 2.73 in standard length. Head length 2.67 to 3.20 in standard length. Dorsal profile of head steeply sloped. Eye diameter 2.78 to 3.06 in head length. Preorbital space (distance below upper jaw and eye) wider, 4.17 to 5.75 in head length. Preorbital width usually less than to eye diameter. Longitudinal scale rows above lateral line rising obliquely. Scale rows on cheek 10 or 11. Caudal fin truncate or emarginate. Preopercular notch and knob well developed. Gillrakers on lower arm of first arch 13-15, total 20-23. Tongue smooth without teeth. Scale rows on back rising

obliquely above lateral line. Generally bright yellow, including fins, with a series of blue stripes on the side. A round black spot, almost equal to eye diameter, is below the anterior-most soft dorsal rays and between second and third lateral stripe, touching the lateral line but mostly above it. Body with 5 blue stripes on sides (6 stripes at times), upper 3 stripes extend to base of dorsal fin and fourth and fifth stripes extend to base of caudal fin. Fins yellowish.



L. quinquelineatus (preserved specimen)



Lutjanus quinquelineatus (after Allen, 1985)

Distribution: India: Gujarat, Maharashtra, Karnataka, Kerala, Tamil Nadu, Andaman & Nicobar Islands. *Elsewhere:* Widely distributed in the Indo-Pacific from the Fiji Islands to the Gulf of Oman and the Gulf and from Australia to southern Japan.

DISCUSSIONS

L. bengalensis and *L. kasmira* are morphologically closely related species in colour pattern. Both the species possess 4 lateral blue stripes on sides. But these two species can be identified by the following characters. The former species possesses 11 to 12 dorsal spines; 10 to 12 transverse rows of scales on cheek; lower gill rakers 17 to 19; no dark spot below soft part of dorsal fin; upper rays of pectoral fin pale or dusky. In contrast to it, *L. kasmira* have 10 dorsal spines; 5 to 6 rows of transverse rows of scales on cheek, lower margin without scales; lower gill

rakers 12 to 14 including rudiments; a dark spot below soft part of dorsal fin present below soft part of dorsal fin; upper rays of pectoral fin dark. Allen (1985) is erroneous in describing *L. bengalensis* with dorsal fin spine counts 10 and 12-14 soft rays in the text but in the key to the species of *Lutjanus* it has been rightly included under the group having dorsal fin with 11 to 12 spines. This is now observed here that *L. bengalensis* well distinguished from other blue striped snappers of the area in having 11 to 12 dorsal fin spines.

L. quinquelineatus and *L. caeruleolineatus* are also almost morphologically similar species in colour pattern and having a dark blotch below front part of soft dorsal fin. But these two species can be separated from each other by the following features. *L. quinquelineatus* possess 5 lateral blue stripes; preopercular notch and knob well developed; snout and cheek without spots and broken narrow bands in former species; while *L. caeruleolineatus* have 7 to 8 lateral blue stripes on sides; preopercular notch and knob indistinct or absent; and with spots and broken narrow bands on snout and cheek. Table 1 shows a comparison of these four blue striped snappers for easy identification.

The identity of these blue striped snappers had remained a confusing subject in Indian literature. Day (1875) reported three species from the Seas of India having blue longitudinal stripes on sides, viz., *Lutjanus bengalensis* Bloch, *L. quinquelineatus* Bloch and *L. quinquelinearis* Bloch. But in his subsequent work (Day, 1888, 1889) these species were treated as *L. kasmira*, *L. coeruleolineata* and *L. quinquelinearis* respectively. However it has been observed that in Bloch (1970) it is spelled *quinquelinearis* on plate and *quinquelineatus* in text and so, later is a valid name, not the former (Eschmeyer, 2013). Hence the last named species should be treated as *L. quinquelineatus*. *Genyorange grammica* of Day (1871) described from Andaman Islands, *Diacope spilura* of Bennett (1833) and *Diacope decemlineata* of Valenciennes (1830) both described from Sri Lanka are considered to be synonyms of *L. quinquelineatus* Bloch (Allen, 1985).

Table 1. Comparison of four blue striped snappers.

Characters	<i>L. bengalensis</i>	<i>L. caeruleopuntatus</i>	<i>L. kasmira</i>	<i>L. quinquelineatus</i>
Dorsal fin spines	XI-XII	X	X	X
Scale rows on cheek	10-12	10-11	5-6	10-11
Lower gill rakers	17-19	14-15	12-14	13-15
Black spot below dorsal	absent	present	present	present
Upper rays of pectoral fin	pale	pale	dark	pale
Preopercular notch & knob	well developed	poorly developed	well developed	well developed
Stripes on sides	4	7-8	4	6

Sir F. Day has certainly confused *kasmira* with *bengalensis*. We have examined Day's *L. bengalensis* specimen from Madras which was figured in Day (1875) and found to be correct, but it is not *L. kasmira* as it contains XI dorsal spines, 11 rows of cheek scales, 17 gill rakers on lower arm of first gill arch and no spot on lateral line below dorsal fin.

Report of *L. coeruleolineata* from Indian waters by Day (1889) compelled us to rethink its possible occurrence along Indian coast. In having poorly developed notch and knob the specimen certainly resemble *L. coeruleolineata*, but it should usually have 7 to 8 stripes. *L. notatus* have 6 stripes on sides but differs in having 11 spines in dorsal fin, which is also unlikely to occur along Indian coast. As per the synonymy given in Day (1875), the specimen is comparable to *Mesoprion quinquelineatus* of Valenciennes (1830) which is based on 'mungi mapudi' of Russell (1803) from Visakhapatnam (east coast of India) and the specimen figured was 6 inches in length and from

the Andaman Islands. Therefore it is sure that he has seen a young specimen where the preopercular notch and knob are properly developed. During the present study, it has been observed that preopercular notch and knob becomes more prominent with age and growth. The authors also found some specimens of *L. quinquelineatus* having an extra stripe (i.e., 6 stripes). From the statement of Day (1875) that "The specimen of Bloch's, *Lutianus quinquelineatus*, 9 inches long, No. 229, is undoubtedly this species", it is concluded that Day's specimen is certainly *L. quinquelineatus*, not *L. coeruleolineatus*. It is further confirmed that *L. coeruleolineatus* is not found in the Indian waters.

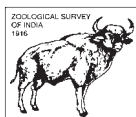
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REFERENCES

- Allen, G.R. 1985. FAO Species catalogue, Vol.6. The Snappers of the World. An Annotated and illustrated catalogue of the lutjanid species known to date. *FAO Fish. Synop.*, (125) **6**: 1-208.
- Bennett, E.T. 1833. Characters of new species of fishes from Ceylon. *Proceedings of the Committee of Science and Correspondence of the Zoological Society of London*, **1832**(2): 182-184.
- Day, F. 1871. On the fishes of the Andaman Islands. *Proc. Zool. Soc. London*, **1870**(3): 677-705.
- Day, F. 1875. *The fishes of India, being a Natural History of fishes known to inhabit the seas and freshwaters of India, Burma and Ceylon*. William Dawson & Sons Ltd., London, (1): 1-168, pls. 1-40.

- Day, F. 1888. *The fishes of India, being a Natural History of fishes known to inhabit the seas and freshwaters of India, Burma and Ceylon*. William Dawson & Sons Ltd., London, (supplementary): 169-368.
- Day, F. 1889. *The Fauna of British India including Ceylon and Burma. Fishes*. Vol. I, Taylor & Francis, London: 1-601.
- Eschmeyer, W. N. (ed). 2013. Catalog of Fishes. California Academy of Sciences (<http://research.calacademy.org/research/ichthyology/catalog/fishcatmain.asp>). Electronic version accessed 11 March 2013.
- Fischer, W. and Bianchi (eds.) 1984. *FAO species identification sheets for Fishery purposes. Western Indian Ocean (Fishing area 51)*, FAO, Rome, 3: pagevar.
- Froese, R. and Pauly, D. (Eds.) 2013. FishBase. World Wide Web electronic publication. www.fishbase.org, version (02/2013)
- Nelson, J.S., 2006. *Fishes of the World* (4th ed.). John Wiley & Sons, Inc, New Jersey & Canada: 601 pp.
- Russell, P. 1803. *Description and figures of two-hundred fishes collected at Vizagapatnam on the coast of Coromandal*, W. Bulmer & Co., London, 2 volumes, 198 pls.
- Talwar, P.K. 1991. Pisces. In: *Animal Resources of India*, Zool. Surv. India, Kolkata: 577-630.
- Talwar, P.K. and Kacker, R.K. 1984. *The Commercial Sea Fishes of India*. Hand Book No. 4. Zool. Surv. India, Kolkata: 997 p.
- Valenciennes, A. 1830. Additions et Corrections. In, Cuvier, G. and Valenciennes, A., *Histoire naturelle des poissons*. **6**: 493-559.



NEW RECORD OF TWO SPECIES OF *BELOBRANCHUS* (TELEOSTEI : GOBIOIDEI : ELEOTRIDAE) FROM ANDAMAN ISLANDS

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INTRODUCTION

Mount Harriet National Park is lies between 10°43'57N latitudes and 92°43'41 to 92°47'11E longitudes. The area of park is about 46.62 km² (Fig. 1). The park possesses various hill ranges, which generally lie in the north and south direction of 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 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. 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. Though the numbers of primary freshwater species are few there are 2 species endemic to Andaman waters viz. the syngnathid *Microphis insularis* (Hora) and the eleotrid *Eleotris andamanensis* Hora. The hill stream gobiid species *Sicyopterus microcephalus* Bleeker is a synonymes of *Sicyopterus garra* Hora recorded from Andaman Islands. Two unique native fish species *Eleotris andamanensis*

and *Microphis insularis* are found nowhere else in the world (Talwar and Jhingran, 1991). A detailed investigation has recently been made on the freshwater fish fauna of Mount Harriet National Park, Andaman Islands. This has yielded 25 species; among these two freshwater eleotrids under the genus *Belobbranchus* were collected. The family Eleotridae commonly known as sleepers (gudgeons) comprises nearly 172 species distributed among 27 genera (data from Eschmeyer and Fong, 2012).

MATERIALS AND METHODS

A study was undertaken from January 2010 to December 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 and gravels with small patch of muddy or silted areas. The banks of the streams are generally steep, with overhanging trees and assorted shrubs. The material studied has been deposited in the reference collections of Zoological Survey of India at Port Blair.

RESULTS

Belobbranchus segura Keith, Hadiaty and Lord, 2012 (fig. 2)

2012. Keith P., Hadiaty R. K., and Lord C., A new species of *Belobbranchus* (Teleostei: Gobioidae: Eleotridae) from Indonesia. *Cybiu*, **36**(3): 479-484.

Diagnostic features : D VI, I,7; A I,7; P 21-24; V. I, 5; C 13-15; LSS 55-60; TRF 24-27; TRB

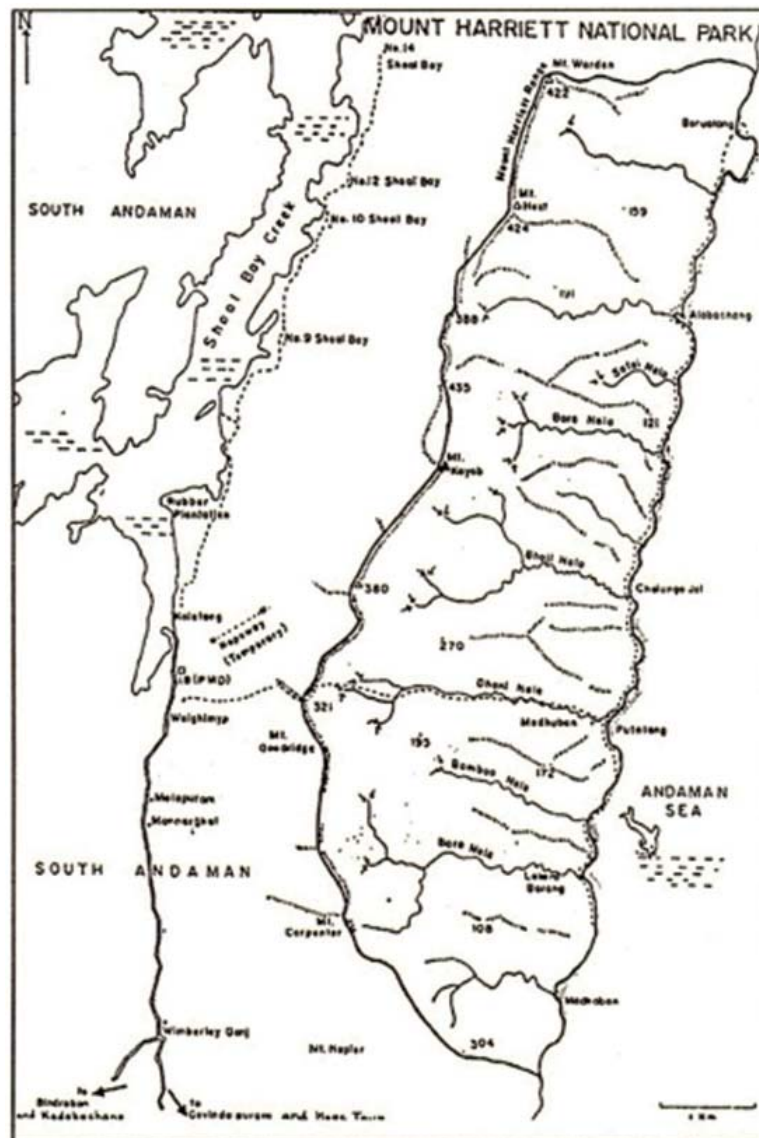


Fig. 1. Map of Mount Harriet National Park to show field location as (Shoal-bay 12) arrow mark

19-21; PDS 18-26. Body elongate, cylindrical anteriorly, slightly compressed posteriorly; head depressed; snout convex; lower jaw prominent; nostrils are not tubulate; mouth large; teeth in front in several rows, outer row a little enlarged; no pore on head; cephalic sensory papillae system well developed with seven row of papillae on head; the first or first and second branchiostegal rays end anteriorly in a sharp, conical forward directed spine form a spine; first dorsal fin obtuse, 2nd to 4th rays longest; caudal fin rounded; ctenoid scales on flanks and caudal peduncle; cycloid scales on top of head, on the base of pectoral fins and on

the belly; anterior part of throat and head naked; scales of nape small; males with a rounded/triangular urogenital papilla with distal tip rounded and the females with bulbous rogenital papilla with fimbrate projections around distal opening. Colour: no sexual dichromatism; body red brown; head grayish brown with brown stripes radiating from eye to snout, top of head and cheeks and fading on nape and operculum; large alternating dark and light brown stripes on back; dorsal fins orange with black zebra stripes; pectoral fin base with dark blotch; caudal peduncle blackish and caudal fin orange and no spots.

Material examined: 4 examples, (58-76mm SL), 14.03 2012, (11° 49' 545'' N, 92° 43' 638'' E); shoal bay, South Andaman, Coll. PT Rajan, (ZSI ANRC 7264).

Ecology: Both the species are benthic. It occurs in lower parts of coastal streams, collected at elevation 93 ft., depths 1.5 to 2.0 m with a substrate of rocky and gravel bottoms.

Distribution: Known only from Indonesia and Andaman Islands, India.



Fig. 2. *Belobranchus segura*

Belobranchus belobranchus (Valenciennes, 1837) (fig. 3)

1837. *Eleotris belobrancha*, Valenciennes, *Hist. Nat. Poissons* 12: 243.

2004. *Belobranchus belobranchus*, Larson, H. K. and B. Pidgeon, New records of freshwater fishes from East Timor. The Beagle, Records of the Museum and Art Galleries of the Northern Territory vol. 20: 195-198.

Diagnostic features: D VI, I,7; A I,7; P 19 and 21; V. I, 5; C 13 and 15; LSS 56 and 63; TRF 31 and 34; TRB 21 and 22; PDS 28 and 32. Body elongate, cylindrical anteriorly, slightly compressed posteriorly; head depressed; snout convex; lower jaw prominent; nostrils are not tubulate; mouth large; teeth in front in several rows, outer row a little enlarged; no pore on head; cephalic sensory papillae system well developed; the first or first and second branchiostegal rays end anteriorly in a sharp, conical forward directed spine; caudal fin rounded. Body dark to olivous above, dark or yellowish below, many narrow dark horizontal lines on the sides, generally light brown bands alternating with dark brown midlateral stripes and the caudal fin is always spotted, head grayish brown with brown stripes radiating from eye to snout, top of head and cheeks and fading

on nape and operclum; dorsal fins also spotted; caudal peduncle with 2-3 large blackish spots.



Fig. 3. *Belobranchus belobranchus*

Material examined: 2 examples, (54mm and 65mm SL), 14.03 2012, (11° 49' 545'' N, 92° 43' 638'' E); shoal bay, South Andaman, Coll. PT Rajan, (ZSI ANRC 7265),

Ecology: Both the species are benthic. It occurs in lower parts of coastal streams, collected at elevation 93 ft., depths 1.5 to 2.0 m with a substrate of rocky and gravel bottoms.

Distribution: Known from Indonesia, Papua New Guinea, Philippines and Andaman Islands, India.

CONCLUSION

In the Pacific area the Eleotridae family developed many endemic genus occurring in the lower to the middle reaches of rivers as *Belobranchus segura* Keith, Hadiaty and Lord, 2012 and *B. belobrancha* (Cuvier and Valenciennes, 1837) are the only two known species of the genera *Belobranchus*, the present study revealed that both the species also present in the Andaman Islands, situated in the remote Eastern Islands of the Indian Ocean. It seems that the Andaman and Nicobar Islands coast has a regular connectivity with the south-eastern coast of Indonesia and north-eastern coast of Burma in terms of faunal affinity. The fish diversity in these waters also receives special interest in terms of marine zoo-geography because of the confluence of Andaman Sea fishes with Western Pacific and the Eastern Indian Ocean. Long-term monitoring studies will allow a better understanding of connectivity patterns along the coast of Andaman and Nicobar Islands as well as the possible establishment of more new populations of species.

SUMMARY

Two new records of fishes *Belobranthus segura* Keith, Hadiaty and Lord, 2012 and *B. belobrantha* (Cuvier and Valenciennes, 1837) are described on the basis of 06 specimens collected from western slope freshwater streams of the Mount Harriet National Park, Andaman Islands. This is herein described as the first record of the genus *Belobranthus* from India.

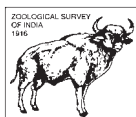
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REFERENCES

- Eschmeyer, W.N. and Fong, J.D. 2012. Species of Fishes by family/subfamily. [http://research.calacademy.org/research/ichthyology/catalog/Species by Family](http://research.calacademy.org/research/ichthyology/catalog/Species%20by%20Family). On-line version dated 23 April 2012.
- KEITH, P., Hadiaty, R.K. & Lord, C. 2012: A new species of *Belobranthus* (Teleostei: Gobioidae: Eleotridae) from Indonesia. *Cybium*, **36**(3): 479-484.
- Larson, H.K. and Pidgeon, B. 2004. New records of freshwater fishes from East Timor. The Beagle, Records of the Museum and Art Galleries of the Northern Territory vol. **20**: 195-198.
- Rema Devi, K. 2010. Freshwater fishes of Andaman Islands. In: Ramakrishna, Raghunathan, C and Sivaperuman (Eds), *Recent trends in Biodiversity of Andaman and Nicobar Islands*: 329-339. (Published by the Director, Zool. Sur. India, Kolkata).
- Talwar, P.K. and Jhingran, A. 1991. *Inland fishes of India and adjacent countries*. Oxford and IBH Publishing Co. Pvt. Ltd., N. Delhi, 2 volumes: xix + 1158.



Short Communication

ON THE OCCURRENCE OF *LUTJANUS VITTA* (QUOY & GAIMARD, 1828) (PISCES: PERCIFORMES: LUTJANIDAE) FROM LAKSHADWEEP, INDIA

INTRODUCTION

During the course of the identification of the fishes of old collections in the holding of the National Zoological Collections, Zoological Survey of India, one specimen of the genus *Lutjanus* Bloch, 1790 was found. The specimen was compared with known species of the genus and the identity of this species is confirmed to be *Lutjanus vitta* (Quoy & Gaimard, 1828) which is commonly known as Brown stripe snapper. The snappers (Pisces: Perciformes: Lutjanidae) are well known as food fishes throughout their occurrence and are of considerable commercial value. These fishes are usually found in marine water, although a few species are also available in estuaries.

L. vitta is widely distributed species in the Indo-West Pacific region. A perusal of the existing literature (Jones & Kumaran, 1980 & Rao, 1991) on the fishes of the family Lutjanidae from Lakshadweep shows that *L. vitta* is not yet reported from this Islands. So, the discovery of this species from Lakshadweep forms the first record from this Islands, although it has already been recorded from Kerala coast (Barman and Mishra, in press). A brief description of the species with its geographical distribution, maximum size, interest to fisheries and habitat and ecology is furnished here to record its first occurrence from Lakshadweep.

Lutjanus vitta (Quoy & Gaimard, 1824)
(Brown striped snapper)

1824. *Serranus vitta* Quoy & Gaimard, Voy. Uranie Zool: 58 (Waigiou)

2001. *Lutjanus vitta*, Anderson & Allen, The diving marine resources of the Western Pacific, 5(3): 2896, pl.IX, 59.

Materials Examined: ZSI F10869/2, 1 ex., 210 mm. SL; Pitti Island, Lakshadweep, India; Dr. Ch.Satyanarayan & party; 26.02.2006.

Diagnostic Features: D X, 12; A III, 8; P. 16. Gill rakers 10-11 (including rudiments) on lower arm of first arch, total rakers 17-18. Body somewhat deep, its depth 3.0 and head length 2.63 times in standard length. Head profile somewhat convex and greater than body depth. Eye diameter 4 times in head length. Suborbital width almost half of eye diameter, 8.7 times in head length. Interorbital space convex, almost equal to eye diameter. Margins of preopercle finely serrate. Preopercular notch and knob poorly developed. Preorbital region between mouth and eyes without scales but scale present on cheek and preopercle. Transverse scale rows on cheek 8. Teeth patch on vomer diamond-shaped; tongue with a patch of granular teeth. Posterior profile of dorsal and anal fins angular. Caudal fin slightly emarginate. Longitudinal scale rows above lateral line raising obliquely to dorsal profile. Soft dorsal and anal fin bases with a scaly sheath.

Body along dorsal profile and upper side brownish in preservation, lower side and abdomen whitish. Longitudinal narrow stripes along sides of the body, those above lateral line slanting posteriorly towards the base of dorsal fin. A dark blackish stripe along middle of sides, extending from behind eye to upper part of caudal peduncle. All fins yellow in colour in life.

Geographical distribution: India : Andhra Pradesh, Tamil Nadu, Kerala, Gujarat and Andaman & Nicobar Islands, *Elsewhere:* Mainly western Pacific and eastern Indian Ocean from New Caledonia and Gilbert Islands to southern India, extending northward to southern Japan; also found in the Seychelles (Anderson & Allen, 2001).

Maximum size: It attains 40 cm, but usually found around 25 cm in total length.

Interest to fisheries: It is an edible fish generally common along its range of occurrence.

Remarks: Although Allen (1985) stated the preorbital width of *L. vitta* to be about equal to eye diameter, we observed that not only in the above mentioned Lakshadweep specimen but also in several specimens along Indian coast, the preorbital width is about half of the eye diameter but clearly less than 9 times of head length so that it cannot be considered as *Lutjanus lutjanus* Bloch, which has more gill rakers (17 to 19) on lower limb of first arch. In the preserved specimen

the dark broad black band from eye to caudal fin gets faded up and we need to depend on gill raker counts, preorbital width and vomerine tooth patch to confirm the identity.



Fig. 1. Photograph of *Lutjanus vitta* (Quoy & Gaimard), ZSI F10869/2, 210 mm. SL

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REFERENCES

- Allen, G.R. 1985. FAO Species catalogue, Vol. 6. The Snappers of the World. An annotated and illustrated catalogue of the lutjanid species known to date. *FAO Fish. Synop.*, (125) **6**: 1-208.
- Anderson, W.D. Jr. and Allen, G.R. 2001. Lutjanidae. In: Carpenter, K.E. and Niem, V.H (eds.). FAO species identification guide for fishery purposes. The living marine resources of the Western Pacific. Volume 5. Bony fishes, Part 3 (Menidae to Pomacentridae): 2840-2918.
- Barman, R.P. and Mishra, S.S. (in press). An annotated checklist of the snappers (Pisces: Perciformes: Lutjanidae) of India. *Rec. zool. Surv. India, Occ. Pap.*
- Jones, S. & Kumaran, M. 1980. *Fishes of Laccadive Archipelago*. Nature Conservation and Aquatic Science, Kerala: 760 pp.
- Rao, G.C. 1991. Lakshadweep: General features. *Fauna of Lakshadweep, State Fauna Series*, 2: 5-40 (Zoological Survey of India, Kolkata).

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