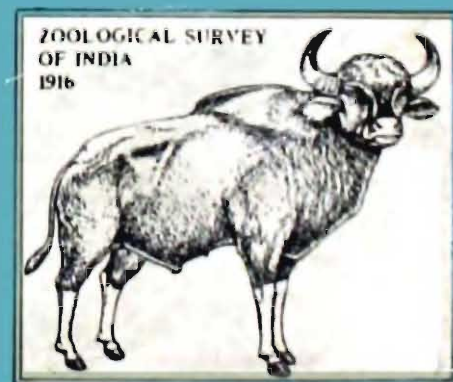


FAUNA OF ORISSA

PART—I

ZOOLOGICAL SURVEY OF INDIA
1987



STATE FAUNA SERIES NO. 1

FAUNA OF ORISSA

PART 1

*Edited by the Director,
Zoological Survey of India*



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1987

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FOREWORD

The faunistic survey of Orissa State was started in the year 1970 in a systematic manner and as many as 55 surveys were conducted in different districts and ecosystems of the State for various groups of the fauna. It is a stupendous work to survey a region with a long coastline, estuaries, mangroves, rivers, hill streams and different types of forests and this is the reason why it took nearly 14 years to complete a general faunistic survey of this small state of the Indian Union.

Very extensive and rich collections of almost all the groups of Animal Kingdom were brought to the laboratory through these surveys and placed at the disposal of different specialists in the Department and outside. Studies on some of the groups have been completed and presented here in this volume on "Fauna of Orissa" under the newly started "State Fauna Series". Further contributions on the fauna of Orissa are proposed to be presented in the future parts of this volume.

I wish to acknowledge my sincere thanks to Dr. O. B. Chhotani, Scientist 'SE' (Deputy Director) who readily came forward to help in bringing out this issue and in editing and preparing of the contributions for publication.

December, 1987

B. S. LAMBA
Acting Director

FAUNA OF ORISSA

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GENERAL INFORMATION, WITH LISTS OF FAUNISTIC SURVEYS CONDUCTED AND COLLECTING LOCALITIES IN ORISSA STATE, INDIA

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AND

O. B. CHHOTANI

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INTRODUCTION

Orissa being located on the eastern coast of India and having tropical climate with fairly high rainfall, is very rich both in fauna and flora. The first ever attempt to work out the faunistic component of the State was made in the early part of the twentieth century, when the then Zoology and Anthropology Section of the Indian Museum took up an intensive faunistic survey of Chilka Lake and a tiny island of Barkuda in the lake under the stewardship of Dr. N. Annandale. The survey of the lake and the island was continued even after the establishment of the Zoological Survey of India in the year 1916. An excellent account of the fauna of this lake, in respect of a number of groups, is published in volume 5 of the *Memoirs of the Indian Museum* and that of the Barkuda island, in three parts, in the *Records of the Indian Museum*, volumes 22, 24 and 25. A few faunistic surveys of the remaining parts of the State were undertaken in subsequent years but a thorough, extensive and well planned survey of all the 13 districts of the State was started in the year 1970 under the direct supervision of Dr. A. P. Kapur, the then Director of the Survey, with a view to bring out an account of the fauna of the State. The survey of the State was continued till late in the year 1983 for different groups of animals by various specialists. The collections thus obtained have been or are being studied by the specialists in the Survey.

A resurvey of the Chilka Lake is being done to assess the changes in the faunistic component of the Lake due to pollution, the level of which has increased in the recent past, and the ecological changes. The results of this study are proposed to be published at a later date in a separate publication.

The Zoological Survey of India has also initiated a programme of exploration and faunistic studies of different states of the Indian Union in a systematic manner. The state of Rajasthan was surveyed, during the times of Dr. M. L. Roowal, in the years 1956-'63 and a very good account of the fauna of the state was published in the *Records of the Zoological Survey of*

India, volume 61 (parts 3 & 4) in the year 1963 and in some stray publications in subsequent volumes of the Records. As the Survey proposes to bring out faunistic accounts of all the States and Union Territories, a new series, "State Fauna" has been initiated so that a complete picture of the fauna of a particular state is available, as far as possible, in one volume. Orissa State, as mentioned above, has been faunistically explored thoroughly in recent years and this issue on Orissa marks the beginning of this series comprising results of studies on various groups so far completed by specialists on particular groups.

The survey for the fauna of the state of West Bengal, is nearly complete and results of these studies will be published in a subsequent issue of the series. The faunistic survey of some other states is also in progress and in due course of time we may be able to bring out accounts of faunistic wealth of all the States and Union Territories of the Indian Union. These faunistic reports will be useful in the dissemination of information for the preparation of district gazetteers being prepared by the states, for providing base-line data on the fauna of the areas where different developmental projects such as irrigation dams, hydro-electric projects and industries are proposed to be established and for the assessment of subsequent changes in the faunal component.

TOPOGRAPHY, PHYSIOGEOGRAPHY, CLIMATE, etc. OF ORISSA

a. Topography

The Orissa state lies between 81°27' to 87°29'E latitudes and 17°49' to 22°34'N longitudes and has an area of about 1, 55, 780 sq km. It is bounded by the Bay of Bengal and the eastern arm of Andhra Pradesh in South, states of Bihar in North, Madhya Pradesh in West and West Bengal in East. It has a long coast-line of about 480 km along the Bay of Bengal.

The state is endowed with bounties of nature in a very liberal manner. It has beautiful sea beaches right from Chandaneswar to Gopalpur-on-Sea and the beaches of Puri, Konarak and Chandipur are very distinctive in their own way. The Chilka Lake, a natural vast expanse of water, covering an area of about 110 sq km and having a number of islands, is another charming place for exploration. Migratory birds visit Chilka during winter and some of the islands are the breeding grounds for a number of species. The lush green and luxuriant forests of Simlipal, the Nandankanan Biological Park and other forest areas in Sambalpur, Phulabani (Baudhkhondmal), Kalahandi and Koraput districts, which support very rich wildlife, are a feast for the eyes of nature lovers.

b. Physiogeography

The State is an extensive Plateau sloping gently into the coastal plains along the Bay of Bengal. All types of rocks, from Archean to the recent alluvium, are found here as it is a part of the old stable block of the world, the Gondwanaland. The river Mahanadi, flowing from West to East through the Plateau, cuts the State into well-defined parts. It may be divided into four important physiogeographical regions, viz. the Northern Plateau, the Central Tract, the south-western Hilly Tracts or the Eastern Ghats and the Coastal Plains. The Northern Plateau is an extension of Chotanagpur Plateau and covers the Mayurbhanj, Keonjhar and eastern Sundargarh areas. In its central part there are a number of small hills and the upper parts of the rivers Subarnarekha, Baitarani and Brahmani lie in this part. The Central Tract covers the districts of Sambalpur, Bolangir, Dhenkanal and parts of Kalahandi, Sundargarh and Phulabani (Baudhkhondmal). The rivers Mahanadi, Brahmani and Baitarani and their tributaries flow through this area and the landscape consists of succession of plateaus, hills, uplands and valleys. The Eastern Ghats form an uneven plateau and extend over Koraput, parts of Kalahandi, Phulabani (Baudhkhondmal) and Ganjam districts. The Coastal Plains cover the districts Balasore, Cuttack, Puri and parts of Ganjam. This area is fertile, runs along the coast-line, and has alluvium deltas of rivers Subarnarekha, Brahmani, Devi and Mahanadi.

c. Climate

The climate of Orissa is generally tropical with fairly good rainfall during the Monsoon and moderately high temperature.

(i) Temperature

The mean daily minimum temperature in Orissa varies from 11.1°C during the month of January to 26.7°C during the months of May and June and the maximum temperature varies from 26.6°C in December to 36.6°C in May. The annual evaporation rate is nearly 187.5 cm in the coastal areas.

(ii) Rainfall

There are four seasons of rainfall i.e. Winter (December to February), Summer or Pre-monsoon (March to May), South-West Monsoon (June to September) and Post-monsoon (October to November) in India. Orissa gets rain during all these four seasons and the average rainfall is 46.23, 142.75, 1130.05 and 126.49 mm, respectively in these four seasons totalling to 1445.52 mm, thus receiving its main rainfall during South-West Monsoon. The monsoon depressions in the Bay of Bengal also cause heavy precipitation in parts of Orissa. The cyclonic storms in the Bay of Bengal formed during April to June and October to December also cause heavy rains and tidal waves hit the coastal areas.

NATURAL RESOURCES

The state of Orissa is very rich in biological resources (vegetation and animal life) and also in minerals. The forests are of great economic utility as they produce timber for use in construction work, and minerals are the basic needs of industrial development and the state does not lag behind any other state in this respect. The fauna is very varied and wildlife extremely rich.

a. Natural Vegetation and Forests

The rainfall rate being fairly high the state has much larger area under forest cover than many other states. Nearly 43 per cent of total area is covered with natural and man-made forests.

The vegetation in the coastal areas can be divided into three distinct categories, (i) the mangrove forests, (ii) the beach type forests and (iii) the Casuarina forests. The mangrove forests are confined to only two places in Cuttack district namely Kanika and Kujang, the former being situated along the river Dhamara (formed by the confluence of Brahmani and Baitarani) and latter in the Mahanadi Delta. The beach type forests occur in the sandy soils along the coasts and rivers and the Casuarina forests are man-made forests planted by the State Forest Department in the coastal sands to serve as soil binders.

The hinterland portion of the State falls in the Northern Sal Division of Eastern Ghats. The maximum development of forests is at the foot-hills of Ghat ranges in the valleys of rivers Gulley and Mahanadi, mainly in level ground valleys and hill slopes. The upper areas are covered with deciduous forests and bamboo and the ravines abound in mango.

b. Fauna and Wildlife

Being situated along the coast of Bay of Bengal and with its hinterland having good amount of rainfall and vegetation of tropical and sub-tropical nature, the fauna is mainly tropical and rather rich. The wildlife in the State used to be very rich and magnificent and as such it was supposed to be the hunter's paradise. Presently also all the districts have a good share of their wild animals. Amongst the wild mammals, tiger, leopard, jungle cats, civet, hyaena, fox, wilddog, sloth bear, elephant, bison, Nilgai, Sambar, spotted deer, barking deer, etc. are fairly plenty. The Chilka Lake has dolphins and is visited by migratory birds during winters. The common birds visiting the Lake are the Flamingo, Brahminy duck, Great Black-headed gull, Laughing gull, Osprey, Eastern Golden Plover, Wood Sand piper, etc. The small hill island of Kalijai in the Lake is the breeding ground for many species of birds such as the white-bellied Sea Eagle, the Little Cormorant, the Open-billed Stork and the Green Heron.

There is only one National Park i. e., North Simlipal in Mayurbhanj District and nine Wildlife Sanctuaries viz., Chandka, Mahanadi Baisipalli and Nandankanan Biological Park in Puri District ; Bhattar Kanika in Cuttack District ; Hadgarh in Keonjhar and Mayurbhanj Districts ; Khalasuni in Sambalpur District ; Kothgarh in Phulabani District ; Satkosia Gorge in Dhenkanal, Puri, Cuttack and Phulabani Districts ; and Simlipal in Mayurbhanj District.

c. Minerals

The major mineral resources of Orissa are Iron-ore, Manganese, Nickel, Chromite, Bauxite and Coal. The Iron-ore accounts for nearly 33 per cent of the total reserves of the country and is found in the Bihar—Orissa Iron-ore Belt in Keonjhar, Sundargarh and Mayurbhanj Districts. The Manganese deposits are found in Keonjhar, Sundargarh, Koraput and Bolangir districts and are nearly 40 per cent of the total reserves. Nickel, in India, is found only in Orissa in the Cuttack district and Chromite, accounting for 90 per cent of total reserves is found in Cuttack, Dhenkanal, Keonjhar and Balasore districts. Bauxite deposits are located in Sambalpur, Bolangir, Kalahandi and Koraput districts and coal deposit in Dhenkanal and Sambalpur districts. Apart from these, vanadium, lead, graphite, quartz, lime-stone, china-clay and fire-clay are also found in the State.

FAUNISTIC SURVEY OF ORISSA AND COLLECTING STATIONS (Plates I-VI)

A thorough and intensive survey of Chilka Lake and a tiny island in the lake, the Barkuda Island, was started in the year 1912 by the Zoology and Anthropology Section of the Indian Museum and later taken over and continued by the Zoological Survey of India on its inception in July, 1916, under the guidance of Dr. N. Annandale, the then Director of the Survey. A number of survey parties visited this part of the State and made very extensive and intensive collections. It was, however, a survey of a very small portion and was continued till the year 1922.

A few parties of the Department conducted faunistic surveys during the later years in Ganjam District (1940), Balasore (1939) and Koraput (1950) for fishes ; Simlipal Hills (1951-52), Chilka (1954) and Puri (1960) for general faunistic survey ; Chilka Lake for fishes and other aquatic animals (Dec. 1954 to Jan. 1955) ; Barkuda Island, Chilka Lake and Puri for termites (July, 1961) ; coastal areas of the State for economically important molluscs (Nov.-Dec., 1962) ; Balimela and Tikarpara Dam Areas (May-June, 1966) ; coastal areas of Puri for marine organisms (December, 1966) and for Protozoa and general collection (1969), until the year 1970, when it was decided

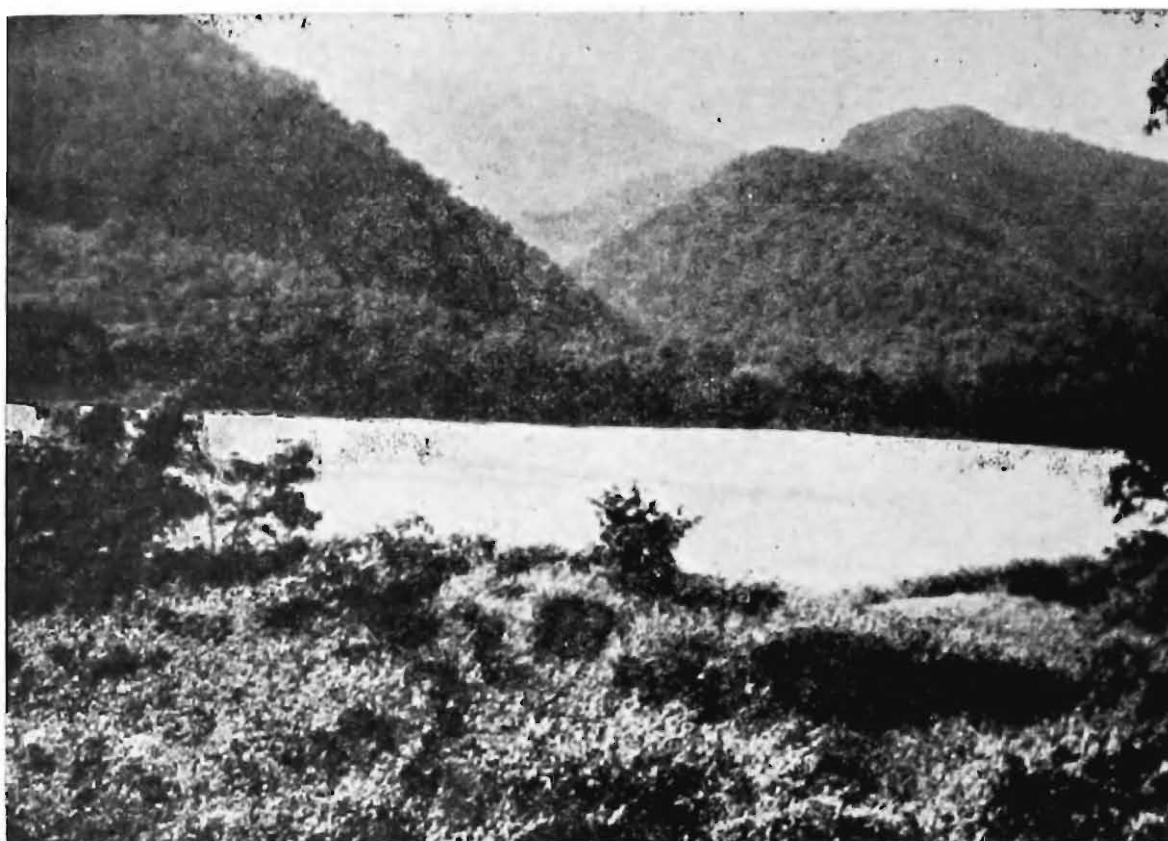
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Fig. 1. Map of Orissa showing main collection localities. Numbers in circles denote districts, thus : 1. Baleshwar (Balasore), 2. Mayurbhanj, 3. Keonjhar, 4. Sundargarh, 5. Cuttack, 6. Dhenkanal, 7. Sambalpur, 8. Puri, 9. Phulabani (Baudhkhondmal), 10. Bolangir, 11. Ganjam, 12. Kalahandi and 13. Koraput.

The Department took up this stupendous work of the exploration of the fauna from different ecological regions and districts of the state under the stewardship of Dr. A. P. Kapur, Director of the Survey at that time. After the superannuation of Dr. Kapur in October, 1973 the survey of the State was continued till 1983 under the guidance and supervision of Dr. S. Khera, Joint Director-in-Charge up to the year 1977 and subsequent Directors Drs. T. N. Ananthakrishnan, K. K. Tiwari and B. K. Tikader. Experts of different groups surveyed all the districts of the State and very extensive and good collections of all groups of animals were brought for study. A list of the surveys undertaken during 1970 to 1983, in different districts, is given in Table-1. Collections were made from more than 300 collecting stations in the State, a list of these stations (arranged district-wise) with their approximate latitude and longitude is given in Table-2.



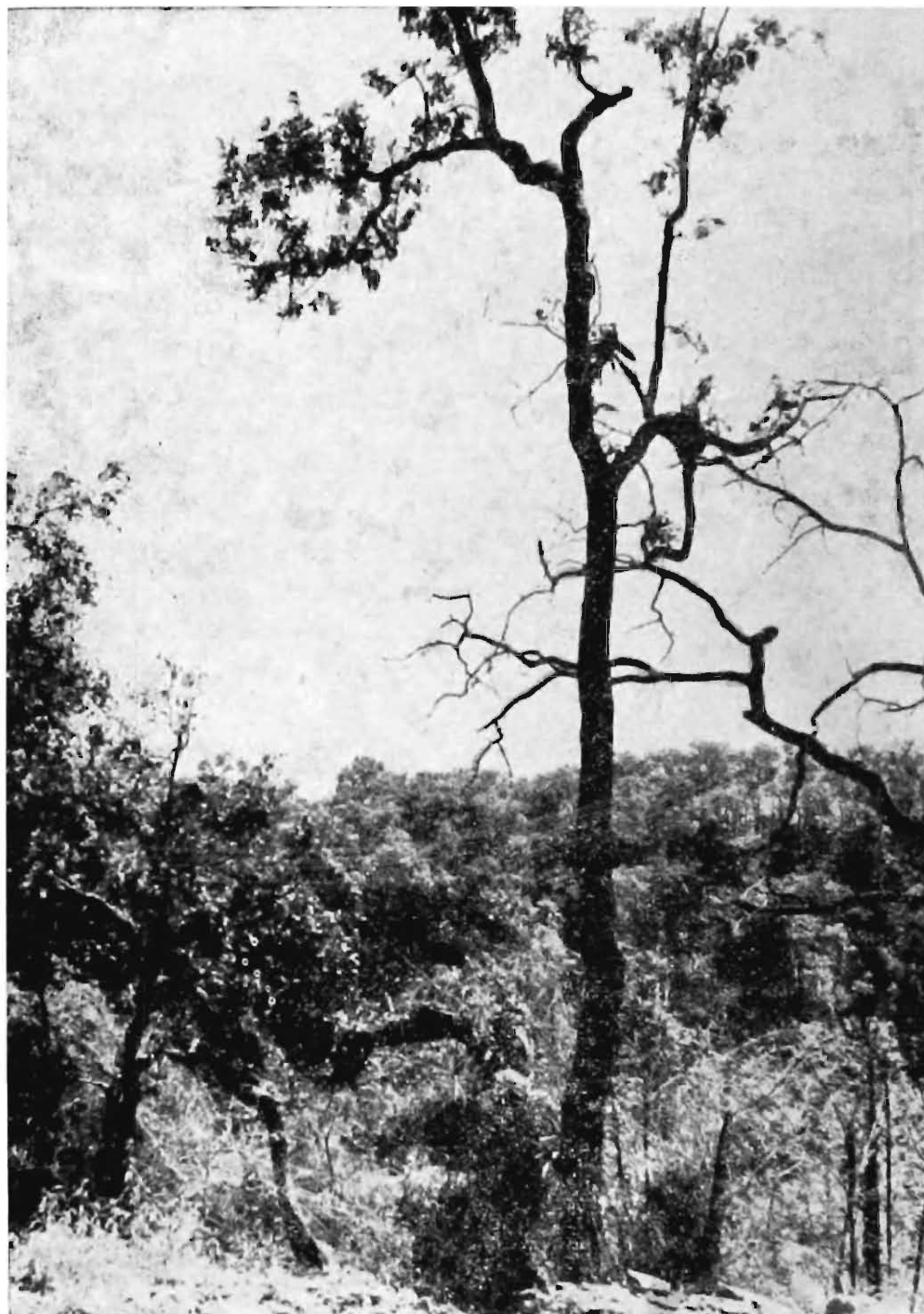
Mound of *Odontotermes obesus* (Rambur), Puri—Balukhand Road (Photo O. B. Chhotani, July, 1961)



A collection site at Tikarpara (Dhenkanal District), showing small hills and a stream
(Photo. J. K. Sen, Nov. 1972)



A freshwater pond at Chatragarh (District Puri), showing ecology of a collection site. (Photo G. Ramakrishna, Feb. 1975)



Hill Forest near Harishankar (Bolangir District), a collection site.
(Photo J. K. Sen, Nov. 1973)



A view of Similipal Tiger Reserve (Photo: S.M.Ali, July 1973)

PLATE V

Grassland in Simlipal Tiger Reserve (Photo: S.M.Ali, July 1973)





Joranda Falls in Similipal Tiger Reserve (Photo: S.M.Ali, July 1973)

PLATE V

Aquatic collection in Similipal Tiger Reserve (Photo: S.Chattopadhyaya, July 1973,



TABLE 1. List of faunistic surveys conducted in the state of Orissa during 1970-1983

Sr. No.	Districts surveyed	Leader of survey party	Period of survey	Purpose/ collections made
1	2	3	4	5
— 1970 —				
1.	Puri, Ganjam	K. N. Nair	7.xii.1970- 11.i.1971	Protozoa
2.	Cuttack	S. Khera	20.-27.xii.1970	Insects and nematodes
— 1971 —				
3.	Mayurbhanj (Simplipal) and Keonjhar	A. K. Mandal	16.i.1971- 9.ii.1971	General survey with special reference to mammals
4.	Baleshwar (Balasore), Cuttak, Puri, Ganjam	D. P. Sanyal	21.x.1971- 23.xi.1971	General faunistic survey w.s.r. to reptiles
5.	Cuttack	A. K. Mukherjee	25.x.1971- 6.xi.1971	Birds
6.	Sundergarh, Sambalpur, Dhenkanal, Bolangir	P. K. Maiti	6.xii.1971- 14.i.1972	General insect survey
7.	Ganjam, Dhenkanal	V. C. Agarwal	14.xii.1971- 15.i.1972	Mammals
— 1972 —				
8.	Phulabani (Baudhkhondmal), Kalahandi, Koraput	K. V. Surya Rao	11.i.1972- 29.ii.1972	Land and fresh water molluscs
9.	Baleshwar (Balasore), Cuttak, Puri, Ganjam	V. K. Premkumar	19.i.1972- 22.ii.1972	Marine collections particularly Crustacea

TABLE 1. (Continued)

1	2	3	4	5
10.	Mayurbhanj, Keonjhar, Dhenkanal	A. R. Bhowmik	24.iv.1972- 2.vi.1972	Insects
11.	Baleshwar (Balasore) (Chandipur), Cuttack, Puri,	P. K. Talwar	10.v.1972- 13.vi.1972	Marine fish and parasitic helminths
12.	Phulbani (Baudh Khondmal), Kalahandi	P. K. Das	16.v.1972- 13.vi.1972	Mammals
13.	Sundargarh, Sambalpur Bolangir	D. P. Sanyal	19.v.1972 to 27.vi.1972	General faunistic survey w.s.r. to Reptilia and Amphibia
14.	Mayurbhanj, Keonjhar, Cuttack	S. K. Mitra	3.viii.1972 to 1.ix.1972	General insect survey and other groups
15.	Cuttack, Puri, Ganjam	Y. Chaturvedi	2.ix.1972 to 12.x.1972	General faunistic survey
16.	Sundargarh, Sambalpur, Bolangir	S. Khera	11.ix.1972 to 8.xi.1972	General faunistic survey w.s.r. to soil nematodes
17.	Mayurbhanj, Keonjhar, Dhenkanal	K. Rai	11.ix.1972 to 11.x.1972	General insect survey
18.	Sundargarh, Sambalpur, Bolangir	J. M. Julka	21.x.1972 to 20.xi.1972	General faunistic survey
19.	Sambalpur, Puri (Chilka Lake)	C. B. Srivastava	24.x.1972 to 22.xi.1972	General faunistic survey w.s.r. to fishes and helminths
20.	Mayurbhanj, Keonjhar, Dhenkanal	J. K. Sen	3.xi.1972- 4.xii.1972	General faunistic survey

TABLE 1. (*Continued*)

1	2	3	4	5
21.	Sambalpur, Bolangir, Sundergarh	A. K. Mandal	11.xii.1972- 10.i.1973	Parasitic and free- living Protozoa also birds, mammals and reptiles
— 1973 —				
22.	Puri, Baleshwar, Ganjam	V. K. Prem- Kumar	7.iii.1973- 8.vi.1973	Marine collec- tions
23.	Mayurbhanj, Dhenkanal, Keonjhar	S. K. Gupta	15.iii.1973- 16.iv.1973	Insects and mites
24.	Sundargarh, Sambalpur, Bolangir	T. K. Sen	20.iii.1973- 4.v.1973	General faunistic survey w.s.r. to hill-stream fishes
25.	—Do—	P. K. Das	9.vii.1973- 10.viii.1973	General faunistic survey w.s.r. to birds
26.	Ganjam, Puri Cuttack	A. K. Mandal	11.vii.1973- 9.viii.1973	Parasitic and free-living Pro- tozoa
27.	Puri	S. M. Ali	5.vii.1973- 21.vii.1973	Wildlife studies
28.	Sundargarh, Sambalpur, Bolangir	J. K. Sen	12.x.1973- 12.xi.1973	General faunistic survey
29.	Koraput, Kalahandi, Phulabani	D. P. Sanyal	20.xi.1973- 24.xii.1973	General faunistic survey w.s.r. to Amphibia and Reptilia
30.	Ganjam, Puri	M. Hafeezullah	20.xi.1973- 28.xii.1973	Helminths
31.	Puri, Cuttack	R. L. Choudhury	28.xii.1973- 22.i.1974	General faunistic survey also mate- rial for Indian Museum Galleries

TABLE 1. (Continued)

1	2	3	4	5
— 1974 —				
32.	Cuttack, Puri, Dhenkanal	S. Biswas	14.i.1974- 14.ii.1974	General faunistic survey w.s.r. to endangered repti- les
33.	Puri, Cuttack	V. C. Agarwal	16.i.1974- 17.ii.1974	Mammals, birds, insects
34.	Gunjam, Sunder- garh, Mayurbhanj	C. B. Srivastava	21.ii.1974- 31.iii.1974	Helminths
35.	Ganjam, Puri, Cuttack	R. K. Kacker	11.iii.1974- 30.iii.1974	Insects, molluscs, fishes
36.	Phulabani (Baudhkhond- mal), Koraput	A. K. Mandal	25.vi.1974- 20.vii.1974	Blood parasitic Protozoa
37.	Koraput, Kalah- andi, Phulbani	T. K. Sen	7.xi.1974- 8.xii.1974	General faunistic survey w.s.r. to hill-stream fishes
38.	Cuttack, Koraput	B. C. Saha	28.xi.1974- 14.xii.1974	General faunistic survey w.s.r. to birds
39.	Sambalpur, Bolangir, Phulabani, Cuttack, Puri, Baleshwar	S. Biswas	6.i.1975- 9.ii.1975	General faunistic survey w.s.r. to rare and endan- gered reptiles
40.	Puri, Ganjam (coastal areas)	G. Ramakrishna	6.ii.1975- 4.iii.1975	General faunistic survey, also eco- nomically impor- tant crustaceans and molluscs
— 1975 —				
41.	Mayurbhanj, Dhenkanal	R. L. Choudhury	10.ii.1975- 5.iii.1975	General faunistic survey, also speci- mens for Indian Museum Galleries
42.	Mayurbhanj, Keonjhar, Dhenkanal	D. P. Sanyal	9.xii.1975- 7.i.1976	General faunistic survey w.s.r. to Amphibia and Reptilia

TABLE 1. (Continued)

1	2	3	4	5
43.	Cuttack, Puri, Baleshwar (coastal areas)	S. Biswas	15.xii.1975- 24.i.1976	General faunistic survey w.s.r. to endangered and rare reptiles
		— 1976 —		
44.	Ganjam	R. L. Chowdhury	10.ii.1976- 8.iii.1976	General faunistic survey also mate- rial for Indian Museum Gallerie Birds, mammals
45.	Puri, Sambalpur	N. Majumder	7.iii.1976- 9.iv.1976	
46.	Cuttack, Baleshwar, Mayurbhanj	P. K. Das	19.iii.1976- 18.iv.1976	Birds, mammals
		— 1977 —		
47.	Baleshwar, Cuttack, Puri	G. C. Rao	10.i.1977- 5.ii.1977	Interstitial fauna
48.	Koraput	N. Majumder	15.ii.1977- 25.iii.1977	Birds
49.	Puri	N. V. Subba Rao	28.xi.1977- 8.xii.1977	Mollusca
		— 1978 —		
50.	Puri	A. K. Podder	2.i.1978 12.i.1978	Birds
51.	—Do—	D. K. Thakur	3.xi.1978- 15.xi.1978	Mollusca
52.	Baleshwar, Puri, Ganjam	K. C. Jayaramakri- shnan	2.ii.1979- 15.iv.1979	Fishes
		— 1980 —		
53.	Bolangir, Sambalpur	D. K. Thakur	1.ii.1980- 12.ii.1980	Mollusca
		— 1983 —		
54.	Mayurbhanj, Keonjhar, Sundargarh, Sambalpur, Dhenkanal	S. Parui	3.viii.1983- 29.viii.1983	General insects
55.	Cuttack (Nandan- Kanan)	S. Biswas	3.xi.1983- 7.xi.1983	Reptiles

TABLE 2. List of collecting stations (arranged district-wise)
with latitude and longitude

Sr. No.	Collecting Station	Approx. latitude N	Approx. longitude E
1	2	3	4
District 1. Baleshwar (Balasore)			
1.	Bagda (8 km N of Balaramgudi)	21°25'	87°00'
2.	Balaramgudi (Off Chandipur)	21°27'	87°02'
3.	Baleshwar (Balasore)	21°25'	86°55'
4.	Baliapal	21°35'	87°15'
5.	Bhadrakh	21°00'	86°30'
6.	Chandbali (55 km from Bhadrak rly. stn.)	20°45'	86°45'
7.	Chandipur	21°27'	87°02'
8.	Dangamal	—	—
9.	Gohaligaon (2 km E of Chandbali)	20°45'	86°45'
10.	Jalcha	—	—
11.	Koso Fall (15 km N of Balaramgudi)	—	—
12.	Mirzapur village nr Chandipur	—	—
13.	Naltapatia	—	—
14.	Nilgiri	21°25'	86°45'
15.	Satbhaya	20°35'	86°55'
District 2. Mayurbhanj			
1.	Amarda Road (45 km SE of Baripada)	21°90'	87°05'
2.	Asana (18 km SW of Bisoi)	22°05'	86°30'
3.	Astia (5 km W of Baripada)	—	—
4.	Bahadurpur, Bangriposi	—	—
5.	Bangriposi (16 km NE of Bisoi)	22°05'	86°20'
6.	Baripada	21°55'	86°40'
7.	Basantapur, Baripada	21°55'	86°40'
8.	Bhalhupahari, Bangriposi	22°05'	86°30'
9.	Bisoi (44 km NE of Jashipur)	22°05'	86°20'
10.	Bokua (Simlipal)	21°55'	86°20'
11.	Budhusai village (3 km W of Jashipur)	21°55'	86°00'
12.	Chahala (Simlipal)	21°55'	86°20'
13.	River Khari and River Bhandan confluence (2 km SE of Jashipur)	21°55'	86°00'
14.	Deopta (7 km E of Bisoi)	22°05'	86°25'
15.	Gurguria (Simlipal Nat. Park)	21°55'	86°20'

TABLE 2. (*Continued*)

1	2	3	4
16.	Jaxapara, Baripada	21°55'	86°40'
17.	Jashipur	21°55'	86°00'
18.	Jenabill Forest (65 km SW of Baripada)	—	—
19.	Joginderpur village (5 km E of Lulung)	21°55'	86°30'
20.	Kalipahar, Lulung	21°55'	86°30'
21.	Kaptipada	21°30'	86°30'
22.	Kendramuri, Bangriposi	22°05'	86°30'
23.	Lulung	21°55'	86°30'
24.	Manbhunj, Bangriposi	22°05'	86°30'
25.	Meghasoni Forest (40 km W of Baripada)	—	—
26.	Moubhander (4 km S of Bisoi)	22°05'	86°20'
27.	Palbani (2 km E of Baripada)	21°55'	86°40'
28.	Sripatganj ($\frac{1}{3}$ km from Baripada)	21°55'	86°40'
29.	Simlipal Nat. Park	21°55'	86°20'
30.	Talbandh (Simlipal)	—	—
31.	Vijay Ramchandrapur village	—	—

District 3. **Keonjhar**

1.	Anandapur	21°40'	86°45'
2.	Atei Res. Forest (Ghatgaon)	21°20'	86°50'
3.	Baigunpal Forest (Ghatgaon)	21°20'	85°50'
4.	Bankapatuli (Keonjhargarh)	21°35'	86°35'
5.	Barabank	—	—
6.	Barahal	21°35'	85°35'
7.	Barpachii (Keonjhargarh)	21°35'	85°35'
8.	Baripada (S of Anandapur)	22°00'	85°20'
9.	Bharbhaderpur (Bhoroharia)	22°15'	85°55'
10.	Bhatsai	—	—
11.	Champua	22°00'	85°40'
12.	Dhenkikote (30 km SE of Keonjhar)	21°25'	85°50'
13.	Ghatgaon (45 km SE of Keonjhar)	21°20'	85°50'
14.	Gohara Agr. Farm (7 km N of Anandapur)	21°43'	86°45'
15.	Gopalpur	21°15'	86°50'
16.	Jaganathpur (Keonjhargarh)	21°35'	85°35'
17.	Lalinjhor	—	—
18.	Kenduapara village nr. Ghatgaon	—	—
19.	Keonjhargarh	21°35'	86°35'

TABLE 2. (Continued)

1	2	3	4
20.	Kushnpur village (3km NW of Ghatgaon)	21°20'	85°50'
21.	Lipardia village (Atei Res. Forest)	—	—
22.	Nandora	—	—
23.	Padampur (Keonjhar)	21°35'	85°35'
24.	Patna village (4 km W of Ghatgaon)	21°20'	85°50'
25.	Silwan (Keonjhar)	21°35'	85°35'
26.	Soras (Keonjhar)	21°35'	85°35'
27.	Tangerpada	—	—
28.	Tarini Pithi nr. Ghatgaon	21°23'	85°50'
29.	Upardhuj village (2 km E of Ghatgaon)	—	—

District 4. Sundargarh

1.	Baliguri	21°10'	85°30'
2.	Balugate (On the bank of Brahmani River, Panposh)	21°25'	84°55'
3.	Banki	22°40'	85°00'
4.	Barsuan (83 km SW of Rourkela Rly. Stn.)	—	—
5.	Bartangra village (7 km from Bonaigarh)	—	—
6.	Bedvyas (at confluence of three rivers Sankh, Koel and Brahmani)	—	—
7.	Bhawani Hill Forest, Koira	21°50'	85°10'
8.	Bicipalli village (nr Bonaigarh)	—	—
9.	Birtal village (25 km from Banki)	—	—
10.	Bishalvari Res. Forest, Sundargarh	—	—
11.	Bisra	22°45'	85°00'
12.	Bonaigarh	—	—
13.	Brahmani River (nr Banki, Panposh and Bonaigarh)	—	—
14.	Brundamal	21°45'	84°00'
15.	Champajhuran (Rourkela)	—	—
16.	Chhner village (nr Panposh)	—	—
17.	Farsotoda (nr Rourkela)	—	—
18.	Gamlai village (3 km from Bonaigarh)	21°45'	84°55'
19.	Kalunga (6 km W of Panposh)	22°10'	84°45'
20.	Koira village (60 km from Bonaigarh)	21°50'	85°10'
21.	Kapana village (5½ km from Bonaigarh)	21°45'	84°45'

TABLE 2. (Continued)

1	2	3	4
22.	Kindrikela (6 km NW of Bonaigarh)	21°45'	84°55'
23.	Kurodhi River Bank (4 km from Barsuan)	—	—
24.	Mahantipara village (1½ km from Sundargarh)	22°05'	84°00'
25.	Nalai village (4½ km from Bonaigaon)	21°45'	84°55'
26.	Nanipara village (40 km from Banki on River Brahmani)	—	—
27.	Naram village (3 km from Bonaigarh)	21°45'	84°55'
28.	Panposh (7 km SW of Rourkela)	22°10'	84°50'
29.	Raikela village (3 km from Barsuan)	—	—
30.	Rourkela	22°25'	85°00'
31.	Satkuta village (6 km from Bonaigarh)	21°25'	84°55'
32.	Senramalai (11 km from Bisra)	—	—
33.	Singardeo Pahar (Bonaigarh)	21°45'	84°55'
34.	Subulia Khasra Forest, Sundargarh	22°50'	84°05'
35.	Sundargarh	22°05'	84°00'
36.	Talpatia village (19 km from Sundargarh)	—	—
37.	Talta Hill (Bonaigarh)	21°45'	84°55'
38.	Tumkela village (40 km from Banki on river Brahmani)	—	—
39.	Turamura village (3½ km from Bonaigarh)	21°45'	84°55'
40.	Uditnagar (Panposh)	21°25'	84°55'
District 5. Cuttack			
1.	Athgarh	20°30'	85°35'
2.	Babadia, nr Paradip	20°15'	86°35'
3.	Balia (4 km S of Kujang)	—	—
4.	Banpada (nr Konarak)	19°50'	86°05'
5.	Bhagwanpur (1½ km E of Nandan Kanan)	20°10'	85°45'
6.	Bhitor Konika	—	—
7.	Bhutmandi (10 km E of Kujang)	—	—
8.	Borai village on bank of Mahanadi	—	—
9.	Chautigunj	—	—
10.	Cuttack	20°25'	85°50'
11.	False Point	20°18'	86°43'
12.	Haldia (30 km E of Kujang)	—	—

TABLE 2. (*Continued*)

1	2	3	4
13.	Hukitola	20°20'	86°45'
14.	Khira Gachha Madeli (23 km E of Kujang)	—	—
15.	Kujang (101 km SE of Cuttack)	—	—
16.	Kushban (3 km W of Nandan Kanan)	20°10'	85°45'
17.	Lion's Rump (6 km NE of Khira—Gachha Madeli)	—	—
18.	Mahanadi Estuary (nr Paradip)	—	—
19.	Nandan Kanan (Cuttack)	20°19'	85°45'
20.	Naraj (Mahanadi Delta)	20°25'	85°45'
21.	Patamundai	20°30'	86°30'
22.	Paradip	20°15'	86°35'
23.	Raghunathpur (3 km S of Nandan Kanan)	20°10'	85°45'
24.	Rahangur village nr Athgarh	20°30'	85°35'
25.	Ranibania Res. For. (20km E of Athgarh)	—	—
26.	Subasi State Forest (nr Khuntuni, 15 km from Athgarh)	—	—
27.	Taladanda canal, Kujang	—	—
28.	Talichua	—	—
District 6. Dhenkanal			
1.	Angul	20°50'	85°00'
2.	Baisamudra Hill Stream (nr Purnakot)	20°35'	86°50'
3.	Dhenkanal	20°35'	85°35'
4.	Kuru Res. Forest (Purnakot)	—	—
5.	Labangi Forest (45 km SE of Angul)	—	—
6.	Lingarajori, Angul	20°50'	85°00'
7.	Majhipara Res. Forest (Purnakot)	—	—
8.	Purnagarh, Angul	20°50'	85°00'
9.	Purnakot (48 km SW of Angul)	20°35'	86°50'
10.	Thanpara, Angul	20°50'	85°00'
11.	Tikarpara	20°54'	84°10'
12.	Shankarpur, Dhenkanal	20°35'	85°35'
13.	Tulka Forest (45 km from Angul)	20°50'	85°00'
District 7. Sambalpur			
1.	Badrama (37 km E of Sambalpur)	20°15'	86°00'
2.	Balarai village (9 km from Barkot)	—	—

TABLE 2. (Continued)

1	2	3	4
3.	Ballimala Dam (Chitrakonda)	—	—
4.	Barkot	21°30'	85°00'
5.	Barundamal	—	—
6.	Binakhand village (nr Sambalpur)	21°25'	86°35'
7.	Bhutel	21°25'	84°25'
8.	Bonilai (Hirakud Dam)	—	—
9.	Brahmani River (nr Barkot)	21°30'	85°00'
10.	Brook's Hill, Sambalpur	21°25'	85°35'
11.	Burapara village nr Jharsuguda	—	—
12.	Burket	—	—
13.	Charbati village	20°40'	88°45'
14.	Dhuttra village (9 km E of Jharsuguda)	—	—
15.	Deogarh (100 km W of Rourkela)	21°30'	84°40'
16.	Dhanupali nr Sambalpur	21°25'	85°35'
17.	Dhutrapara village	—	—
18.	Guira Nallah (10 km from Deogarh)	—	—
19.	Gogoa village (24 km from Barkot)	—	—
20.	Haldinallah vicinity nr Sambalpur	21°25'	85°55'
21.	Hirakud Dam	21°25'	85°55'
22.	Jeera River (Bargarh, 47 km from Sambalpur)	21°20'	83°35'
23.	Jharsuguda	—	—
24.	Kansar	—	—
25.	Kantabali village (40 km from Barkot)	—	—
26.	Khasra Forest, Rairakhol	21°05'	84°15'
27.	Khinda (9 km from Hirakud)	—	—
28.	Kontabali village (40 km from Barkot)	—	—
29.	Kuchinda village (48 km from Barkot)	21°40'	84°20'
30.	Kudukut waterfall (4 km W of Deogarh)	21°30'	84°40'
31.	Kumarpara village	—	—
32.	Mahanadi River Bank (nr Hirakud River Dam)	21°25'	85°55'
33.	Mordung village (7 km from Barkot)	—	—
34.	Palahara	—	—
35.	Pradhanpat For. Res. (6 km N of Deogarh)	21°30'	84°40'
36.	Pradhanpat Water Fall (Deogarh)	21°30'	84°40'
37.	Rairakhol	21°05'	84°15'

TABLE 2. (Continued)

1	2	3	4
38.	Rangoli village (45 km from Barkot)	—	—
39.	Sambalpur	21°25'	85°35'
40.	Satighat Nallah (Deogarh)	21°30'	84°40'
41.	Sonapali	—	—
42.	Sundamundi village	—	—
43.	Tulsa village (8 km N of Deogarh)	—	—
44.	Ushakothi Game Sanctuary (Badrama Forest Range)	21°15'	86°00'

District 8. Puri

1.	Anterkyari village nr Balugaon	—	—
2.	Balighai (nr Puri)	19°50'	85°55'
3.	Balugaon	19°40'	85°10'
4.	Balukhand (nr Puri)	19°45'	85°15'
5.	Balypatpur (Baliapatpur)	—	—
6.	Banpada nr Konarak	—	—
7.	Banpur (Balugaon)	19°50'	85°10'
8.	Barkuda Island (Off Rambha)	19°45'	85°20'
9.	Barkul village (4 km S of Balugaon)	19°40'	85°10'
10.	Berbera (35 km NW of Balugaon)	—	—
11.	Bhatpara (10 km S of Berbera)	—	—
12.	Bhisari (nr Balugaon)	—	—
13.	Bhubaneswar	20°15'	85°50'
14.	Bhusandpur (P. O. Singhipur, 38 km N of Balugaon)	19°55'	85°25'
15.	Borokondi (60 km N of Balugaon)	—	—
16.	Champagarh (35 km S of Berbera)	—	—
17.	Chandrabhaga Sea Beach (4 km E of Konarak)	19°50'	86°05'
18.	Chandraput village (Balugaon)	19°40'	85°10'
19.	Chilka village (7 km SE of Balugaon)	—	—
20.	Chilka Lake	19°45'	85°20'
21.	Dhuvanlo village (nr Balugaon)	—	—
22.	Gondalba village	—	—
23.	Gonia	21°00'	84°00'
24.	Kalijai Isl. (16 km E of Balugaon)	19°45'	85°20'
25.	Kalipura Ghat (30 km SE of Balugaon)	—	—

TABLE 2. (*Continued*)

1	2	3	4
26.	Kaliyugeshwar Isl. (5 km from Balugaon)	19°40'	85°10'
27.	Khurda	20°10'	85°35'
28.	Jatia Isl. (Chilka Lake, off Balugaon)	19°45'	85°20'
29.	Konarak	19°50'	86°05'
30.	Nayagarh	20°05'	85°00'
31.	Nimapara	20°04'	85°58'
32.	Nimikhet village (nr Balugaon)	—	—
33.	Pancota village (nr Puri)	—	—
34.	Pipli	20°05'	85°50'
35.	Pratap (31 km from Berbera)	—	—
36.	Puri	19°45'	85°50'
37.	Ramachandi Creek (4 km from Konarak)	19°50'	85°05'
38.	Singhipur	—	—
39.	Sonasaipur (40 km E of Berbera)	—	—
40.	Tikarpara (nr Balighat Check-Post)	20°05'	86°20'
41.	Udaigiri (8 km NW of Bhubaneswar)	—	—

District 9. **Phulabani (Baudhkhondmal)**

1.	Baliguda	20°07'	83°05'
2.	Baikul Hill (Phulabani)	20°25'	84°10'
3.	Baudhgarh (Baudh 75 km N of Phulabani)	—	—
4.	Biraguda (5 km W of Balliguda)	20°07'	83°05'
5.	Boudapimpli River (Hill Stream) (10 km from Kotagarh)	20°05'	85°10'
6.	Chuvalduva River (3 km E of Kotagarh)	20°10'	84°30'
7.	Damodai Stream (4 km W of Baliguda)	20°07'	83°05'
8.	Gomadi River	20°07'	83°58'
9.	Kalinga (50 km SE of Phulabani on Berhampur Road)	20°05'	84°20'
10.	Kotagarh (58 km S of Baliguda)	20°10'	84°30'
11.	Parasar River (Hill stream, 4 km from Kotagarh)	20°10'	84°30'
12.	Phulabani	20°25'	84°10'
13.	Rubharamunda, Baliguda (4 km S of Baliguda)	20°07'	83°05'
14.	Saluk River (Hill stream, 2 km NW of Phulabani)	20°25'	84°10'
15.	Sampauch	—	—

TABLE 2. (Continued)

1	2	3	4
16.	Sartaguda (6 km NW of Phulabani)	20°25'	84°10'
17.	Tikarpara Ghai (Mahanadi River Tributary, 35 km from Phulabani)	20°35'	84°10'
District 10. Bolangir			
1.	Baiganjhuri (4 km from Sonepur)	20°55'	84°00'
2.	Bolangir	20°40'	83°25'
3.	Bolangir State Fisheries Farm Tank (37 miles from Bolangir)	20°55'	84°00'
4.	Brunmandal	—	—
5.	Burapara village (nr Jharsuguda)	23°00'	82°53'
6.	Chhatamakhna village (19 km E of Bolangir)	—	—
7.	Chimnavati village (3 Km NE of Bolangir)	—	—
8.	Dhunakhamund village (Harishankar)	—	—
9.	Dhutra village	—	—
10.	Gaundrial village	—	—
11.	Harishankar (About 40 km N of railway station)	20°50'	82°50'
12.	Harishankar Road	20°35'	82°45'
13.	Hathisalpara	—	—
14.	Hatpara village (nr Titlagarh rly. stn.)	20°15'	83°05'
15.	Kadampara village	—	—
16.	Kansaripara village (Bolangir)	—	—
17.	Lathor (Harishankar)	20°35'	82°45'
18.	Mahakhand village Forest (120 km SW of Bolangir city)	20°25'	82°50'
19.	Nawapara	20°45'	82°30'
20.	Patnagarh	20°40'	83°05'
21.	Salapali	—	—
22.	Sargigura village (1½ km NE of Titlagarh)	20°15'	85°05'
23.	Sonepur	20°55'	84°00'
24.	Tal River (a tributary of Mahanadi)		
25.	Teshil village (2 km E of Titlagarh)	20°15'	85°05'
26.	Titlagarh	20°15'	83°05'

TABLE 2. (Continued)

1	2	3	4
District 11. Ganjam			
1. Berhampur	19°15'	84°45'	
2. Chandragiri	20°05'	84°40'	
3. Gopalpur	19°15'	84°55'	
4. Khajuripada (74 km from Taptapani)	—	—	
5. Mohana (50 km N of Khajuripada)	19°50'	84°15'	
6. Nowrangpur	—	—	
7. Perlekimundi	18°47'	84°08'	
8. Rambha	19°30'	85°00'	
9. Son-Arjipally (50 km S of Gopalpur)	—	—	
10. Taptapani (54 km W of Berhampur)	19°25'	84°20'	
11. Tara Singi	19°00'	84°00'	
District 12. Kalahandi			
1. Asha Sagar (Reservoir, 1 km W of Bhawanipatna)	19°50'	83°10'	
2. Bhawanipatna	19°50'	83°10'	
3. Boston Sagar (5 km from Bhawanipatna)	—	—	
4. Gotuma (5 km S of Khariar)	20°50'	82°30'	
5. Harihar Sagar (Behind Madanpur-Rampur Irrigation Dept. Rest House)	22°20'	82°55'	
6. Jaipatna (78 km SW of Bhawanipatna)	20°10'	86°20'	
7. Jonk River (2 km N of Khariar Road)	20°50'	82°30'	
8. Jurakhman (ca 12 km E of Madanpur-Rampur)	22°20'	82°55'	
9. Katabanji (5 km N of Bhawanipatna)	19°51'	83°10'	
10. Kesinga	—	—	
11. Khariar Road	20°50'	82°30'	
12. Komna (50 km S of Khariar)	20°30'	82°40'	
13. Kundamal (36 km S of Bhawanipatna)	—	—	
14. Madanpur-Rampur (Two townships 56 km E of Bhawanipatna and 15 km apart)	22°20'	82°55'	
15. Mundrapalli (2 km W of Khariar Road)	20°50'	82°30'	
16. Nakjhari (18 km SE of Madanpur-Rampur)	20°20'	82°55'	
17. Nawapara (11 km S of Khariar)	20°45'	83°30'	
18. Piplinalah (nr Bhawanipatna)	19°51'	83°10'	
19. Pustam Sagar (5 km from Bhawanipatna)	19°51'	82°10'	
20. Raja Khariar	—	—	

TABLE 2. (Concluded)

1	2	3	4
21.	Ram Sagar (7 km from Bhawanipatna)	19°51'	83°10'
22.	Sanyasi Kundamal (36 km S of Bhawanipatna on Jeypur Road)	—	—
23.	Sundari River (nr Komna village)	20°30'	82°40'
24.	Tangradongarh Hill (Katanbanji)	19°51'	83°10'
25.	Tel River (2 km W of Kesinga)	—	—
26.	Uttai Hill Stream (3 km from Madanpur-Rampur)	22°20'	82°55'
District 13. Koraput			
1.	Ambodala (50 Km E of Bhawnipatna)	29°45'	83°25'
2.	Bacheli—Vizianagram rly. track (4 km S of Chandili)	20°40'	82°45'
3.	Badchindri (2 km NE of Koraput)	18°45'	82°40'
4.	Bagra (Bakra) water falls (13 km SE of Jeypore and 1 km S of village Bagra)	18°50'	82°30'
5.	Baliguda village	—	—
6.	Balimala Dam	19°50'	82°30'
7.	Banglabada (2 km N of Jeypore)	18°50'	82°30'
8.	Chandili (64 km W of Jeypore on Jeypore-Jagdulpur Road)	20°40'	82°45'
9.	Chitrakonda (Balimala Dam)	19°00'	82°30'
10.	Devighat (bet. Jaypore and Koraput)	—	—
11.	Dimla (4 km S of Jeypore)	18°50'	82°30'
12.	Comadi River Bank, Baliguda	—	—
13.	Indravati River (2 km S of Nowrangapur, an important tributary of Godavri)	19°10'	82°30'
14.	Jagannath Sagar (Jeypore)	18°50'	82°30'
15.	Jeypore (22 km NNW of Koraput)	18°50'	82°30'
16.	Koraput	18°45'	81°50'
17.	Malakanagiri (105 km SW of Jeypore on Kalimela Road)	18°20'	81°50'
18.	Nowrangapur (42 km N of Jeypore)	19°10'	82°30'
19.	Patragadda Stream (3 km NE of Jeypore)	18°50'	82°30'
20.	Pirinji village (5 km NW of Chandili)	20°40'	82°45'
21.	Pottangi (45 km SE of Koraput on National Highway 43)	18°30'	82°55'
22.	Semiliguda (22 km SE of Koraput on National Highway 43)	18°40'	82°50'
23.	Teliguda (5 km N of Jeypore)	18°50'	82°30'

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BIBLIOGRAPHY

Information on the state of Orissa has been collected from the following reports, books and references :—

COLLECTORS. *Reports on Faunistic surveys of Orissa.*

MANI, M. S. (Ed.) 1974. *Ecology and Biogeography in India*. xix+773 pp. The Hague (Dr. W. Junk b. v., Publ.)

PADHI, B. (Ed.) 1977. *Souvenier 64th Session Indian Sci. Congr.* (Jan. 3-7, 1977, Bhubaneswar, Orissa). vii+132 pp. Bhubaneswar (Utkal Univ.)

SINHA, B. N. 1981. *Geography of Orissa*. iv+200 pp. Delhi (Director, National Book Trust, India).

Zool. Surv. India, Fauna of Orissa : State Fauna Series 1 : 1-23, 1987

PROTOZOA (FREELIVING)

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INTRODUCTION

Taxonomic work on the freeliving protozoa of Orissa is practically negligible. In several of the following publications there are casual mentions on the occurrence of this group from the state without giving any specific or generic names. While dealing with the coelenterate fauna of the Chilka Lagoon, Annandale (1915) mentioned the presence of 'numerous fixed and free protozoa' on submerged timber in the lagoon along with a coelenterate species, *Bimeria fluminalis*. Annandale and Kemp (1915) noticed several 'unicellular forms' in considerable quantities in the plankton at some seasons 'notably species of Dinoflagellates' in the Chilka. In the same lagoon, Chilton (1921) observed some drifting weed, *Potamogeton pectinatus* which was covered with 'vorticellid protozoa'. Of course, Chaudhuri (1929) recorded one species of freeliving ciliates, namely, *Colpoda cucullus* from the soil of Orissa. Further, in the course of dealing with the intertidal or littoral fauna of Orissa coast Nagabhushanam and Rao (1969) enlisted 25 species of protozoa (11 species of foraminifera and 14 species of ciliates) from the coast along with other groups of coastal fauna.

The present communication deals with 48 species of freeliving Protozoa comprising 46 species of ciliates and one species each of flagellates and rhizopods, which have been collected from Orissa by different parties of the Zoological Survey of India during the years 1969-1973. A complete list of freeliving Protozoa hitherto known from this state including the present records (69 species) and key to the identification of their families and genera have been incorporated in the paper. In the systematic account synonymies have been deliberately omitted to avoid repetition as most of these are readily available in the works of Bhatia (1936), Mahajan (1969, 1971, 1977), Mahajan and Nair (1971) and Nair, Das and Mukherjee (1971).

LIST OF FREELIVING PROTOZOA HITHERTO
RECORDED FROM ORISSA

The classification is based on Levine *et al.* (1980).

* Recorded by Nagabhusanam and Rao, 1969

** Recorded by Nagabhushnam and Rao, 1969 and also present in the
National Zoological Collections, Zoological Survey of India.

A. Flagellates

Class I. **Phytomastigophorea**

Order (i) DINOFLAGELLIDA

Family 1. GYMNODINIIDAE

* 1. *Gymnodinium splendens* Lebour

* 2. *Amphidinium pellucidum* Herdman

Order (ii) EUGLENIDA

Family 2. ANISONEMIDAE

3. *Peranema trichophorum* (Ehrenberg)

B. Rhizopods

Class II. **Lobosea**

Order (iii) ARCELLINIDA

Family 3. ARCELLIDAE

4. *Arcella vulgaris* Ehrenberg

Class III. **Granuloreticulosea**

Order (iv) FORAMINIFERIDA

Family 4. MILIOLIDAE

* 5. *Triloculina* sp.

* 6. *Quinqueloculina* sp.

Family 5. NONIONIDAE

* 7. *Elphidium* sp.

Family 6. ROTALIIDAE

* 8. *Epistomina elegans* d'Orbigny

* 9. *Rotalia pulchella* d'Orbigny

*10. *Rotalia* sp.

*11. *Discorbis vesicularis* Lamarck

*12. *Discorbis* sp.

Family 7. TROCHAMMINIDAE

- *13. *Trochammina inflata* Montague

C. Ciliates

Class IV. Kinetofragminophorea

Order (v) PROSTOMATIDA

Family 8. PRORODONTIDAE

14. *Prorodon marinus* Claparede & Lachmann
 *15. *Prorodon morgani* Kahl
 16. *Urotricha globosa* Schewiakoff

Family 9. COLEPIDAE

- *17. *Coleps* sp.

Family 10. ENCHELYIDAE

18. *Lacrymaria elegans* Engelmann
 **19. *Lacrymaria olor* (Muller)
 20. *Lacrymaria salinarum* Kahl
 21. *Trachelophyllum clavatum* Stokes

Family 11. SPATHIDIIDAE

22. *Spathidium fossicola* Kahl

Order (vi) PLEUROSTOMATIDA

Family 12. AMPHILEPTIDAE

23. *Loxophyllum grande* (Entz)
 24. *Loxophyllum setigerum* Quennerstedt
 25. *Loxophyllum uninucleatum* Kahl

Order (viii) KARYORELICTIDA

Family 13. TRACHELOCERCIDAE

26. *Trachelocerca phoenicopterus* Cohn
 *27. *Trachelocerca* sp.

Family 14. LOXODIDAE

- *28. *Remanella* sp.

Family 15. Geleiidae

- *29. *Geleia decolor* Kahl
 30. *Geleia nigriceps* Kahl

Order (viii) TRICHOSTOMATIDA

Family 16 PLAGIOPYLIDAE

- 31. *Plagiopyla nasuta* Stein
- 32. *Plagiopyla ovata* Kahl

Order (ix) COLPODIDA

Family 17 Colpodidae

- 33. *Colpoda cucullus* Muller

Order (x) NASSULIDA

Family 18. Nassulidae

- 34. *Nassula* sp.

Family 19. LEPTOPHARYNGIDAE

- 35. *Pseudomicrothorax agilis* Mermod

Order (xi) CRYPTOPHORIDA

Family 20. CHILODONELLIDAE

- 36. *Chilodonella cucullulus* (Muller)
- 37. *Chilodonella uncinata* (Ehrenberg)

Family 21. CHLAMYDODONTIDAE

- 38. *Chlamydodon mnemosyne* Ehrenberg

Class V. Oligohymenophorea

Order (xii) HYMENOSTOMATIDA

Family 22. PARAMECIIDAE

- 39. *Paramecium caudatum* Ehrenberg
- 40. *Paramecium calkinsi* Woodruff

Family 23. FRONTONIIDAE

- 41. *Frontonia marina* Fabre-dom

Order (xiii) SCUTICOCILIATIDA

Family 24. URONEMATIDAE

- 42. *Uronema marinum* Dujardin
- 43. *Uronema filificum* Kahl

Family 25. COHNILEMBIDAE

- 44. *Cohnilembus verminus* (Muller)
- 45. *Cohnilembus subulatus* (Kent)

Family 26. LOXOCEPHALIDAE

46. *Loxocephalus plagiatus* (Stokes)

Family 27. PLEURONEMATIDAE

47. *Pleuronema marinum* Dujardin

Family 28 CYCLIDIIDAE

48. *Cyclidium citrullus* Cohn

Class IV. Polyhymenophorea

Order (xiv) HETEROTRICHIDA

Family 29. SPIROSTOMATIDAE

49. *Blepharisma undulans* Stein
50. *Spirostomum teres* Claparede & Lachmann
51. *Gruberia calkinsi* Beltran

Family 30. METOPIDAE

52. *Metopus es* Muller
*53. *Metopus* sp.

Family 31. CONDYLOSTOMATIDAE

- **54. *Condylostoma patens* (Muller)
55. *Condylostoma magnum* Spiegel

Family 32. CAENOMORPHIDAE

56. *Caenomorpha capucina* Kahl

Order (xv) OLIGOTRICHIDA

Family 33. STROMBIDIIDAE

57. *Strombidium calkinsi* Kahl

Family 34. CODONELLIDAE

58. *Tintinnopsis lohmani* Laackmann

Order (xvi) HYPOTRICHIDA

Family 35. HOLOSTICHIDAE

59. *Holosticha manca* Kahl
**60. *Keronopsis rubra* (Ehrenberg)
61. *Uroleptus mobilis* Engelmann

Family 36. KERONIDAE

- *62. *Epiclintes ambiguus* (Muller)

Family 37. ASPIDISCIDAE

- *63. *Aspidisca* sp.

Family 38. EUPLOTIDAE

64. *Euplotes charon* (Muller)
 *65. *Euplotes moebiusi* Kahl
 66. *Euplotes vannus* (Muller)
 67. *Euplotes woodruffi* Gaw
 *68. *Euplotes* sp.
 **69. *Diophrys appendiculata* (Ehrenberg)

KEY TO THE FAMILIES AND GENERA

- 1 (4) Two flagella present
- 2 (3) One flagella directed anteriorly and the other usually posteriorly.
 [Body colourless with variously marked pellicle ; stigma absent]
 Family (1). Anisonemidae
- Body highly plastic ; pellicle shows fine striations ; cytostome
 expansible with a thickened ridge and two oral rods at anterior
 end ; one flagellum free, long and conspicuous, other adhering to
 the pellicle Genus 1. *Peranema*
- 3 (2) One flagella being transverse and the other longitudinal. [Presence
 of characteristic furrows and 1/2-4 turns of annulus]
 Family (2) Gymnodiniidae
- a (b) Epicone large ; annulus usually in the middle or at posterior
 part ; sulcus on hypocone only ... Genus 2. *Gymnodinium*
- b (a) Epicone small ; annulus anteriorly located ; sulcus on hypo-
 cone or also on part of epicone ... Genus 3. *Amphidinium*
- 4 (1) Flagella absent
- 5 (14) Body enveloped by test or shell ; cilia absent
- 6 (7) Test without any foreign body ; form filopod or lobopod
 Family (3). Arcellidae
- Test transparent, chitinous, with hexagonal markings ; aperture
 circular, central ; form slender lobopodia ... Genus 4. *Arcella*

- 7 (6) Test usually with various foreign material ; form anastomosing rhizopod
- 8 (13) Test calcareous
- 9 (10) Wall imperforate. [Chambers typically a half coil in length ; aperture large, toothed] Family (4). Miliolidae
- a (b) Chambers (specially in microspheric forms) added in planes 120° apart ; aperture with a bifid tooth
... ... Genus 5. *Triloculina*
- b (a) Chambers added in planes 144° apart ; aperture with a simple tooth Genus 6. *Quinqueloculina*
- 10 (9) Wall finely or coarsely perforate
- 11 (12) Test planispiral, occasionally trochoid ... Family (5). Nonionidae
Test mostly involute, biradially symmetrical ; chambers numerous with distinct sutures ; aperture one or more ... Genus 7. *Elphidium*
- 12 (11) Test plano-convex or biconvex, trochoid throughout
... ... Family (6). Rotaliidae
- a (b) Test typically plano-convex. [Umbilical region generally open ; aperture at the base of the umbilical margin]
... ... Genus 8. *Discorbis*
- b (a) Test biconvex
- c (d) Umbilical area closed ; aperture single, lying between the periphery and umbilical area ... Genus 9. *Rotalia*
- d (c) Umbilical area filled ; aperture of two sorts
... ... Genus 10. *Epistomina*
- 13 (8) Test silicious with distinctly chitinous base
... ... Family (7). Trochamminidae
Aperture an arched slit at the inner margin of the ventral side of the chamber Genus 11. *Trochammina*
- 14 (5) Body without any shell or test ; cilia present
- 15 (22) Cytostome apical or subapical ; circumoral infraciliature unspecialised
- 16 (19) Somatic toxocysts common and not localised ; cytostome round and oval sometimes in shallow atrium
- 17 (18) Body characteristically barrel-shaped bearing armoured plates in longitudinal rows with small lateral teeth ... Family (8). Colepidae

- Prominent anterior and caudal thorns and a long caudal cilium present Genus 12. *Coleps*
- 18 (17) Body ovoid to cylindrical ; armoured plates absent
 Family (9). Prorodontidae
- a (b) Ciliation uniform and complete without any longer caudal cilia. [Oral basket made up of double trichites which end deep in cytoplasm] Genus 13. *Prorodon*
- b (a) Ciliation uniform except in posterior region which may lack cilia ; one or more longer caudal cilia present. [Cytostome surrounded by ring of heavier cilia]
 Genus 14. *Urotricha*
- 19 (16) Somatic toxocysts localised typically in or near the oral area ; cytostome slit-like
- 20 (21) Cytostome eversible and located at distal end of a long flexible neck Family (10). Enchelyidae
- a (b) Body cylindrical, spindle- or flask-shaped with a long contractile proboscis Genus 15. *Lacrymaria*
- b (a) Body elongate, flattened, flexible, ribbon-like ; without any contractile proboscis. [Anterior end neck like and tip truncate] Genus 16. *Trachelophyllum*
- 21 (20) Cytostome noneversible, located apically on non-ciliated ridge of the body Family (11) Spathidiidae
- Body flask- or sack-shaped, compressed with truncate anterior end
 Genus 17. *Spathidium*
- 22 (15) Cytostome located along edge of laterally compressed body ; ciliation near cytostome showing left-right differentiation
 Family (12). Amphileptidae
- Body flask-shaped ; ventral side with a hyaline border reaching posterior end and bearing trichocysts Genus 18. *Loxophyllum*
- 23 (28) Vestibular cavity absent ; body fragile and highly thigmotactic
- 24 (25) Cytostome apical ; thigmotactic cilia on ventral surface
 Family (13). Trachelocercidae
- Body elongate, more or less extensible with drawn out anterior end ; neck absent Genus 19. *Trachelocerca*
- 25 (24) Cytostome not apical but near the anterior end of the body ; no such thigmotactic cilia present

- 26 (27) Cytostome lateral and located on the concave body surface, slit like ; body laterally compressed, non contractile ; ciliation on the right side only Family (14). Loxodidae
Body lancet-like ; endoskeleton with spindle-shaped needles lying below ciliated surface in 3-5 longitudinal strings connected with fibrils Genus 20. *Remanella*
- 27 (26) Cytostome ventral , near anterior end of the body ; body not laterally compressed but large elongate and highly contractile ; ciliation uniform Family (15). Geleidae
Oral ciliature and infraciliature complex ... Genus 21. *Geleia*
- 28 (23) Cytostome preceeded by vestibulum. [The latter lined with distinctive ciliature] ; thigmotactic cilia absent Family (16). Plagiopylidae
Peristome a broad ventrally open groove ; peristomal cilia short except a zone of longer cilia at anterior end ; a 'stripe band' located on the dorsal surface starting from peristomal groove
... ... Genus 22. *Plagiopyla*
- 29 (30) Cytopharyngeal apparatus not of the cytros type ; body with distorted ciliary rows Family (17). Colpodidae
Body kidney-shaped ; oral funnel in the middle of the flattened ventral side ; peristome giving rise dorsally to a diagonal groove
... ... Genus 23. *Colpoda*
- 30 (29) Cytopharyngeal apparatus typically of the cytros type ; body without any distorted ciliary rows
- 31 (34) Hypostomial frange limited to the left side of the ventral surface ; preoral suture distinct
- 32 (33) Hypostomial frange short but multiple, often extending along preoral structure Family (18). Nassulidae
Oval to elongate ; ventral surface flat, dorsal surface convex ; opening of oral basket deep in a vestibule with a membrane
... ... Genus 24. *Nassula*
- 33 (32) Hypostomial frange reduced to a few short kinetal segments bearing 'pseudomembranelles' ... Family (19). Leptopharyngidae
Body more or less compressed ; body surface marked with a broad longitudinal ridge with cross striations ; furrows canal like ; cytopharynx tubular with elastic rods Genus 25. *Pseudomicrothorax*
- 34 (31) Hypostomial frange not identifiable as such ; preoral suture skewed far to the left

- 35 (36) Thigmotactic zone broad ; body ovoid, width more than two-third the body length ... Family (20). Chilodonellidae
 Body ovoid, dorsoventrally flattened ; ventral surface with ciliary rows ; cytostome round ; oral basket conspicuous
 Genus 26. *Chilodonella*
- 36 (35) Thigmotactic zone localised ; body ellipsoidal, width less than two-third the body length ... Family (21). Chlamydodontidae
 Along lateral margin, a characteristic striped band present ; cytostome oval, covered with a membrane bearing a slit ; oral basket made up of rods with apical process ... Genus 27. *Chlamydodon*
- 37 (48) Oral apparatus comprised of well defined preoral membrane located in a buccal cavity
- 38 (39) Prebuccal area of vestibulum conspicuous leading to buccal cavity ; two peniculi in buccal cavity ; cytostome not expansible
 Family (22). Parameciidae
 Body 'slipper-shaped' ; buccal cavity located equatorially ; peristome long, broad and slightly oblique ; two contractile vacuole without any collecting canal Genus 28. *Paramecium*
- 39 (38) Prebuccal area shallow or absent ; three peniculi in buccal cavity ; cytostome expansible ... Family (23). Frontoniidae
 Body ovoid to ellipsoidal ; oral groove in anterior third of the flat ventral surface ; one or two contractile vacuoles with collecting cannals and an external pore ... Genus 29. *Frontonia*
- 40 (45) Infraciliature or paroral membrane bipartite without any 'C' segment ; scutico-vestige separate and posterior to paroral
- 41 (44) Body not uniformly ciliated ; anterior pole conspicuously naked
- 42 (43) Body sparsely ciliated ; buccal ciliature relatively inconspicuous in long shallow depression. ['Membranelle' number I entirely non-ciliferous] Family (24). Uronematidae
 Body oval to elongate ; peristome inconspicuous ; cytostome with a small tongue like membrane ; a long caudal cilium present
 Genus 30. *Uronema*
- 43 (42) Body thickly ciliated ; buccal ciliature conspicuous. [Clear cut post-oral suture may be present ; prebuccal cavity small, antero-ventral]
 Family (25). Loxocephalidae

- Body ovoid to cylindrical, sometimes compressed ; cytostome crescentric on slightly flattened area near anterior end ; a long caudal cilium present ... Genus 31. *Loxocephalus*
- 44 (41) Body uniformly ciliated without having any naked surface. [A false "double membrane" conspicuous in narrow oral depression]
... ... Family (26). Cohnilembidae
- Body flexible, slender and spindle-shaped ; peristome from anterior to middle of the body or longer ; curved to right ; a caudal cilium or a few longer cilia at the posterior end ... Genus 32. *Cohnilembus*
- 45 (40) Infraciliature of paroral membrane tripartite including 'C' segment as a permanent scutico-vestige
- 46 (47) Paroral membrane prominent, sometimes present as a stiff velum and distinctly curling around the cytostome
... ... Family (27). Pleuronematidae
- Body ovoid to ellipsoid ; peristome begins at anterior end and extends upto two-third of the body length ; a semicircular swelling to the left near oral area ... Genus 33. *Pleuronema*
- 47 (46) Paroral membrane less prominent without forming any velum. [Cytostome variable in position] ... Family (28). Cyclididae
- Small to very small in size ; body ovoid with refractile pellicle and caudal cilium ; no semicircular swelling on the left edge of the oral region ... Genus 34. *Cyclidium*
- 48 (37) Oral apparatus comprised of conspicuous paramembranellae often extending out of buccal cavity on or around anterior end of the body
- 49 (60) Somatic ciliation frequently holotrichous with regular rows of simple cilia
- 50 (55) Somatic ciliation uniform, even dense ; body often contractile
- 51 (54) Anterior part of the body not twisted ; somatic ciliation dense
- 52 (53) Body large often elongated, cylindrical ; buccal ciliature relatively inconspicuous ... Family (29). Spirostomatidae
- a (b) Body pyriform, somewhat narrowed anteriorly ; peristome on the left border and connected with the oral funnel with membrane ... Genus 35. *Blepharisma*
- b (a) Body elongated, cylindrical, peristome not connected with oral funnel

- c (d) Highly contractile ; posterior end of the body usually blunt ; contractile vacuole terminal, large with a long dorsal canal
... .. Genus 36. *Spirostomum*
- d (c) Slightly contractile, posterior end of the body drawn out, contractile vacuole small and posterior ... Genus 37. *Gruberia*
- 53 (52) Body typically large with anterior end truncate and posterior end rounded ; buccal ciliation prominent
... .. Family (30) Condylomatidae
- Peristome V-shaped and wide at anterior end ; peristomal field not ciliated Genus 38. *Condyloma*
- 54 (51) Anterior part of the body uniquely twisted ; somatic ciliation uniform but not dense ... Family (31). Metopidae
- Body oblong or fusiform ; peristome conspicuous, slightly spirally diagonal beginning at the anterior and reaching the middle of the body Genus 39. *Metopus*
- 55 (50) Somatic ciliation almost absent or reduced ; body noncontractile
- 56 (57) Somatic ciliation absent except for caudal tuft and several anteriorly located cirri. [Buccal ciliation extensive encircling the body and spiralling towards posterior] ... Family (32) Caenomorphidae
- Body bell-shaped ; carapaced ectoplasm ; cilia 8 rows ; peristome long, cytostome posterior and cytopharynx anteriorly directed
... .. Genus 40. *Caenomorpha*
- 57 (56) Somatic ciliation greatly reduced. [Buccal paramembranellae conspicuous, often in two sections—one inside the buccal cavity and the other on the body surface encircling the body]
- 58 (59) Body small, rounded without any lorica ; circlet of apical membranellae 'open' Family (33) Strombidiidae
- Body ovoid to spherical ; adoral zone very conspicuous, 2-4 sickle-shaped frontal membranellae and adoral membranellae extend upto cytopharynx Genus 41. *Strombidium*
- 59 (58) Body cylindrical or cone-shaped ; highly contractile, loricate. [Lorica tubular or cup-shaped with or without collar ; wall usually reticulate] Family (34) Codonellidae
- Lorica cup-shaped, always with a broad aperture ; aboral end closed ; wall thin, covered with foreign bodies
... .. Genus 42. *Tintinnopsis*

60 (49) Somatic ciliation heterotrichous, usually represented by rows or localised groups of cirri

61 (66) Frontoventral differentiated

62 (63) Right and left marginal cirri present, with variable number of rows of other ventral cirri. [Transverse and frontal cirri often differentiated ; oral ciliature not extending more than half of the body]

... ... Family (35). Holostichidae

a (d) Three frontals distinct along anterior margin

b (c) Body elliptical ; 2 ventral and 2 marginal rows of cirri present ; anals also present ... Genus 43. *Holosticha*

c (b) Body elongated, drawn out into tail-like portion ; 2-4 rows of ventral cirri ; 2 marginals but no anal

... ... Genus 44. *Uroleptus*

d (a) Frontals not distinct ; body slender, anterior end slightly enlarged ; 2 ventral rows of cirri reaching frontal field ; anals variable ... Genus 45. *Keronopsis*

63 (62) Marginal cirri absent or greatly reduced in number

64 (65) Oral ciliature prominent, usually extending more than half length of the body. [Transverse and frontoventrals highly developed and conspicuous] ... Family (36). Euplotidae

a (b) Peristome broadly triangular ; frontoventrals 9 or more ; 5 anals, 4 scattered caudals ... Genus 46. *Euplotes*

b (a) Peristome relatively large ; often reaching upto anals ; frontoventrals 7-9 ; 5 anals, 3 strong cirri near posterior margin

... ... Genus 47. *Diophrys*

65 (64) Oral ciliature not prominent. [Ventral cirri prominent]

... ... Family (37). Aspidiscidae

Body small, ovoid ; dorsal surface conspicuously ridged ; adoral zone rudimentary ; 7 fronto-ventrals ; 5-12 anals

... ... Genus 48. *Aspidisca*

66 (61) Frontoventral undifferentiated ... Family (38). Keronidae

Body elongate, spoon-shaped ; ventral surface flattened, with 2 rows of cirri ; marginal rows 2 in number Genus 49. *Epiclintes*

SYSTEMATIC ACCOUNT

Class **Phytomastigophorea**Order **EUGLENIDA**Family **ANISONEMIDAE**1. **Peranema trichophorum** (Ehrenberg)

Material examined : 4 exs., Khajuripada (Dist. Ganjam), 17.vii. 1973, coll. A. K. Mandal.

Distribution : India : Orissa (first record), Rajasthan and South India. Elsewhere : cosmopolitan in distribution.

Remarks : Elongate, 50-60 μm in length with a truncate posterior end. It is common in stagnant water.

Class **Lobosea**Order **ARCELLINIDA**Family **ARCELLIDAE**2. **Arcella vulgaris** Ehrenberg

Material examined : 1 ex., Khajuripada (Dist. Ganjam), 17.vii.1973, coll. A. K. Mandal.

Distribution : India : Orissa (first record), West Bengal and Rajasthan. Elsewhere : Cosmopolitan in distribution.

Remarks : This species has been collected from the bottom ooze of a freshwater pond. In similar habitat it is quite common in West Bengal. Test diameter of the present material is 62 μm .

Class **Kinetofragminophorea**Order **PROSTOMATIDA**Family **PRORODONTIDAE**3. **Prorodon marinus** Claparede & Lachmann

Material examined : 1 ex., Chilka Lagoon near Kaluparaghat, 10.vi.1969, coll. K. N. Nair.

Distribution : India : Orissa (first record), also first record from India. Elsewhere : Waterbodies of Atlantic (with plankton).

Remarks : Body ovoid, with both anterior and posterior end rounded ; dimension $72\mu\text{m} \times 28\mu\text{m}$; mouth slit-like, opening into oral basket supported by trichites.

4. *Urotricha globosa* Schewiakoff

Material examined : 20 exs., Chilka Lagoon at Satpara, 12.vi.1969, coll. K. N. Nair.

Distribution : India : Orissa (first record) and Andaman and Nicobar Islands. Elsewhere : New Zealand (in freshwater).

Remarks : Body globular with a longer caudal cilium ; dimensions $24.8-29\ \mu\text{m} \times 12-16.6\ \mu\text{m}$; ciliation uniform excepting posterior region which lacks cilia.

Family ENCHELYIDAE

5. *Lacrymaria elegans* Engelmann

Material examined : 3 exs., Chilka Lagoon at Satpara, 3.i.1971, coll. K. N. Nair.

Distribution : India : Orissa (first record), also first record from India. Elsewhere : Universal in freshwater bodies with vegetation.

Remarks : Body cylindrical, neck contractile with 4-5 annulations ; dimensions $70-82.8\ \mu\text{m} \times 24.8-41.4\ \mu\text{m}$.

The present specimens are considerably smaller than those recorded by Kahl (1930) ($130-200\ \mu\text{m}$ in length).

6. *Lacrymaria olor* (Muller)

Material examined : 1 ex., Chilka Lagoon at Puri, 27.xii.1970, coll. K. N. Nair.

Distribution : India ; Orissa, West Bengal, Rajasthan, Andhra Pradesh and Andaman and Nicobar Islands. Elsewhere : Universal in freshwater bodies with vegetation.

Remarks : Body elongate ; neck very long and highly contractile with well developed oral cone ; dimension $161.5\ \mu\text{m} \times 29\ \mu\text{m}$.

7. *Lacrymaria salinarum* Kahl

Material examined : 1 ex., Chilka Lagoon around Chiriakuha Is., 30.v.1969, coll. K. N. Nair.

Distribution : India : Orissa (first record), also first record from India. Elsewhere : Universal in saltwater.

Remarks : Body slender, spindle-shaped with short and blunt posterior end ; neck short and not appreciably contractile ; dimension $99.4\ \mu\text{m} \times 32.1\ \mu\text{m}$.

8. *Trachelophyllum clavatum* Stokes

Material examined : 4 exs., Chilka Lagoon at Khalikota, 20.ii.1969, coll. K. N. Nair.

Distribution : India : Orissa (first record), also first record from India. Elsewhere : Universal in freshwater bodies.

Remarks : Body flexible, ribbon-like ; dimensions $103.5-135.6 \mu\text{m} \times 16.6-29 \mu\text{m}$; cytopharynx narrow with trichocysts.

Family SPATHIDIIDAE

9. *Spathidium fossicola* Kahl

Material examined : 5 exs., Chilka Lagoon at Khalikota, 2.vi.1969, coll. K. N. Nair.

Distribution : India : Orissa (first record), also first record from India. Elsewhere : Universal in sea water.

Remarks : Body flask-shaped and contractile, anterior end truncated ; cytostome slit-like, located apically ; macronucleus single and horse-shoe shaped ; dimensions $74.5-103.5 \mu\text{m} \times 33.1-41.4 \mu\text{m}$.

Order PLEUROSOTOMATIDA

Family AMPHILEPTIDAE

10. *Loxophyllum grande* (Entz)

Material examined : 1 ex., Chilka Lagoon near Gangadharpur, 18.vi.1969, coll. K. N. Nair.

Distribution : India : Orissa (first record), also first record from India. Elsewhere : Universal in sea water.

Remarks : Body lanceolate, flattened, ventral side with hyaline border bearing trichocysts ; dimension $160.6 \mu\text{m} \times 47.6 \mu\text{m}$; macronuclei 2 in number.

11. *Loxophyllum setigerum* Quennerstedt

Material examined : 2 exs., Chilka Lagoon at Khalikota 19.xii.1970, coll. K. N. Nair.

Distribution : India : Orissa (first record), also first record from India. Elsewhere : Universal in salt and brackish water.

Remarks : General feature as in *L. grande* but body leaf-shaped ; macronuclei 4 in number, contractile vacuole in a row ; dimensions $95.2-155.2 \mu\text{m} \times 45.5-53.8 \mu\text{m}$.

12. Loxophyllum uninucleatum Kahl

Material examined : 1 ex., Chilka Lagoon around Chiriakuha Is., 31.v.1969, coll. K. N. Nair.

Distribution : India : Orissa (first record), also first record from India. Elsewhere : Universal in salt water.

Remarks : General feature as in *L. grande* but considerably small ; dimension $78.6\ \mu\text{m} \times 28.9\ \mu\text{m}$; macronucleus single and round ; contractile vacuole single and terminal.

Order KARYORELICTIDA**Family TRACHELOCERCIDAE****13. Trachelocerca phoenicopterus Cohn**

Material examined : 1 ex., Chilka Lagoon at Barkuda, 29.v.1969, coll. K. N. Nair.

Distribution : India : Orissa (first record), Andhra Pradesh and Andaman and Nicobar Islands. Elsewhere ; Universal in saltwater.

Remarks : Body elongate, extensible, contractile, $350\ \mu\text{m}$ long ; cytopharynx with trichocysts ; contractile vacuoles in a row ; macronuclei 4 in number and arranged radially ; 6 compact micronuclei.

Family GELEIIDAE**14. Geleia nigriceps Kahl**

Material examined : 1 ex., Chilka Lagoon at Satpara, 12.vi.1969, coll. K. N. Nair.

Distribution : India : Orissa (first record), also first record from India. Elsewhere : Universal in saltwater.

Remarks : Body elongate, highly contractile with uniform somatic cilia-ture ; anterior end without any beak and anterior part filled with an aggregation of distinct black granules ; dimension $231.84\ \mu\text{m} \times 37.3\ \mu\text{m}$.

Order TRICHOSTOMATIDA**Family PLAGIOPYLIDAE****15. Plagiopyla nasuta Stein**

Material examined : 4 exs., Chilka Lagoon at Khalikota, 2.vi.1969 & 4.vi.1969, coll. K. N. Nair.

Distribution : India : Orissa (first record), West Bengal. Elsewhere : Universal in brackish water.

Remarks : Body ovoid ; marginal elevation of the peristome (beak) very distinct ; dimensions $62.1-74.5 \mu\text{m} \times 45.5-55.9 \mu\text{m}$.

16. *Plagiopyla ovata* Kahl

Material examined : 5 exs., Chilka Lagoon at Khalikota, 2.vi.1969, coll. K. N. Nair.

Distribution : India : Orissa (first record), first record from India : Elsewhere : Universal in brackish water.

Remarks : Body oval ; marginal elevation of the peristome very feeble and sometimes not visible ; dimensions $55.9-93.1 \mu\text{m} \times 43.5-68.3 \mu\text{m}$.

Order COLPODIDA

Family COLPODIDAE

17. *Colpoda cucullus* Muller

Material examined : 2 exs., Taptapani (Dist. Ganjam), 17.vii.1973, coll. A. K. Mandal.

Distribution : India : Orissa (As above and also from some unknown locality, see Chaudhuri, 1929), Kashmir, Punjab, Uttar Pradesh, Madhya Pradesh, Andhra Pradesh, Tamil Nadu, Karnataka, Maharashtra, West Bengal and Assam. Elsewhere : Universal in soil and freshwater.

Remarks : Body reniform, compressed, oral funnel in the middle of the flattened ventral side ; anterior keel with 8-10 indentations $103.5 \mu\text{m} \times 66.2 \mu\text{m}$.

The species commonly occurs in soil and sometimes in freshwater with decaying vegetation.

Order NASSULIDA

Family NASSULIDAE

18. *Nassula* sp.

Material examined : 5 exs., Chilka Lagoon at Khalikota ; 19.ii.1969, coll. K. N. Nair.

Distribution : Orissa : As above.

Remarks : Body roughly ellipsoidal and uniformly ciliated, cytostome ventral ; hypostomial fringe short but multiple, dimensions $182.1-215.3 \mu\text{m} \times 136.6-180 \mu\text{m}$.

Family LEPTOPHARYNGIDAE

19. *Pseudomicrothorax agilis* Mermod

Material examined : 3 exs., Taptapani (Dist. Ganjam), 17.vii.1973, coll. A. K. Mandal.

Distribution : India : Orissa (first record), West Bengal. Elsewhere : China and U.S.A. (in freshwater).

Remarks : Body ellipsoid, number of ciliary meridian 12 ; dimensions $35.2\text{-}58\text{ }\mu\text{m}\times 20.7\text{-}29\text{ }\mu\text{m}$.

This is a rare species (*see* Nair and Das, 1974), and present specimens are considerably larger than those collected from West Bengal ($25\text{-}31\text{ }\mu\text{m}\times 16\text{-}20\text{ }\mu\text{m}$ in dimensions).

Order CRYPTOPHORIDA

Family CHILODONELLIDAE

20. *Chilodonella cucullulus* (Muller)

Material examined : 2 exs., Chilka Lagoon near Kaluparaghat, 5.i.1971. coll. K. N. Nair.

Distribution : India : Orissa (first record), Kashmir, Rajasthan, Maharashtra and Andhra Pradesh. Elsewhere : Universal in fresh and brackish water.

Remarks : Body dorsoventrally flattened ; oral basket conspicuous ; cytopharynx straight ; 19-20 ventral ciliary rows ; dimension $100\text{-}111.7\text{ }\mu\text{m}\times 50\text{-}66.2\text{ }\mu\text{m}$.

21. *Chilodonella uncinata* (Ehrenberg)

Material examined : 1 ex., Deogarh (Sambalpur), 31.xii.1972, coll. A. K. Mandal.

Distribution : India ; Orissa (first record), Rajasthan. Elsewhere : Universal in freshwater.

Remarks : Body shape as that of *C. cucullulus* but cytopharynx curved and 11 ventral rows present ; dimension $42\text{ }\mu\text{m}\times 28\text{ }\mu\text{m}$.

Family CHLAMYDODONTIDAE

22. *Chlamydodon mnemosyne* Ehrenberg

Material examined : 4 exs., Chilka Lagoon at Khalikota, 19.ii.1969, & 21.ii.1969, coll. K. N. Nair.

Distribution : India : Orissa (first record), also first record from India. Elsewhere : Universal in saltwater.

Remarks : Body reniform ; dimensions $68.3-70.4 \mu\text{m} \times 37.3-47.6 \mu\text{m}$; band of trichites parallel to the body outline ; oral basket with 8-10 rods.

Order HYMENOSTOMATIDA

Family PARAMECIIDAE

23. *Paramecium calkinsi* Woodruff

Material examined : 2 exs., around Ghantashilla and Barkuda, 31.v.1969 & 1.vi.1979, coll. K. N. Nair.

Distribution : India : Orissa (first record), also first record from India. Elsewhere : Universal in fresh and salt water.

Remarks : Body foot shaped with broadly rounded posterior end ; dimensions $111.8-153.2 \mu\text{m} \times 58-78.7 \mu\text{m}$; macronucleus single with 2 vesicular micronuclei.

24. *Paramecium caudatum* Ehrenberg

Material examined : (i) 1 ex., Badrama (Sambalpur), 25.xii.1972, coll. A. K. Mandal ; (ii) 2 exs., Konarak, 25.vii & 27.vii.1973, coll. A. K. Mandal ; (iii) 2 exs., Nandankanan (Cuttack), 2.viii.1973, coll. A. K. Mandal.

Distribution : India : Orissa (first record), Kashmir, Uttar Pradesh, West Bengal and Andhra Pradesh. Elsewhere : Universal in freshwater.

Remarks : Body cigar-shaped ; posterior end bluntly pointed ; dimensions $101.4-211.1 \mu\text{m} \times 33.1-82.8 \mu\text{m}$; macronucleus single with a compact micronucleus.

This species commonly occurs in freshwater throughout India.

Family FRONTONIIDAE

25. *Frontonia marina* Fabre-dom

Material examined : 4 exs., Chilka Lagoon around Barkuda, 30.v.1969, coll. K. N. Nair.

Distribution : Orissa (first record), also first record from India. Elsewhere : Universal in saltwater.

Remarks : Body ellipsoid ; rim as well as cytostome carries 6-8 rows of oral cilia ; usually 2 micronuclei adjacent to single macronucleus ; dimensions $136.7-149 \mu\text{m} \times 64.2-78.7 \mu\text{m}$.

Order SCUTICOCILIATIDA

Family URONEMATIDAE

26. *Uronema filificum* Kahl

Material examined : 4 exs., Chilka Lagoon (1 ex. each around Khalikota, Parikudh, Panaspada and Satpara), 21.xii & 27.xii.1970, 3.i. & 7.i.1971, coll. K. N. Nair.

Distribution : India : Orissa (first record), also first record from India. Elsewhere : Universal in saltwater.

Remarks : Body ovoid ; anterior end with broad plate and posterior half spindle-like ; dimensions $28.9-37.2\ \mu\text{m} \times 14.5-20.7\ \mu\text{m}$; ciliated row about 8 in number.

27. *Uronema marinum* Dujardin

Material examined : 50 exs., Chilka Lagoon at Khalikota, 26.ii.1969 & 23.vi.1969, coll. K. N. Nair.

Distribution : India : Orissa (first record), Karnataka. Elsewhere : Universal in saltwater.

Remarks : Shape slender, ovoid, broad towards posterior part ; dimensions $33.1-39.3\ \mu\text{m} \times 16.5-24.8\ \mu\text{m}$; cytostome on right broad side ; six ciliated rows on each side.

Family COHNILEMBIDAE

28. *Cohnilembus subulatus* (Kent)

Material examined : 2 exs., Chilka Lagoon at Nalbano, 29.xii.1970, coll. K. N. Nair.

Distribution : India : Orissa (first record), Rajasthan. Elsewhere : Universal in saltwater.

Remarks : Body slender, lanceolate, posterior end broad ; dimensions $74.5-81\ \mu\text{m} \times 20-22.8\ \mu\text{m}$; length-breadth ratio 3.6 : 1 ; peristome from anterior end to the middle of the body ; anal cilia not very distinct.

29. *Cohnilembus verminus* (Muller)

Material examined : 6 exs., Chilka Lagoon around Barkul, Nalbano and Satpara, 21.ii.1969, 10.vi.1969 & 12.vi.1969, coll. K. N. Nair.

Distribution : India : Orissa (first record), also first record from India. Elsewhere : Universal in saltwater.

Remarks : Body, more particularly anterior half very slender ; dimensions $45.5-93.1\ \mu\text{m} \times 8.3-12.4\ \mu\text{m}$; length-breadth ratio 6.4 : 1 ; peristome as in *C. subulatus* ; anal bristle fine and long.

Family LOXOCEPHALIDAE

30. *Loxocephalus plagiatus* (Stokes)

Material examined : 5 exs., Nandankanan (Cuttack), 1.viii & 6.viii.1973, coll. A. K. Mandal.

Distribution : India : Orissa (first record), also first record from India. Elsewhere : Universal in freshwater.

Remarks : Body cylindrical with 15-16 ciliary rows ; endoplasm slightly dark ; dimensions $43.5-53.8 \mu\text{m} \times 16.6-24.9 \mu\text{m}$.

Family PLEURONEMATIDAE

31. *Pleuronema marinum* Dujardin

Material examined : 4 exs., Chilka Lagoon at Khalikota, 26.ii.1969 & 23.vi.1969, coll. K. N. Nair.

Distribution : India : Orissa (first record), also first record from India. Elsewhere : Universal in saltwater.

Remarks : Body ovoid with about 50 ciliary rows ; dimensions $80.7-111.8 \mu\text{m} \times 47.6-86.9 \mu\text{m}$; caudal cilia 20-25 μm long.

Family CYCLIDIIDAE

32. *Cyclidium citrullus* Cohn

Material examined : 25 exs., Chilka Lagoon at Balugan, 30.xii.1970, coll. K. N. Nair.

Distribution : India : Orissa (first record), also first record from India. Elsewhere : Universal in fresh and brackish water.

Remarks : Small, ovoid ; dimensions $80.7-111.8 \mu\text{m}$; peristome distinctly recognisable extending upto two-third length of the body ; caudal cilium comes out of a distinct depression or pit.

Order HETEROTRICHIDA

Family SPIROSTOMATIDAE

33. *Blepharisma undulans* Stein

Material examined : 4 exs., Nandankanan (Cuttack), 25.vii.1973 & 2.viii.1973, coll. A. K. Mandal.

Distribution : India : Orissa (first record), Rajasthan. Elsewhere : Universal in freshwater.

Remarks : Body pyriform, somewhat narrowed anteriorly ; dimensions $140.8\ \mu\text{m} \times 37.3\ \mu\text{m}$; undulating membrane very prominent and about two-third of peristomal length ; macronucleus in two parts.

34. *Spirostomum teres* Claparede & Lachmann

Material examined : 1 ex., Chilka Lagoon at Panaspada, 3.i.1971, coll. K. N. Nair.

Distribution : India : Orissa (first record). Andhra Pradesh and Kashmir. Elsewhere : Universal in freshwater.

Remarks : Elongated, spindle-shaped, highly contractile ; dimension $289.8\ \mu\text{m} \times 99.4\ \mu\text{m}$; peristome one-third of the body-length ; macronucleus single, oval to rod-shaped.

35. *Gruberia calkinsi* Beltran

Material examtned : 8 exs., Chilka Lagoon at Barkul and Satpara, 21.ii.1969 & 12.vi.1969, coll. K. N. Nair.

Distribution : India : Orissa (first record), Andhra Pradesh. Elsewhere : Universal in brackish water.

Remarks : Elongated but posterior end drawn out ; slightly contractile ; dimensions $310.5\text{--}351.9\ \mu\text{m} \times 64.2\text{--}80.7\ \mu\text{m}$; moniliform macronucleus ; many micronuclei ; many contractile vacuoles distributed all over the body.

Family METOPIDAE

36. *Metopus es* Muller

Material examined : 3 exs., Chilka Lagoon at Khalikota and Satpara, 4.vi.1969 & 3.i.1971, coll. K. N. Nair.

Distribution : India : Orissa (first record), Rajasthan and Andhra Pradesh. Elsewhere : Universal in fresh and brackish water.

Remarks : Body to some extent 'S'—shaped ; dimensions $107.6\text{--}142.8\ \mu\text{m} \times 51.7\text{--}62.1\ \mu\text{m}$; peristome conspicuous, slightly spirally diagonal, extending from the anterior end to the middle of the body.

Family CONDYLOSTOMATIDAE

37. *Condylostoma magnum* Spiegel

Material examined : 4 exs., Chilka Lagoon at Parikudh, 9.vi.1969, coll. K. N. Nair.

Distribution : India : Orissa (first record), also first record from India. Elsewhere : Universal in brackish water.

Remarks : Anterior end truncate and posterior half narrow ; dimensions $186.3-298\ \mu\text{m} \times 51.7-68.3\ \mu\text{m}$; about 40 striations on each side.

38. *Condylostoma patens* (Muller)

Material examined : 6 exs., Chilka Lagoon at Khalikota, Parikudh, Kaluparaghat and Satpara, 22.ii. & 26.ii.1969, 10.vi. & 12.vi. 1969 ; coll. K. N. Nair.

Distribution : India : Orissa (As above and from Puri), Rajasthan, Andhra Pradesh and Andaman and Nicobar Islands. Elsewhere : Universal in salt-water.

Remarks : Anterior end truncate, posterior half oval, broad, terminal end rounded ; about 20 striations on each side ; dimensions $213.2-322.9\ \mu\text{m} \times 58-111.8\ \mu\text{m}$.

Family CAENOMORPHIDAE

39. *Caenomorpha capucina* Kahl

Material examined : 3 exs., Chilka Lagoon at Satpara, 3.i.1971, coll. K. N. Nair.

Distribution : India : Orissa (first record) also first record from India. Elsewhere : Universal in saltwater.

Remarks : Bell-shaped ; dimensions $66.2-70\ \mu\text{m} \times 37.2-42\ \mu\text{m}$; caudal seta long ; secondary spine short ; macronucleus sausage-shaped.

Order OLIGOTRICHIDA

Famiiy STROMBIDIIDAE

40. *Strombidium calkinsi* Kahl

Material examined : 15 exs., Chilka Lagoon at Khalikota, Kaluparaghat and Parikudh, 19.ii.1969, 26.ii.1969 & 19.vi.1969, coll. K. N. Nair.

Distribution : India : Orissa (first record), also first record from India. Elsewhere : Universal in saltwater.

Remarks : Body ovoid ; posterior end provided with a long, sharp, cytoplasmic spine ; dimensions $41.4-47.6\ \mu\text{m} \times 28.9-31\ \mu\text{m}$.

Family CODONELLIDAE

41. *Tintinnopsis lohmani* Laackmann

Material examined : 1 ex., Chilka Lagoon at Rambha, 2.xii.1970, coll. K. N. Nair.

Distribution : India : Orissa (first record), also first record from India. Elsewhere : Universal in saltwater.

Remarks : Lorica 35 μm long. The species is found in brackish water.

Order HYPOTRICHIDA

Family HOLOSTICHIDAE

42. *Holosticha manca* Kahl

Material examined : 2 exs., Chilka Lagoon at Barkuda, 31.v.1969, coll. K. N. Nair.

Distribution : India : Orissa (first record), Andhra Pradesh. Elsewhere : Universal in brackish water.

Remarks : Body slender, elliptical with thin ectoplasm ; dimension 91 $\mu\text{m} \times 37.3 \mu\text{m}$; peristome one-third of the body length.

43. *Keronopsis rubra* (Ehrenberg)

Material examined : 9 exs., Chilka Lagoon at Barkul and Satpara, 22.ii.1969 & 12.vi.1969, coll. K. N. Nair.

Distribution : India : Orissa (As above and Konarak). Andhra Pradesh. Elsewhere : Universal in saltwater.

Remarks : Slender, reddish, anterior end sometimes slightly expanded ; dimensions 115.9-171.8 $\mu\text{m} \times 28.9-41.4 \mu\text{m}$; peristome one-fourth to one-fifth of the body length ; frontal membranellae 8-10, frontal cirri 3 in number, sharp and distinct.

44. *Uroleptus mobilis* Engelmann

Material examined : 8 exs., Puri, 25.vii.1973, coll. A. K. Mandal.

Distribution : India : Orissa (first record), Kashmir, Punjab, Delhi, Madhya Pradesh and Tamil Nadu. Elsewhere : Universal in soil and freshwater.

Remarks : Body very slender, flexible and non contractile ; posterior end roundish ; dimensions 62.1-70.4 $\mu\text{m} \times 8.3-12.4 \mu\text{m}$ (average length-breadth ratio 6.3 : 1) ; peristome one-ninth of the body-length ; marginal cirri relatively long and delicate : six ovoid macronuclei arranged in longitudinal row.

Family EUPLOTIDAE

45. *Euplotes charan* (Müller)

Material examined : 1 ex., Chilka Lagoon at Balugan, 30.xii.1970, coll. K. N. Nair.

Distribution : India : Orissa (first record), Maharashtra, Rajasthan. Elsewhere : Universal in saltwater.

Remarks : Body oval, rounded at two extremities ; dimension $72\ \mu\text{m} \times 39\ \mu\text{m}$; ten fronto-ventral cirri ; postero-marginal setae unbranched ; macronucleus band-shaped and curved.

46. *Euplotes vannus* (Müller)

Material examined : 9 exs., Chilka Lagoon at Barkul and Satpara, 22.ii.1969 & 12.vi.1969 ; coll. K. N. Nair.

Distribution : India : Orissa (first record), Andhra Pradesh, Andaman and Nicobar Islands. Elsewhere : Universal in saltwater.

Remarks : Both the right and left margins almost parallel and rectilinear and both anterior and posterior extremities uniformly rounded ; nine fronto-ventral cirri ; macronucleus C-shaped with a sharp bend at posterior extremity and sometimes a curve at anterior left ; dimensions $58-66.2\ \mu\text{m} \times 25-33.1\ \mu\text{m}$.

47. *Euplotes woodruffi* Gaw

Material examined : 8 exs., Chilka Lagoon at Khalikota, Parikudh, Nalbano, Balugan and Rambha, 19.ii.1969, 9.vi, 10.vi & 12.vi.1969, 17.xii.1970, coll. K. N. Nair.

Distribution : India : Orissa (first record), Andhra Pradesh. Elsewhere : Universal in saltwater.

Remarks : Body oval ; dimensions $99.4-107.6\ \mu\text{m} \times 62.1-72\ \mu\text{m}$; nine fronto-ventral cirri ; macronucleus consistently T-shaped.

48. *Diophrys appendiculata* (Ehrenberg)

Material examined : 7 exs., Chilka Lagoon at Barkul, Khalikota and Nalbano, 26.ii.1969 & 10.vi.1969, coll. K. N. Nair.

Distribution : India : Orissa (as above and Puri and Konarak), Andhra Pradesh, Andaman and Nicobar Islands. Elsewhere : Universal in brackish water.

Remarks : Body ellipsoid ; dimension $60-87\ \mu\text{m} \times 45.5-64.2\ \mu\text{m}$; peristome large, reaching almost middle of the body ; frontoventral cirri 7-8 in number ; two marginal cirri on the left side of the posterior part of the peristome.

SUMMARY

A comprehensive account of the freeliving protozoa of Orissa is given in the paper. Sixty-nine species of protozoa comprising flagellates, rhizopods and ciliates are reported from the state out of which 42 species are recorded for the first time. A complete list of freeliving protozoa reported so far from Orissa and keys to the identification of their families and genera are also incorporated.

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REFERENCES

- ANNANDALE, N. 1915. Fauna of the Chilka Lake : The coelenterates of the lake, with an account of the Actiniaria of brackish water in the Gangetic Delta. *Mem. Indian Mus.*, 5 : 65-114.
- ANNANDALE, N. AND KEMP, S. 1915. Fauna of the Chilka Lake : Ctenophora. *Mem. Indian Mus.*, 5 : 117-118.
- BHATIA, B. L. 1936. *The fauna of British India, including Ceylon and Burma, Protozoa : Ciliophora*, xxi+493 pp., London (Taylor & Francis, Ltd.).
- CHILTON, C. 1921. Fauna of the Chilka Lake : Amphipoda. *Mem. Indian Mus.*, 5 : 519-558.
- CHAUDHURI, H. 1929. A study on the protozoal content of certain soils of India. *Ann. Protistologie Paris*, 2 : 41-60.
- KAHL, A. 1930. Urtiere oder Protozoa, I: Wimpertiere oder Ciliata (Infusoria). Eine Bearbeitung der freilebenden und ectocommensalen Infusorien der Erde, unter Ausschluss der marinen Tintinnidae. 1. Allgemeiner Teil und Prostomata. In : Dahl, F., *Tierwelt Dtsch.*, 180 pp., Jena.

- LEVINE, N. D., CORLISS, J. O., COX, G. E. F., DEROUX, G., GRAIN, J., HONIGBERG, B. M., LEEDSLE, G. E., LOEBLICH, A. R., LOM, J., LYNN, D., MERINFELDS, G. E., PAGE, F. C., POLJANSKY, G., SPRAGUE, V., VAVRA, J. AND WALLACE, F. G. 1980. A newly revised classification of the protozoa. *J. Protozool.*, **27** : 37-58.
- MAHAJAN, K. K. 1969. Fauna of Rajasthan, India. Part 2. Protozoa (No. 1). *Rec. zool. Surv. India*, **61** : 377-401.
- MAHAJAN, K. K., 1971. Fauna of Rajasthan, India. Part 10. Protozoa (No. 2). *Rec. zool. Surv. India*, **63** : 45-76.
- MAHAJAN, K. K. 1977. Fauna of Rajasthan, Protozoa (No. 3). *Rec. zool. Surv. India*, **72** : 213-225.
- MAHAJAN, K. K. AND NAIR, K. N. 1971. On some freshwater ciliates (Protozoa) from Calcutta and its environs. *Rec. zool. Surv. India*, **63** : 1-22.
- NAIR, K. N. AND DAS, A. K. 1974. On a new and two rare freshwater ciliates (Protozoa) from West Bengal, India. *Proc. zool. Soc., Calcutta*, **27** : 35-39.
- NAIR, K. N., DAS, A. K. AND MUKHERJEE, R. N. 1971. On some freshwater Rhizopoda and Heliozoa (Protozoa) from Calcutta and its environs. *Rec. zool. Surv. India*, **65** : 1-16.
- NAGABHUSHANAM, A. K. AND RAO, G. C. 1969. Preliminary observations on a collection of shore fauna of the Orissa coast, India. *Proc. zool. Soc., Calcutta*, **22** : 67-82.

PROTOZOA (PARASITIC)

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INTRODUCTION

From the state of Orissa a number of coccidian parasites were reported by Patnaik and his co-workers (Patnaik, 1963, 1965a, 1965b, 1966 ; Patnaik and Ray, 1965, 1966a, 1966b ; Patnaik and Mohanty, 1969 ; Patnaik and Acharjyo, 1971, 1972, 1977) from domestic and zoo animals and Mandal and Nair (1975, 1976) have described three species of endocommensal ciliates from three species of earthworms. Nandi and Mandal (1977), McClure *et al.* (1978) and Mandal *et al.* (1984) have contributed much on the parasitic Protozoa of Orissa but since there is no consolidated account of the protozoan fauna of Orissa, the present paper is communicated.

ANNOTATED LIST OF PARASITIC PROTOZOA FROM ORISSA

The following is the list of parasitic protozoa from Orissa. The list also provides other informations in relation to locality, author and hosts harbouring the parasitic forms.

<i>Family and species</i>	<i>Host</i>	<i>Reported by</i>	<i>Locality</i>
Family TRYPANOSOMATIDAE (Blood parasites)			
1. <i>Trypanosoma rotatorium</i> (Mayer, 1843)	<i>Bufo</i> sp. (AMPHIBIA)	Mandal <i>et al.</i> (1984)	Lathore, Bolangir, Biswanathpur Koraput
2. <i>Trypanosoma</i> sp.	Stone lizard (REPTILIA)	„	Berbera, Puri
Family TRICHOMONADIDAE (Lumenicolous flagellates)			
3. <i>Trichomonas gallinae</i> (Rivolta, 1878)	<i>Streptopelia</i> <i>chinensis</i> (Buccal cavity, AVES)	„	„

<i>Family and species</i>	<i>Host</i>	<i>Reported by</i>	<i>Locality</i>
Family HAEMOGREGARINIDAE (Blood parasites)			
4. <i>Haemogregarina mirabilis</i> Castellani and Willey, 1904	<i>Xenochrophis piscator</i> (REPTILIA)	Mandal <i>et al.</i> (1984)	Chilka lake
5. <i>Haemogregarina triedri</i> Robertson, 1908	<i>Hemidactylus</i> sp. (REPTILIA)	„	Deogarh, Sambalpur
6. <i>Haemogregarina</i> sp.	<i>Calotes versicolor</i> Stone lizard (Both REPTILIA)	„ „	Berbera, Puri „
Family EIMERIIDAE (Intestinal coccidians)			
7. <i>Isospora gypsi</i> Patnaik and Mohanty, 1969	<i>Gyps bengalensis</i> (AVES)	Patnaik and Mohanty (1969)	Bhubaneswar
8. <i>Isospora mayuri</i> Patnaik, 1966 (Syn. <i>I. pellerdyi</i>)	<i>Pavo cristatus</i> (AVES)	Patnaik (1966) and Patnaik (1965a)	„ „
9. <i>Isospora felina</i> Patnaik and Acharjyo, 1971	<i>Felis bengalensis</i> (MAMMALIA)	Patnaik and Acharjyo (1971)	Nandankanan
10. <i>Isospora nandankanani</i> Patnaik and Acharjyo, 1977 (Syn. <i>I. bengalensis</i>)	„	Patnaik and Acharjyo (1977)	„
11. <i>Isospora felis</i> Wenyon, 1923	<i>Panthera tigris</i> (MAMMALIA)	Mandal <i>et al.</i> (1984)	„
12. <i>Isospora pardusi</i> Patnaik and Acharjyo, 1971	<i>Panthera pardus</i> (MAMMALIA)	Patnaik and Acharjyo (1971)	„
13. <i>Isospora suis</i> Biester and Murray, 1934	<i>Sus scrofa</i> (MAMMALIA)	Patnaik (1963)	Orissa
14. <i>Eimeria ambassi</i> Patnaik and Acharjyo, 1972	<i>Puntius ambassis</i> (= <i>Barbus ambassis</i>) (PISCES)	Patnaik and Acharjyo (1972)	Bhubaneswar
15. <i>Eimeria columbae</i> Mitra and Dasgupta, 1937	<i>Columba livia</i> (AVES)	Patnaik and Ray (1966b)	„

<i>Family and species</i>	<i>Host</i>	<i>Reported by</i>	<i>Locality</i>
16. <i>Eimeria columbarum</i> Nieschulz, 1935	<i>Columba livia</i> (AVES)	Patnaik and Ray (1966b)	Bhubaneswar
17. <i>Eimeria dispersa</i> Tyzzer, 1929	<i>Gallus</i> sp. (Domestic fowl) (AVES)	Patnaik (1963)	Orissa
18. <i>Eimeria acervulina</i> Tyzzer, 1929	<i>Gollus</i> sp. (Domestic fowl) (AVES)	Patnaik (1963)	Orissa
19. <i>Eimeria maxima</i> Tyzzer, 1929	„	„	„
20. <i>Eimeria mitis</i> Tyzzer, 1929	„	„	„
21. <i>Eimeria necatrix</i> Johnson, 1930	„	„	„
22. <i>Eimeria tanella</i> Railliet and Lucet, 1891	„	„	„
23. <i>Eimeria adenoeides</i> Moore and Brown, 1951	<i>Meleagris gallopavo</i> (AVES)	„	„
24. <i>Eimeria meleagrimistis</i> Tyzzer, 1929	„	„	„
25. <i>Eimeria innocua</i> Moore and Brown, 1952	„	„	„
26. <i>Eimeria patnaiki</i> Ray, 1966 (Syn. <i>E. pavonis</i> ; <i>E. indica</i>)	<i>Pavo cristatus</i> (AVES)	Patnaik (1965, 1966) ; Ray (1966)	Bhubaneswar
27. <i>Eimeria pavonis</i> Mandal, 1965 (Syn. <i>E. cristata</i>)	„	Patnaik (1965b)	
28. <i>Eimeria ahsata</i> Honess, 1942	<i>Capra</i> sp. and <i>Ovis</i> sp. (Domestic sheep and goat) (MAMMALIA)	Patnaik (1963)	Orissa
29. <i>Eimeria carandelis</i> Honess, 1942	„	„	„
30. <i>Eimeria intricata</i> Spiegel, 1925	„	„	„

<i>Family and species</i>	<i>Host</i>	<i>Reported by</i>	<i>Locality</i>
31. <i>Eimeria faurei</i> (Moussu and Marotel, 1902)	<i>Capra</i> sp. and <i>Ovis</i> sp. (Domestic sheep and goat) (MAMMALIA)	Patnaik (1963)	Orissa
32. <i>Eimeria arloingi</i> Marotel, 1905	„	Misra and Mahapatra (1972)	„
33. <i>Eimeria granulosa</i> Christensen, 1938	„	Misra and Mahapatra (1972)	„
34. <i>Eimeria ninakholyakimovi</i> Yakimoff and Rastegaiff, 1930	„	„	„
35. <i>Eimeria parva</i> Cotlan, Mocsy and Vajda, 1929	„	„	„
36. <i>Eimeria bovis</i> Zublin, 1908	<i>Bos indicus</i> (MAMMALIA)	Patnaik (1963)	„
37. <i>Eimeria cylindrica</i> Wilson, 1931	„	„	„
38. <i>Eimeria zuernii</i> Rastegaiff, 1930	„	„	„
39. <i>Eimeria gaurusi</i> Patnaik and Acharjyo, 1971	<i>Bos gaurus</i> (MAMMALIA)	Patnaik and Acharjyo (1971)	Nandankanan
40. <i>Eimeria yakimovi</i> Rastegaieff 1930	<i>Boselapus</i> <i>tragocamelus</i> (MAMMALIA)	„	„
41. <i>Eimeria chausinghi</i> Pande, Bhatia, Chauhan, and Garg, 1970	<i>Tetracerus</i> <i>quadricornis</i> (MAMMALIA)	„	„
42. <i>Eimeria wassilewskyi</i> Rastegaieff, 1930	<i>Axis axis</i> (MAMMALIA)	„	„
43. <i>Eimeria parahi</i> Pande, Bhatia, Chauhan and Garg, 1970	<i>Axis porcinus</i> (MAMMALIA)	„	„

<i>Family and species</i>	<i>Host</i>	<i>Reported by</i>	<i>Locality</i>
44. <i>Eimeria coucangi</i> Patnaik and Acharjyo, 1970	<i>Nycticebus coucang</i> (MAMMALIA)	Patnaik and Acharjyo (1970)	Nandankanan
45. <i>Eimeria nycticebi</i> Patnaik and Acharjyo, 1970	„	„	„
46. <i>Eimeria perminuta</i> Henry, 1931	<i>Sus scrofa</i> (MAMMALIA)	Patnaik (1963)	Orissa
47. <i>Eimeria scabra</i> Henry, 1931	„	„	„
48. <i>Eimeria spinosa</i> Henry, 1931	„	„	„
49. <i>Eimeria polita</i> Pellerdy, 1949	<i>Sus</i> sp. (MAMMALIA)	Mandal <i>et al.</i> (1984)	Nandankanan
50. <i>Eimeria newali</i> Dubey and Pande, 1963	<i>Herpestes edwardsi</i> (= <i>H. mungo</i>) (MAMMALIA)	Patnaik and Ray (1965)	Orissa
51. <i>Eimeria pandei</i> Patnaik and Ray, 1965	„	„	„
Family LEUCOCYTOZOIDAE (Blood parasites)			
52. <i>Akiba caulleryi</i> Mathis and Leger, 1909 (Syn. <i>Leucocytozoon caulleryi</i>)	Desi fowl (<i>Gallus</i> sp.) (AVES)	Biswal and Naik (1958)	Orissa
53. <i>Leucocytozoon sabrazei</i> Mathis and Leger, 1910	„	„	„
54. <i>Leucocytozoon</i> sp.	<i>Hemipus picatus</i>	McClure <i>et al.</i> (1978)	Orissa
	<i>Dendrocitta formosae</i>	„	„
	<i>Parus xanthogenys</i>	„	„
	<i>Chrysomma sinense</i>	„	„
	<i>Dumetia hyperythra</i>	„	„
	<i>Monticola cinclorhynchus</i>	„	„
	<i>Zoothera citrina</i>	„	„
	<i>Arachnothera longirostris</i>	„	„
	<i>Zosterops palpebrosa</i>	„	„
	(All AVES)		

<i>Family and species</i>	<i>Host</i>	<i>Reported by</i>	<i>Locality</i>
Family HAEMOPROTEIDAE (Blood parasites)			
55. <i>Haemoproteus columbae</i> Kruse, 1890	<i>Streptopelia chinensis</i> (AVES)	Nandi and Mandal(1977); Mandal <i>et al.</i> (1984)	Kalinga, Phulbani
56. <i>Haemoproteus dicruri</i> de Mello, 1935	<i>Dicrurus adsimilis</i> (AVES)	,,	Kalinga
57. <i>Haemoproteus fallisi</i> Bennett and Campbell, 1972	<i>Copsychus saularis</i> (AVES)	,,	,,
58. <i>Haemoproteus fringillae</i> Labbé, 1894	,,	,,	,,
59. <i>Haemoproteus lanii</i> de Mello, 1937	<i>Lanius schach</i> (AVES)	,,	Badrama, Sambalpur
60. <i>Haemoproteus meropis</i> (Zargar, 1945)	<i>Merops orientalis</i> (AVES)	,,	Berbera
61. <i>Haemoproteus orizivora</i> Anschutz, 1909	<i>Copsychus saularis</i> <i>Turdoides striatus</i> (Both AVES)	,, ,,	Kalinga ,,
62. <i>Haemoproteus passeris</i> Kruse, 1890	<i>Passer domesticus</i> (AVES)	,,	Deogarh
63. <i>Haemoproteus sacharovi</i> Novy and Mac Neal, 1904	<i>Streptopelia chinensis</i> (AVES)	,,	Kalinga
64. <i>Haemoproteus velans</i>	<i>Jynx torquilla</i> (AVES)	McClure <i>et al.</i> (1978)	Orissa ,,
65. <i>Haemoproteus</i> sp.	<i>Acrocephalus dumetorum</i>	,,	,,
	<i>Alcippe poioicephala</i>	,,	,,
	<i>Dendrocitta formosae</i>	,,	,,
	<i>Hypothymis azurea</i>	,,	,,
	<i>Lonchura kelaarti</i>	,,	,,
	<i>Lonchura punctulata</i>	,,	,,
	<i>Megalaima zeylanica</i>	,,	,,
	<i>Monticola cinclorhynchus</i>	,,	,,

<i>Family and species</i>	<i>Host</i>	<i>Reported by</i>	<i>Locality</i>
<i>Haemoproteus</i> sp.	<i>Muscicapa muttui</i>	McClure <i>et al.</i> (1978)	Orissa
	<i>Muscicapa tickelliae</i>	„	„
	<i>Phragmaticola aedon</i>	„	„
	<i>Phylloscopus inornatus</i>	„	„
	<i>Phylloscopus trochiloides</i>	„	„
	<i>Ploceus philippines</i>	„	„
	<i>Sitta castanea</i>	„	„
	<i>Sitta frontalis</i>	„	„
	<i>Zosterops palpebrosa</i>	„	„
	(All AVES)		

Family PLASMODIIDAE (Blood parasites)

66. <i>Plasmodium</i> (<i>Novyella</i>) <i>vaughani</i> Novy and Mac Neal, 1904	<i>Ploceus philippines</i> (AVES)	Nandi and Mandal(1977); Mandal <i>et al.</i> (1984)	Berbera
67. <i>Plasmodium</i> sp.	<i>Terpsiphone paradisi</i>	„	Kalinga
	<i>Tephrodornis virgatus</i>	McClure <i>et al.</i> (1978)	Orissa
	<i>Parus xanthogenys</i>	„	„
	(All AVES)		

Family OPALINIDAE (Intestino-rectal endocommesal opalinids)

68. <i>Opalina coracoidea</i>	<i>Rana cyanophlyctis</i> (AMPHIBIA)	Mandal <i>et al.</i> (1984)	Konarak, Puri
69. <i>Protoopalina malabarica</i> Uttangi, 1961	<i>Rana</i> sp. (AMPHIBIA)	„	Badrama, Sambalpur, Deogarh

Family BALANTIDIIDAE (Intestino-rectal endocommensal ciliates)

70. <i>Balantidium gracile</i> Bezenberger, 1904	<i>Rana</i> sp. (AMPHIBIA)	Mandal <i>et al.</i> (1984)	Konarak, Puri

Family OPHRYOSCOLECIDAE (Symbiotic rumen ciliates)

71. <i>Diplodinium minor</i> (Dogiel, 1925)	<i>Muntiacus muntjak</i> (Barking deer) (MAMMALIA)	Mandal <i>et al.</i> (1984)	Berbera

<i>Family and species</i>	<i>Host</i>	<i>Reported by</i>	<i>Locality</i>
72. <i>Entodinium dubardi</i> Buisson, 1923	<i>Muntiacus muntjak</i> (Barking deer) (MAMMALIA)	Mandal <i>et al.</i> (1984)	Berbera
73. <i>Entodinium ovinum</i> Dogiel, 1927	„	„	„
74. <i>Entodinium ovoideum</i> Kofoid and MacLennan, 1930	„	„	„
75. <i>Entodinium simplex</i> Dogiel, 1925	„	„	„
76. <i>Eudiplodinium maggi</i> Fiorentini, 1889	„	„	„
77. <i>Metadinium medium</i> Awerinzew and Mutafova, 1914	„	„	„
Family HYSTEROGINETIDAE (Gut-inhabiting endocommensal ciliates)			
78. <i>Ptychostomum drawidi</i> Mandal and Nair, 1976	<i>Drawida willisi</i> (OLIGOCHAETA)	Mandal and Nair (1976) : Mandal <i>et al.</i> (1984)	Biswanathpur
Family NYCTOTHERIDAE (Intestinal endosymbiotic ciliates)			
79. <i>Nyctotherus cordiformis</i> (Ehrenberg, 1838)	<i>Rana</i> sp. (AMPHIBIA)	Mandal <i>et al.</i> (1984)	Badrama, Sambalpur
80. <i>Nyctotherus magnus</i> Bezenberger, 1904	<i>Bufo</i> sp. (AMPHIBIA)	„	„
81. <i>Nyctotherus ovalis</i> Leidy, 1849	<i>Blatta</i> sp. (INSECTA)	„	„
Family PLAGIOTOMIDAE (Endocommensal ciliates)			
82. <i>Plagiotoma dichogasteri</i> Mandal and Nair, 1975	<i>Dichogaster bolau</i> (OLIGOCHAETA)	Mandal and Nair (1975) ; Mandal <i>et al.</i> (1984)	Khajuripada
83. <i>Plagiotoma pellogasteri</i> Mandal and Nair, 1976	<i>Pellogaster</i> <i>bengalensis</i> (OLIGOCHAETA)	Mandal <i>et al.</i> (1984)	Biswanathpur,

DISCUSSION

A total of 83 parasitic Protozoa have so far been recorded from Orissa. Although all the major groups viz. haemoflagellates (1 sp.), intestinal coccidians (45 spp.), haemosporidians (13 spp.) and endocommensal or symbiotic ciliates (16 spp.) have been reported from Orissa, but still many more species may be found to occur in Orissa. Myxosporidan parasites, an important group of fish Protozoa, have not yet been documented at all though there are 85 species of fish-inhabiting myxosporidians occurring in India (Nandi *et al.*, 1983). The number of host species harbouring protozoan parasites has been found to vary even within different groups of vertebrate animals. There are 17 species of mammals, 38 of birds, 4 of reptiles, 3 of amphibians and a single species of fishes (viz. *Puntius ambassis*) recorded to harbour one or more species of Protozoa. The number of protozoan species (parasites) occurring in the vertebrate hosts has also been noted to vary in different groups as follows : 1 species in Pisces, 6 species in Amphibia, 4 species in Reptilia, 31 species in Aves and 36 species in Mammalia. While, among invertebrates, only 4 species of endocommensal ciliates are recorded from 3 species of oligochaetes and 1 species of insects.

A perusal of the literature revealed that Nandi and Mandal (1977) encountered a low prevalence of avian haematozoa in 15 (12.7%) of 118 birds of 30 species surveyed from Orissa and that Mandal *et al.* (1984) observed higher incidence of blood Protozoa in comparison to intestinal protozoans. The absence of myxosporidan and other parasites (microsporidians, gregarines and termite flagellates) might be attributed to the lack of specific parasitological survey from this region.

In the Indian context (vide Bhatia, 1936, 1938), the protozoan fauna of Orissa is ill-explored especially for the free-living forms. The diverse ecology of Orissa with dense forests, extensive hill ranges, fertile valleys and vast coastal waters is expected to support rich population of both free-living and parasitic Protozoa. However, year-round survey of the wild animals from 18 wildlife sanctuaries of Orissa is required to understand the parasite burden of these biotopes, impact of parasites on the health of the hosts and their epizootiology so that the management strategy of wildlife, our precious heritage, may be better formulated.

SUMMARY

An annotated list of protozoan (parasitic) fauna from Orissa state is presented. It includes 83 forms. Distribution of the parasitic protozoa has been analysed with respect to hosts. Avian and mammalian species are quite well studied over others. Survey of the protozoan parasites from the sanctuaries of Orissa is suggested.

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BIBLIOGRAPHY

- BHATIA, B. L. 1936. *The Fauna of British India. Protozoa : Ciliophora*. pp. 493+xxii. London (Taylor and Francis).
- BHATIA, B. L. 1938. *The Fauna of British India, Protozoa : Sporozoa*. pp. 497+xx. London (Taylor and Francis).
- BISWAL, G. AND NAIK, B. C. 1958. *Leucocytozoon* infection in Desi fowl in Orissa. *Indian vet. J.*, **35** (4) : 161-163.
- MANDAL, A. K. AND NAIR, K. N. 1975. *Plagiotoma dichogasteri* sp. nov. (Plagiotomidae) a new heterotrichous ciliate from the earthworm *Dichogaster bolawi* (Michaelson) of Orissa, India. *Arch. Protistenk.*, **17** : 38-40.
- MANDAL, A. K. AND NAIR, K. N. 1976. *Ptychostomum drawidi* sp. n. and *Plagiotoma pellogasteri* sp. n.—new ciliates from earthworms of Orissa, India. *Acta. Protozool.*, **30** : 269-272.
- MANDAL, A. K., RAY, R. AND NAIR, K. N. 1984. Studies on the protozoan parasites of Orissa. *Rec. zool. Surv. India*, **81** (3 & 4) : 137-151.
- McCLURE, H. E., POONSWAD, P., GREINER, E. C. AND LAIRD, M. 1978. *Haematozoa in the birds of eastern and southern Asia*. pp. x+296. St. John's, Newfoundland, Canada, Memorial University of Newfoundland Press.
- MISRA, S. C. AND MOHAPATRA, G. S. 1972. Coccidian infection in goats and the chemotherapeutic effect of Purmidian and Sulmet. *Orissa vet. J.*, **7** : 9-14.
- NANDI, N. C. AND MANDAL, A. K. 1977. Studies on some avian haematozoa from Orissa, India. *Indian J. Anim. Sci.*, **47** : 558-561.
- NANDI, N. C., NANDI, R. AND MANDAL, A. K. 1983. Index-catalogue and bibliography of the protozoan parasites from Indian fishes. *Occ. Pap. Rec. zool. Surv. India*, No. **41** : 1-46.
- PATNAIK, M. M. 1963. Coccidian parasites of domestic animals in Orissa. *Orissa vet. J.*, **1** : 25-28.

- PATNAIK, M. M. 1965a. *Isospora pellerdyi* n. sp. from Indian Peacock (*Pavo cristatus*). *Indian J. Microbiol.*, **5** : 67-68.
- PATNAIK, K. M. 1965b. *Eimeria pavonis* n. sp. from Indian Peacock. (*Pavo cristatus*). *Indian J. Microbiol.*, **5** : 45-47.
- PATNAIK, M. M. 1966. Remarks on Coccidia species from Indian Peacock (*Pavo cristatus*). *Indian J. Microbiol.*, **6** : 53-54.
- PATNAIK, M. M. AND ACHARJYO, L. N. 1970. *Eimeria nycticebi* n. sp. and *E. coucangi* n. sp. from Indian slow loris (*Nycticebus coucang*) and notes on *Isospora leonina* from an African Lion (*Panthera leo*). *Orissa vet. J.*, **5** : 13-14.
- PATNAIK, M. M. AND ACHARJYO, L. N. 1971. Notes on the coccidian parasites of wild mammals in captivity at Nandankanan. *Orissa vet. J.*, **6** : 133-135.
- PATNAIK, M. M. AND ACHARJYO, L. N. 1972. *Eimeria ambassi* sp. nov. from a minnow (*Barbus embassis*). *Indian J. Microbiol.*, **12** : 53-54.
- PATNAIK, M. M. AND ACHARJYO, L. N. 1977. Remarks on *Isospora bengalensis* Patnaik and Acharjyo, 1971 from Leopard cat. *Orissa vet. J.*, **11** : 47.
- PATNAIK, M. M. AND MOHANTY, D. N. 1969. *Isospora gypsi* n. sp. from the Indian Vulture (*Gyps bengalensis*). *Curr. Sci.*, **38** (13) : 316.
- PATNAIK, M. M. AND RAY, S. K. 1965. Coccidia of Indian Mongoose (*Herpestes edwardsi*). *Indian J. Anim. Hlth.*, **4** : 35-36.
- PATNAIK, M. M. AND RAY, S. K. 1966a. Letters to the Editor. *Indian J. Anim. Hlth.*, **5** : 203.
- PATNAIK, M. M. AND RAY, S. K. 1966b. Coccidia of Indian pigeon (*Columba livia intermedia*) with a note on the superimposed echinostome infection in naturally coccidia infected pigeons. *Utkal. vet.*, **1** : 11-14.

PORIFERA

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INTRODUCTION

Sponges form a significant group of organisms in the aquatic ecosystems. Their sedentary mode of living is unique among the aquatic fauna. In recent years though considerable attention has been paid to the study of marine and also to some extent freshwater sponges, the estuarine forms have practically remained neglected.

Our knowledge of the sponge fauna of Orissa, both estuarine and freshwater, is mainly based on the works of Annandale (1915 & 1906-1919, respectively). But, this is far from complete. Further, the taxonomic position of some of the taxa described by Annandale (*op. cit.*) as new, on the basis of some ecomorphic fluctuations is doubtful. Apparently, the observed variations are due to stress of secondary adaptation of the fauna from marine to low salinity waters. Unfortunately, no comparative study has so far been undertaken to remove the existing confusion. Hitherto, ten species, five each of marine and freshwater are reported from the area as follows :

PORIFERA RECORDED FROM ORISSA

Marine forms :-

1. *Cliona vastifica* Hancock, 1849
2. *Suberites sericeus* Thiele, 1898
3. *Laxosuberites lacustris* Annandale, 1915
4. *L. aquae-dulcioris* (Annandale, 1914)
(=*Suberites aquae-dulcioris*)
5. *Tetilla dactyloidea* var. *lingua* Annandale, 1915

All these forms are reported from Chilka lake and are also listed by Harrison (1974, p. 37). Of these, while the widely distributed species *Cliona vastifica* appears to be the only successful coloniser, also reported by Thomas (1975) from Zuari and Mandavi estuaries (Goa), the occurrence of another marine form *Suberites sericeus* in Chilka waters needs confirmation. As regards Annandale's two species, viz. *Laxosuberites lacustris* and *L. aquae-dulcioris*, their taxonomic status appears to be doubtful. It is possible that future studies may prove them to be synonyms of some other widely distributed forms.

Regarding the variety *lingua* of *Tetilla dactyloidea* (Carter, 1869) which was based mainly on the shape of the sponge, it may be stressed here that the species is very variable and thus, the shape character clearly loses its diagnostic value.

In view of the paucity of the available information it is not possible to give diagnostic keys and full distribution of the above listed taxa as done for freshwater forms (*vide infra*).

Freshwater forms :—

Of the following five species, barring one which is found both in fresh and brackish waters, the remaining four inhabit only freshwaters. A list along with their full distribution and also generic key are presented below.

1. ***Spongilla alba*** Carter, 1849 (= *S. nana* Annandale, 1915)

Distribution : India : Lake Chilka and Rambha (Orissa) ; North Salt lake, 24-Parganas ; Port Canning and Calcutta (West Bengal) ; Bombay and Igatpuri (Maharashtra) ; Backwater near Shasthancottah, Travancore (Kerala). Elsewhere : SE Asia, Africa, Australia, and South America.

2. ***Eunapius crassissimus*** (Annandale, 1907)

Distribution : India : Sur lake (Orissa) ; Calcutta (West Bengal). Elsewhere : Bangladesh ; tropical SE Asia ; and possibly Australia.

3. ***Eunapius carteri*** (Bowerbank, 1863)

Distribution : India : Sur lake (Orissa) ; common throughout India. Elsewhere : A widely distributed species, for details see Penney and Racek (1968, p. 24).

4. ***Radiospongilla cerebellata*** (Bowerbank, 1863)

Distribution : India : Sur lake and Rambha (Orissa) ; Mangal-dai near Bhutan frontier (Assam) ; Berhampore, Calcutta and neighbourhood (West Bengal) ; Jharia, Siripur, Saran Dist. (Bihar) ; Malwa Tal, Kumaon (U. P.) ; Igatpuri, Aurangabad, and Khandalla (Maharashtra) ; Bangalore (Karnataka) ; Pagnor taluq, Nellore Dist. (Andhra Pradesh) ; Madras and neighbourhood (Tamil Nadu) ; Ernakulum and Trichur (Kerala). Elsewhere : Burma ; Bangladesh ; and Sri Lanka (See Penney and Racek, p. 74).

5. ***Radiospongilla hemephydatia*** (Annandale, 1909)

Distribution : India : Sur lake (Orissa) ; and Pune (but needs confirmation). Elsewhere : Australia ; and possibly New Guinea (but needs confirmation).

A KEY FOR IDENTIFICATION OF FRESHWATER GENERA OF ORISSA

All the three genera reported here from the area are characterised in having gemmoscleres spiny amphioxea or amphistongyla. This character is used by Volkmer-Ribeiro (1981) for separation of genera. In fact, Harrison and Simpson (1976, pp. 3-4) had observed too that, ".....most taxonomic schemes in use today employ gemmule and gemmosclere (gemmule spicule) morphology as diagnostic criteria"; and these characters have been taken into account.

1. Microscleres absent 2
 Microscleres present (Foramen simple) *Spongilla*
2. Gemmoscleres tangentially embedded in a much thicker pneumatic coat having several layers of large polygonal air spaces. (Pneumatic coat often enveloping groups of gemmules) *Eunapius*
 Gemmoscleres radially embedded in a less thicker pneumatic coat having air spaces of small size (Gemmoscleres usually with larger spines aggregated at tip of scleres as sceptor—like terminations or pseudo-rotules) *Radiospongilla*

It is likely that more intensive surveys of the area along with various physico-chemical parameters of the water bodies holding sponge populations will yield rich dividends in knowledge and further additions to the faunal list thereby aiding in removing the taxonomic complexities presented by some taxa.

ACKNOWLEDGEMENT

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REFERENCES

- ANNANDALE, N. 1909. Notes on freshwater sponges. XI. Description of a new species of *Spongilla* from Orissa. *Rec. Indian Mus.*, 3 : 275.
- ANNANDALE, N. 1911. In : *Fauna British India, including Ceylon and Burma Freshwater sponges, hydroids and Polyzoa*. pp. : 27-126, 241-245.
- ANNANDALE, N. 1915. Fauna of the Chilka Lake. Sponges. *Mem. Indian Mus.*, 5 (1) : 21-54.
- HARRISON, F. W. 1974. Sponges (Porifera : Spongillidae). PP. 29-66. *Pollution Ecology of Freshwater Invertebrates*. (Eds.) C. W. Hart and S. L. H. Fuller (Academic Press, New York & London).

- HARRISON, F. W. AND SIMPSON, T. L. 1976. Introduction : Principles and Perspectives in Sponge Biology : 3-17. In : *Aspects of Sponge Biology*. (Eds. F. W. Harrison and R. R. Cowden). (Academic Press) New York & London.
- PENNEY, J. T. AND RACEK, A. A. 1968. Comprehensive Revision of a world-wide collection of Freshwater Sponges (Porifera : Spongillidae). *Bull. U. S. natn. Mus.*, No. 272 : 1-184.
- THOMAS, P. A. 1975. Boring sponges of Zuari and Mandovi Estuaries. *Bull. Dept. Mar. Sci. Univ. Cochin*, 7 : 117-126.
- VOLKMER-RIBEIRO, C. 1981. Key to the presently known families and genera of neotropical freshwater sponges. *Rev. Brasil. Biol.*, 41 (4) : 803-808.

Addendum for

PORIFERA

T. D. SOOTA

SARMA, A. L. N., RAO, D. G., AND SATAPATHY, S. 1980. Faunal associations of littoral sponges in and around Balugaon in Chilka lake (Lagoon). *J. Bombay nat. Hist. Soc.*, **76** (1) : 192-195.

POLYCHAETA

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INTRODUCTION

Our knowledge of the polychaete fauna of Orissa is mainly based on the works of Southern (1921), Fauvel (1932) and Soota and Rao, (1977). Apart from these, there are some reports on small collections from the area (Julka and Rao, 1976 ; Nagabhushanam and Rao, 1969 ; Rao, 1969, 1978 and Rao, 1981). During a general faunistic survey of Orissa coast undertaken by a party of the Zoological Survey of India during December-January, 1975-76, the first author had an opportunity of collecting the polychaete material at Puri, Konarak and Chandipur along the coast and Chandbali, Bhitorkanika and Talichua in the Baitarani-Brahmani estuary (Fig. 1).

This contribution deals not only with the present material collected from Orissa but also with that collected by other members of the Survey and available in the unnamed departmental collection. This comprises of 26 species belonging to 20 genera and 10 families, of which 7 species are recorded for the first time from Orissa (marked with single asterisk) including one for Indian waters (marked with double asterisks). One interesting form *Nerinides* sp. included here seems to be new to science but this could be confirmed only with more numbers of examples. Detailed description of the species, therefore, is avoided and only the diagnostic features are mentioned. To avoid repetition, only original synonymies have been given since most of them are available in Fauvel (1953) and Day (1967). The paper also includes a complete list of polychaetes so far recorded from Orissa with individual locality records (Appendix).

SYSTEMATIC ACCOUNT

Family POLYNOIDAE

Gattyana deludens Fauvel

1932. *Gattyana deludens* Fauvel, *Mem. Indian Mus.*, 12 : 18.

Material : 2 exs., Z. S. I. Reg. No. An 1656/1, Sandy beach, north of Kasafal, Chandipur, V. K. Premkumar & party, 24.1.1972 ; 1 ex., Z. S. I. Reg. No. An 1657/1, sandy beach, Chandipur, S. Biswas & A. Misra, 18.1.1976 ; 3 exs., Z. S. I. Reg. No. An 1658/1, off Paradip, V K. Premkumar & party 31.1.1972.

Diagnosis : Body much flattened, oval and elongate ; prostomium bilobed with blunt peaks and four eyes ; median antenna terminal, lateral antennae ventral ; elytra 15 pairs, with fringed outer border and polygonal areas on smooth upper surface ; notosetae much finer than neurosetae, both spinulose excluding tip.

Remarks : Occasionally occur on the shells of hermit crabs in the intertidal silty sands. The largest specimen measures 18 mm in length and 6 mm in maximum width.

Distribution : Bay of Bengal, Arabian Sea, Yellow Sea.

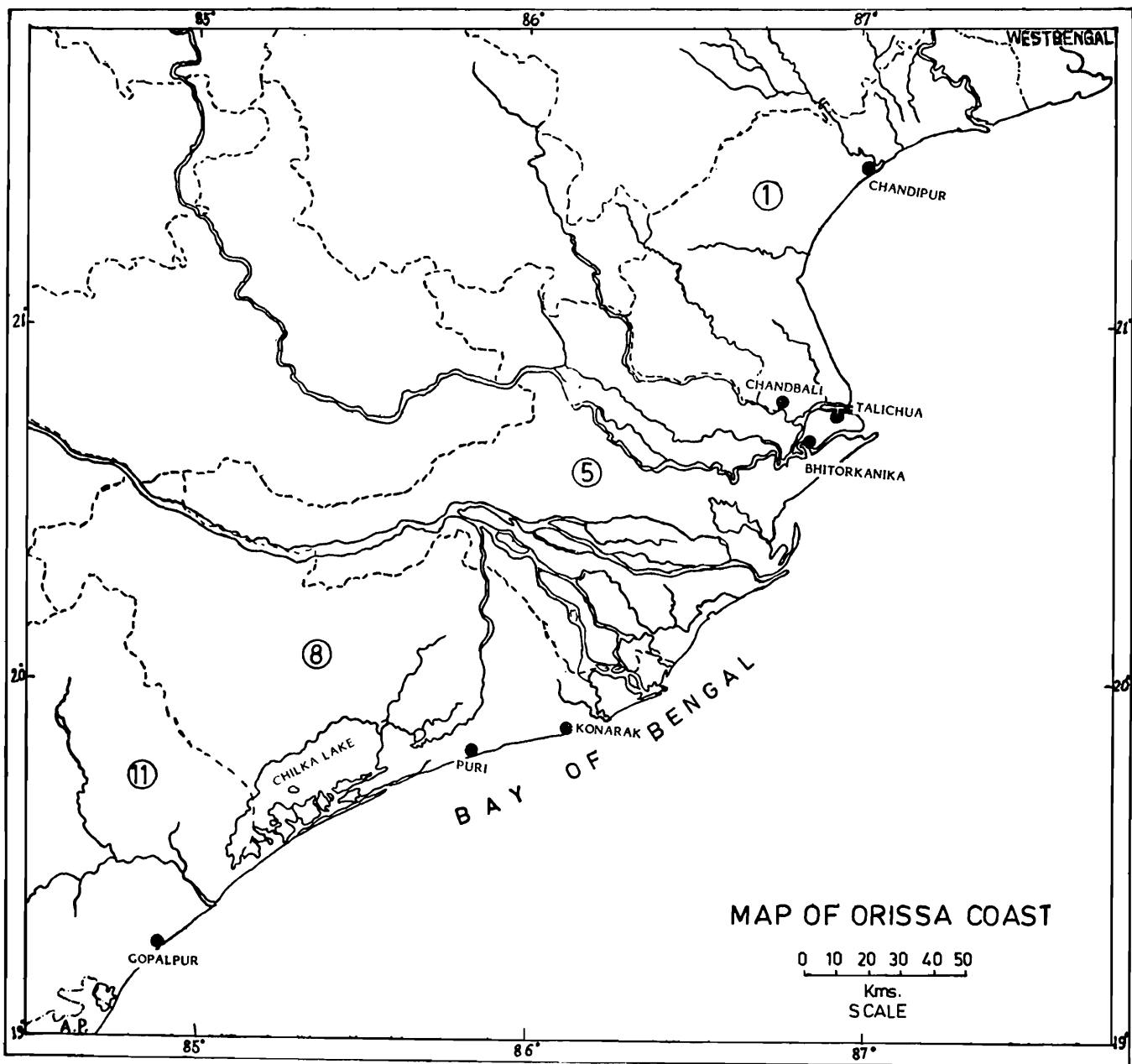


Fig. 1. Map of coastal region of Orissa showing collecting localities of Polychaeta.

Family NEREIDAE

Dendronereides heteropoda Southern

1921. *Dendronereides heteropoda* Southern, *Mem. Indian Mus.*, 5 : 603.

Material : 2 exs., Z. S. I. Reg. No. An 1659/1, muddy sand, Chandipur, S. Biswas & A. Misra, 17.1.1976.

Diagnosis : Body long and slender ; proboscis with soft papillae having both basal and maxillary rings ; superior lobe of notopodium divided to form simple series of numerous branchial filaments inserted below dorsal cirrus and above dorsal ligule, extending from 6th to 50th segment ; notosetae homogomph spinigers and neurosetae with both spinigers and falgigers.

Remarks : One of the commonest polychaetes in muddy sands, particularly abundant in the area with variable salinity. The largest specimen measures 120 mm in length and 4 mm in maximum width.

Distribution : India : Gangetic delta, Bombay waters. Also Diamond Is. (Burma).

Dendronereis arborifera Peters

1854. *Dendronereis arborifera* Peters, *Mber. Akad. Wiss.*, Berlin, 1854 : 612.

Material : 13 exs., Z. S. I. Reg. No. An 1571/1, muddy sands, Chandipur, S. Biswas & A. Misra, 17.1.1976.

Diagnosis : Body slender ; proboscis without paragnath or soft papillae ; notopodium with three and neuropodium with four postsetal and two presetal lobes ; dorsal cirri beginning from 10th foot bearing pinnate gills and continuing upto 30th ; setae all homogomph spinigers.

Remarks : Most common in muddy sands with variable salinity of overlying water. The largest specimen measures 50 mm in length and 3 mm in maximum width. The specimens correspond mostly to the description of Fauvel (1953) excepting that the gills continue upto 30th segment instead of 22nd segment.

Distribution : India : Gangetic delta ; Baitarani river, Orissa ; Vishakhapatnam ; Goa. Also Madagascar ; Mozambique.

Namalycastis indica (Southern)

1921. *Lycastis indica* Southern, *Mem. Indian Mus.*, 5 : 578.

Material : 3 exs., Z. S. I. Reg. No. An 1587/1, Bhasra Is., Chilka Lake K. S. Misra, 25.1.1954 ; 10 exs., Z. S. I. Reg. No. An 1660/1, muddy shore, Kespur, 20 km south of Balugaon, V. K. Premkumar & party, 23.3.1973.

Diagnosis : Body long and slender ; proboscis without paragnath or soft papillae ; parapodia uniramous, notopodial lobes and dorsal cirrus both elongated and flattened posteriorly ; neuropodial falcigers with long, straight and blunt blades.

Remarks : Quite common in the muddy shore of brackish-water habitat. The largest specimen measures 110 mm in length and 5 mm in maximum width.

Distribution : India : Gangetic delta ; Chilka Lake, Orissa ; Madras ; Gujarat ; Andamans. Also Sri Lanka ; Makassar, Sulawesi (Indonesia).

***Nereis (Neanthes) chilkaensis* Southern**

1921. *Nereis chilkaensis* Southern, *Mem. Indian Mus.*, 5 : 584.

Material : 7 exs., Z. S. I. Reg. No. An 1588/1, Barkuda Is., Chilka Lake, K. N. Nair & party, 25.5.1969 ; 8 exs., Z. S. I. Reg. No. An 1661/1, Kaligai Is., Chilka Lake, G. Ramakrishna & party, 21.2.1975.

Diagnosis : Proboscis with Gr. I, 5 to 6 conicals ; Gr. II, several small dots ; Gr. III, a rectangular cluster of several dots arranged in 4 curved lines ; Gr. IV, a wedge shaped cluster of dots ; Gr. V, nil ; Gr. VI, 3 to 4 dots in a line ; Gr. VII & VIII, 2 alternating irregular rows ; falcate heterogomph setae with short spinulose terminal piece.

Remarks : Common in muddy estuarine habitats. The largest specimen measures 100 mm in length and 4 mm in maximum width. The specimens correspond mostly to the description of Fauvel (1953) excepting the number and the arrangement of paragnaths in the proboscis.

Distribution : India : Chilka Lake, Orissa ; Ennur Backwater ; Madras ; Pambam, Travancore, Kerala.

***Nereis (Neanthes) indica* Kinberg**

1866. *Nereis indica* Kinberg, *ofuers. K. Vetensk. Akad. Forh.*, 22 : 169.

Material : 6 exs., Z. S. I. Reg. No. An 1662/1, muddy beach, Gopalpur, V. K. Premkumar & party, 15.2.1972 ; 2 exs., Z. S. I. Reg. No. An 1663/1, sandy beach, Chandipur, S. Biswas & A. Misra, 17.1.1976.

Diagnosis : Proboscis with Gr. I, 1 ; Gr. II, a double row ; Gr. III, an oval patch ; Gr. IV, wedge shaped cluster, Gr. V, nil ; Gr. VI, round cluster of 5 to 6 ; Gr. VII & VIII, 3 irregular rows ; neuropodial heterogomph falcigers with sickle shaped blade.

Remarks : Occasionally occur in the fine sands. The largest specimen measures 55 mm in length and 3 mm in maximum width. The specimen corresponds mostly to the description of Fauvel (1953) excepting the arrangement of the paragnaths in the proboscis.

Distribution : India : Waltair ; Pambam, Gulf of Mannar ; Gujarat. Also Sri Lanka ; Bangka Strait, Sumatra (Indonesia).

***Nereis (Nereis) persica (Fauvel)**

1911. *Nereis zonata-persica* Fauvel, *Arch. Zool. exp. gen.* (ser. 5), 6 : 385.

Material : 4 exs., Z. S. I. Reg. No. An 1635/1, sandy beach, Gopalpur, V. K. Premkumar & party, 30.3.1973 ; 1 ex., Z. S. I. Reg. No. An 1664/1, Chandipur, S. Biswas & A. Misra, 17.1.1976.

Diagnosis : Proboscis with Gr. I, 1 ; Gr. II, double row ; Gr. III, few conicals ; Gr. IV, 2 to 3 irregular rows ; Gr. V, nil ; Gr. VI, cluster of of several dots ; Gr. VII & VIII, 3 rows forming broad band with larger point anteriorly ; notopodial homogomph falcigers with 2-3 blunt teeth, neuropodial heterogomph falcigers, spinulose and without teeth.

Remarks : Occasionally occur in sandy beaches. The largest specimen measures 25 mm in length and 2 mm in maximum width.

Distribution ; India : Pambam, Gulf of Mannar ; Marmugao, Goa ; Gujarat ; also widely occurring in the Indian Ocean and Red Sea.

Perinereis nigropunctata (Horst)

1924. *Nereis nigropunctata* Horst, *Siboga-Expeditie*, Leyden, III, 171.

Material : 3 exs., Z. S. I. Reg. No. An 1589/1, sandy beach, Gopalpur, V. K. Premkumar & party, 31.3.1972 ; 1 ex., Z. S. I. Reg. No. An 1636/1, sandy beach, Gopalpur, V. K. Premkumar & party, 30.3.1973.

Diagnosis : Proboscis with Gr. I, 1 ; Gr. II, 2-3 rows ; Gr. III, a patch of about 18-20 conicals ; Gr. IV, a wedge shaped cluster ; Gr. V, a triangle ; Gr. VI, a transverse bar ; Gr. VII & VIII, 2 irregular rows ; superior lobe of posterior feet enlarged and elongated, bearing dorsal cirrus on its upper distal margin ; falcigers with short sickle shaped terminal piece.

Remarks : Prefer to occur in sandy beach. The largest specimen measures 65 mm in length and 3 mm in maximum width.

Distribution : India : Gangetic delta ; Chilka Lake, Orissa ; Gujarat coast ; Tamil Nadu coast (Cape Comorin=Kanya Kumari). Also widely distributed in the tropical Indo-West Pacific.

Pseudonereis variegata (Grube)

1857. *Nereilepas variegata* Grube, *Vidensk. Meddel. fra. d. naturhist. foren*, Kopenhagen, pt. II : 164.

Material : 3 exs., Z. S. I. Reg. No. An 1665/1, within rock boulders, Gopalpur, V. K. Premkumar & party, 15.2.1972.

Diagnosis : Proboscis with Gr. I, 1 ; Gr. II & III, dense rows of small points arranged in comb like fashion ; Gr. IV, wedge shaped cluster ; Cr. V, 1 ; Gr. VI, a single transverse bar ; Gr. VII & VIII, 2-3 irregular rows ; superior lobe of posterior feet large and flattened, with a small cirrus on its upper border ; notosetae homogomph spinigers, neurosetae falcigers with short blades.

Remarks : Occur within cracks and burrows of rocky substratum. The largest specimen measures 130 mm in length and 6 mm in maximum width.

Distribution : India : Andamans ; Marmugao Bay. And widely distributed in circum-tropical region.

***Tylonereis bogoyawlenskyi Fauvel**

1911. *Tylonereis bogoyawlenskyi* Fauvel, *Archile. Zool. Exper. Gen.*, Paris, 6 : 373.

Material : 3 exs., Z. S. I. Reg. No. An 1570/1, sandy beach, Chandipur, S. Biswas & A. Misra, 17.1.1976.

Diagnosis : Proboscis with soft papillae only ; setae all homogomph spinigers ; dorsal ligule triangular and foliaceous, ventral ligule decreasing in size backwards ; anterior notopodium expanded at tip and bifid posteriorly, neuropodium first trilobed then bilobed.

Remarks : Occasionally occur in muddy sands. The largest specimen measures 65 mm in length and 4 mm in maximum width.

Distribution : India : Krusadai Is., Tuticorin, Kilakarai, Pambam back water, Tamil Nadu ; Travancore, Kerala. Also Persian Gulf.

Family NEPHTYIDAE**Nephtys oligobranchia Southern**

1921. *Nephtys oligobranchia* Southern, *Mem. Indian Mus.*, 5 : 610.

Material : 2 exs., Z. S. I. Reg. No. An 1666/1 ; sandy mud, Chandipur ; S. Biswas & A. Misra ; 18.1.1976.

Diagnosis : Gills appear on second foot, fully developed on 6th and then disappearing on 20th ; barred setae restricted to anterior feet replaced by long, slender, capillary setae in middle and posterior ones.

Remarks : Occasionally occur in silty sands. The largest specimen measures 25 mm in length and 1 mm in maximum width.

Distribution : India : Gangetic delta ; Chilka Lake, Orissa ; Visakhapatnam, A. P. ; Cochin Backwater.

Family GLYCERIDAE

Glycera alba (Muller)

1776. *Nereis alba* Muller, *Zoologia Danicae Prodromus popularium* : 217.

Material : 3 exs., Z. S. I. Reg. No. An 1667/1., sandy beach, Kasafal, Chandipur, V. K. Premkumar & party, 23.1.1972.

Diagnosis : Parapodia with two equal, pointed prestal and two unequal blunt postsetal lobes ; branchiae smaller than presetal lobe and starting from 40th foot.

Remarks : One of the actively burrowing polychaetes and quite common in sandy beach. The largest specimen measures 70 mm in length and 25 mm in maximum width.

Distribution : India : Ganjam coast, Orissa ; Cochin backwater ; Marmugao bay. Also Red Sea ; Atlantic Ocean.

Glycera lancadive Schmarda

1861. *Glycera lancadive* Schmarda, *Neue Wirbellose Thiere*, I, p. 95.

Material : 1 ex., Z.S.I. Reg. No. An 1668/1., sandy beach, Puri, G. Ramakrishna & party, 9.2.1975, 14 exs., Z.S.I. Reg. No. An 1590/1, sandy beach, Gopalpur, south of light House, V. K. Premkumar & party, 13.2.1972 ; 12 exs., Z.S.I. Reg. No. An 1669/1, bank of Burabalang river Chandipur, V. K. Premkumar & party, 10.8.1973 ; 20 exs. ; Z.S.I. Reg. No. An 1670/1, sandy beach, Puri, S. Biswas & A. Misra, 21.12.1975.

Diagnosis : Branchiae absent, parapodia with two subequal, pointed presetal lobes and a rounded postsetal one.

Remarks : Actively burrowing polychaetes occur in abundance throughout the sandy beaches. The largest specimen measures 55 mm in length and 4 mm in maximum width.

Distribution : India : Madras coast ; Lakshadweep. Also Burma ; Sir Lanka ; Persian Gulf ; Maldivé Archipelago ; North-east Australia ; New Caledonia, Pacific Ocean.

Glycera rouxi Audouin & Milne-Edwards

1833. *Glycera rouxi* Audouin & Milne-Edwards, *Ann. Sci. Nat.*, 29 : 264.

Material : 4 exs., Z. S. I. Reg. No. An 1671/1, sandy mud, Chandipur, S. Biswas & A. Misra, 17.1.1976,

Diagnosis : Branchiae simple and retractile, parapodia with two equal pointed lobes and two posterior subequal ones.

Remarks : Commonly occur in silty sands. The largest specimen measures 125 mm in length and 3 mm in maximum width.

Distribution : India : Andamans ; Chandipur, Orissa ; Visakhapatnam, A. P. ; Pamban Backwater, Tamil Nadu. Also Persian Gulf ; North Atlantic Ocean ; Mediterranean Sea ; Japan and California (U.S.A.).

Glycera tessellata Grube

1863. *Glycera tessellata* Grube, *Zahlreiche Gattungen*, 29 : 41.

Material : 2 exs., Z. S. I. Reg. No. 1672/1, sandy beach, Gopalpur, V K. Premkumar & party, 30.3.1973 ; 1 ex., Z. S. I. Reg. No. An 1673/1, sandy mud, Chandipur, S. Biswas & A. Misra, 18.1.1976.

Diagnosis : Branchiae absent ; parapodia with two equal, elongated presetal and two shorter, rounded, equal postsetal lobes.

Remarks : Quite common in silty sands. The largest specimen measures 30 mm in length and 2 mm in maximum width.

Distribution : India : Gangetic delta ; Andamans ; Off Puri, Orissa ; Gujarat. Also Pacific and Atlantic Ocean.

Family ONUPHIDAE

***Diopatra cuprea** (Bosc)

1802. *Nereis cuprea* Bosc, *Historie naturelle des vers contenant leur description et leur moeurs avec figures desinees d'apars nature*, Paris, 1 : 142.

Material : 11 exs., Z. S. I. Reg. No. An 1674/1, muddy shore, Burabalang river mouth, Chandipur, S. Biswas & A. Misra, 19.1.1976.

Diagnosis ; Branchiae large with spirally inserted filaments starting from 5th foot, increasing in size and then gradually decreasing to disappear at about 60th foot ; pseudocompound setae hooded and strongly bidented, present on first 4 or 5 setigers, comb setae with 20-25 fine teeth appearing on and from 10th foot.

Remarks : Abundant in muddy estuarine sheltered zones. The largest specimen measures 100 mm in length and 5 mm in maximum width. *D. cuprea* resembles in some respects with *D. neapolitana* which latter differs from the former in possessing unidentate or weakly bidentate pseudocompound setae and comb setae with 5-10 coarse teeth. This species has been reported first to occur at Gangetic delta by Misra *et al* (1984). Day (1960) has rightly stated "it is very probable that many of the records of *D. neapolitana* from the Indian ocean which refer to specimens with bidentate pseudocompound setae and comb setae with numerous teeth really refer to *D. cuprea*."

Distribution : Possibly widely distributed in Indian coast ; tropical Indian Ocean ; tropical western Africa ; Florida (U.S.A.) ; Brazil.

***Onuphis (Onuphis) eremita* Audouin & Milne-Edwards**

1833. *Onuphis eremita* Audouin & Milne-Edwards, *Ann. Sci. Nat.*, **29** : 226.

Material : 9 exs., Z.S.I. Reg. No. An 1637/1, sandy beach, Gandhalba, Konarak, S. Biswas & A. Misra, 29.12.1975.

Diagnosis . Branchiae on first food as simple filament ; tentacular cirri well separated and dorsolaterally situated ; anterior hooded pseudocompound hooks with three teeth, posterior setae include winged capillaries, comb setae, and bidentate acicular setae with guard.

Remarks : Quite common in sandy beach and traditionally used as baits for catching fish. The largest specimen measures 115 mm in length and 4 mm in maximum width.

Distribution : India : Madras coast. Also Sri Lanka ; Indo-China ; Madagascar, Suez-Canal, Atlantic Ocean.

Family LUMBRINERIDAE

***Lumbrineris notocirrata* (Fauvel)**

1932. *Lumbriconereis notocirrata* Fauvel, *Mem. Indian Mus.*, **12** : 156.

Material ; 2 exs., Z.S.I. Reg. No. An 1675/1, sandy mud, Chandipur, S. Biswas & A. Misra, 17.1.1976.

Diagnosis : Dorsal cirri reduced in anterior feet to small knobs, and long in middle and posterior ones, setigerous process with two ligules, anterior short and rounded, posterior long and conical, gradually increasing and becoming erect in middle and posterior feet ; capillaries in all feet and simple hooks starting from the middle region.

Remarks : Very large specimens occurring in estuarine sandy muds. The largest specimen measures 300 mm in length and 6 mm in maximum width.

Distribution : India : Orissa coast ; Vishakhapatnam, A.P.

Lumbrineris polydesma (Southern)

1921. *Lumbriconereis polydesma* Southern, *Mem. Indian Mus.*, 5 : 622.

Material : 14 exs., Z.S.I. Reg. No. An 1676/1, mud beach, Talichua, S. Biswas & A. Misra, 14.1.1976 ; 7 exs., Z.S.I. Reg. No. An 1617/1, sandy mud, Chandipur, V. K. Premkumar & party, 24.1.1972 ; 11 exs., Z.S.I. Reg. No. An 1677/1, sandy mud, Chandipur, S. Biswas & A. Misra, 18.1.1976.

Diagnosis : Dorsal cirri absent, feet with an anterior short, rounded ligule and a posterior longer, conical one not erect ; capillaries in all feet simple hooks starting from 30th foot.

Remarks : Commonly encountered in estuarine muds and sandy muds. The largest specimen measures 175 mm in length and 1 mm in maximum width.

Distribution : India : Gangetic delta ; Chiriyas Is., Chilka Lake, Orissa.

Family SPIONIDAE

***Malacoceros indicus (Fauvel)**

1928. *Scolecopsis indica* Fauvel, *Bull. Mus. Hist. nat. Paris*, 34 : 93.

Material : 3 exs., Z. S. I. Reg. No. An 1678/1, sandy beach, Chandipur, S. Biswas & A. Misra, 17.1.1976.

Diagnosis : Prostomium with lateral peaks and tapering posteriorly ; long cirriform branchiae starting on setiger 1 and continuing upto posterior end, dorsal lamellae lanceolate attached only at base of branchiae, ventral lamellae rounded anteriorly and with a nipple like projection posteriorly ; notosetae capillaries throughout, neurosetae capillaries in anterior feet and hooded hooks in posterior ones.

Remarks : Quite common in silty sands. The largest specimen measures 50 mm in length and 1.5 mm in maximum width.

Distribution : India : Vishakhapatnam, A. P. ; Gulf of Mannar, Tamil Nadu. Also Indo-west-Pacific.

Polydora ciliata (Johnston)

1838. *Leucodora ciliatus* Johnston, *Mag. Zool. Bot. Edinle.*, 2 : 67.

Material : 10 exs., Z. S. I. Reg. No. An 1679/1, muddy beach, Talichua, S. Biswas & A. Misra, 15.1.1976.

Diagnosis : Prostomium slightly notched anteriorly and prolonged back upto setiger 2 ; notosetae absent on first foot, branchiae from setiger 7 to near posterior end ; enlarged hooks of fifth segment stout with an accessory tooth, hooded and bidentate hooks starting in neuropodium of setiger 7.

Remarks : Commonly occur in estuarine muds forming 'U'-shaped burrow. The largest specimen measures 35 mm in length and 1 mm in maximum width.

Distribution : India : Chandipur, Orissa. Also Australia ; Red Sea ; Atlantic Ocean ; Mediterranean Sea ; Falkland Is. (South Atlantic Ocean).

Nerinides sp.

Material : 1 ex., Z. S. I. Reg. No. An 1680/1, sandy beach, Paradip, V. K. Premkumar & party, 29.1.1972.

Description : Prostomium sharply pointed anteriorly and with an erect occipital tentacle posteriorly, eyes two pairs, small ; first setiger small but with both notosetae and neurosetae, branchiae from setiger 2, large, lanceolated and elongated, completely fused to notopodial lamellae in anterior half and a notch appearing between branchiae and lamella from middle which deepens posteriorly, neuropodial lamellae not notched, ear-shaped in anterior and middle part, disappearing in posterior ones ; notosetae winged capillaries throughout, neuropodial capillaries replaced by hooded bidentate hooks posteriorly.

Remarks : The specimen measures 60 mm in length and 1.5 mm in maximum width. The specimen resembles in some respects with *N. gilchrist* Day which latter differs by having flag-shaped middle branchiae, hooded hooks with three denticles above the main fang.

Family OWENIIDAE

Owenia fusiformis Delle Chiaje

1844. *Owenia fusiformis* Delle Chiaje, *Descrizione e notomia degli animali invertebrati della Sicilia catereiore osservati vivi negli anni. 1822-1830*, 81p.

Material : Several, Z. S. I. Reg. No. An 1619/1, sandy beach, Chandipur, S. Biswas & A. Misra, 18.1.1976.

Diagnosis : Tube membranous, strengthened by imbricating sand grains ; prostomium with frilly membrane, thoracic region with three short segments having capillary setae, abdominal region long, with notopodial capillaries and neuropodial rows of minute long-shafted hooks bearing two teeth.

Remarks : Abundant in silty sands in dense colonies within tough tubes imbricated by sand grains. The largest specimen measures 65 mm in length and 1.5 mm in maximum width.

Distribution : India : Orissa coast ; Tuticorin ; Andamans. Also widely recorded from Indian Ocean ; Pacific and Atlantic Ocean ; Mediterranean and Red Sea.

Family TEREHELLIDAE

* *Lanice socialis* (Willey)

1905. *Polymnia socialis* Willey, *Roy. Soc. Rep. on Pearl Oyster Fish., Suppl. Rep.*, 30 : 299.

Material : 2 exs., Z.S.I. Reg. No. An. 1591/1, muddy sand, Chandipur, S. Biswas & A. Mishra, 19.1. 1976.

Diagnosis : Tentacular lobe short and collar-shaped, arborescent gills 3 pairs ; lateral lobes on first three segments ; notosetae with smooth tips, uncini avicular, thoracic ones biserial and opposed back to back posteriorly, abdominal ones uniserial and borne on long pinnules.

Remarks : Occasionally available in muddy tubes projecting above the surface. The largest specimen measures 30 mm in length and 2.5 mm in maximum width.

Distribution : India : Gujarat coast. Also Sri Lanka.

Loimia medusa (Savigny)

1820. *Terebella medusa* Savigny, *Système des annélides, principalement de celles des côtes de l'Égypte et de la Syrie*, ect., 95 pp.

Material : 1 ex., Z.S.I. Reg. No. An 1681/1, sandy beach, Kasafal, Chandipur, V. K. Premkumar & party, 24.1.1972 ; 8 exs., Z.S.I. Reg. No. An. 1682/1, sandy beach, Chandipur, S. Biswas & A. Misra, 19.1.1976.

Diagnosis : Tentacular lobe short and collar-like, branched gills 3 pairs ; lateral lobes on first few segments ; notosetae capillaries with fine tips, uncinni pectiniform with a single vertical series of about 5-6 teeth, in double rows back to back on posterior thorax.

Remarks : Lives in fragile 'U'-shaped sandy tubes projecting both ends above the surface. The largest specimen measures 130 mm in length and 12 mm in maximum width.

Distribution : India : Gangetic delta ; Orissa coast ; Gulf of Mannar ; Andamans. Also Sri Lanka ; Persian Gulf ; California (U.S.A.) ; Japan ; Indo-China ; Red Sea ; Pacific and Atlantic Ocean.

*** *Streblosoma persica* (Fauvel)**

1908. *Grymaea persica* Fauvel, *Bull. Mus. Hist. nat.*, Paris, 14 : 386.

Material : 1 ex. ; Z.S.I. Reg. No. An 1683/1 ; sandy beach, Chandrabhaga marine drive, south of light house, Konarak ; V. K. Premkumar & party ; 11.2.1972.

Diagnosis : Body small, tentacular lobe with transverse rows of eye spots, gills 3 pairs, first with 4-5 filaments, second and third with 2-3 only ; notosetae on first branchiferous segment short, broad winged capillaries with tips, uncini avicular in single rows with several rows of denticles on the vertex, abdominal pinnules produced.

Remarks : Rarely occurring in sandy beaches of the open coast. The specimen measures 45 mm in length and 2.5 mm in maximum width.

Distribution : India : Pambam. Krusadai Is., Gulf of Mannar. Also Persian Gulf ; Tropical Western Africa.

Family SERPULIDAE**** *Hydroides exaltatus* (Marenzeller)**

1884. *Eupomatus exaltatus* Marenzeller, *Denschr. Acad. Wiss.*, Wien, 49 : 217.

Material : 1 ex., Z.S.I. Reg. No. An 1684/1, sandy beach, Chandipur ; S. Biswas & A. Misra, 19.1.1976.

Diagnosis : Operculum funnel-shaped with a crown of 8-9 strong horny spines lacking lateral projections, arising from centre, dorsal spine twice larger than others ; collar-setae bayonet-shaped, thoracic—one winged capillaries and abdominal—one trumpet-shaped.

Remarks : This small tube-dwelling serpulid is very rarely occurring in sandy beaches. The specimen measures 25 mm in length and 1 mm in maximum width.

Distribution : India ; Sri Lanka ; Japan ; Red Sea and Zanzibar.

GENERAL REMARKS

In the *Fauna of India* series, Fauvel (1953) gave about 450 species from the waters in and around India and rightly stated that this was probably half of the total number occurring in these waters. Forty-eight species were recorded from Orissa inshore and offshore waters in the Fauna and the number has now gradually increased to 107 species including 7 undetermined ones (vide list at the end) distributed to 28 families. This is mainly due to the extensive survey of Orissa recently undertaken by the Zoological Survey of India.

From the analysis of the polychaete fauna of Orissa it appears that the family Nereidae is well represented with 22 species which corresponds favourably with the Indian Ocean fauna recently worked out by Hartman (1976). The next largest family is Spionidae with 6 species followed by Polynoidae, Eunicidae, Phyllodocidae, Hesionidae and Glyceridae with 5 species each and then Syllidae, Terebellidae, Onuphidae and Lumbrineridae with 4 species each. Though 6 of the ten large families of Indian Ocean fauna are also available in Orissa water, their very poor representation can not be easily explained.

ACKNOWLEDGEMENTS

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SUMMARY

Twentysix species of polychaetes from Orissa are dealt with, of which 6 form new records from Orissa and one from Indian waters. The paper also includes an up-to-date list of polychaetes so far recorded from coastal and estuarine waters of Orissa with locality records.

REFERENCES

- DAY, J. H. 1960. The polychaete fauna of South Africa. Part 5. Errant species dredged off cape coasts. —*Ann. S. Afr. Mus.*, **45** : 261-373.
- DAY, J. H. 1967. A monograph on the polychaeta of Southern Africa. Pts. I & II. —*Br. Mus. (Nat. Hist.)*, Publ. No. 656 : 1-878.
- FAUVEL, P. 1932. Annelida Polychaeta of the Indian Museum, Calcutta. —*Mem. Indian Mus.*, **12** : 1-262.
- FAUVEL, P. 1953. *Fauna of India, Annelida, Polychaeta* : 1-507.
- HARTMAN, O. 1976. Polychaetous annelids of the Indian Ocean including an account of species collected by members of the International Indian Ocean Expeditions, 1963-1964, and a Catalogue and Bibliography of the species from India. Part II. —*J. Mar. biol. Ass. India*, 1974, **16** (2), 609-644.
- JULKA, J. M. AND RAO, C.A.N. 1976. On a collection of Polychaetes from Mahanadi estuary. —*Newsl. zool. Surv. India*, **2** (2) : 52-53.
- MISRA, A., SOOTA, T. D. AND CHOUDHURY, A. 1984. On some polychaetes from Gangetic delta, West Bengal, India. —*Rec. zool. Surv. India.*, **81** : 41-54.

- NAGABHUSHANAM, A. K. & RAO, G. C. 1969. Preliminary observation on a collection of shore fauna of the Orissa coast, India. —*Proc. zool. Soc.*, Calcutta, **22** : 67-82.
- RAO, C.A.N. 1981. On two new polychaetes (Nereidae : Annelida) from estuarine waters of India. —*Bull. zool. Surv. India*, **3** (3) : 213-217.
- RAO, C. G. 1969. The marine interstitial fauna inhabiting the beach sands of Orissa coast. —*J. zool. Soc. India*, **21** (1) : 89-104.
- RAO, G. C. 1978. On a new species of Hesionides (Polychaeta : Hesionidae) from Orissa coast, India. —*Bull. zool. Surv. India*, **1** (3) : 271-274.
- SOOTA, T. D. & RAO, C.A.N. 1977. On some polychaetes from Orissa coast. —*Rec. zool. Surv. India*, **73** : 327-336.
- SOUTHERN, R. 1921. Polychaeta of the Chilka lake and also of fresh and brackish waters in other parts of India. —*Mem. Indian Mus.*, **5** : 563-659.

APPENDIX : *List of polychaetes from Orissa with locality records*

(The numbers between parentheses besides locality records refer to the references given in foot note).

Species	Locality
Fam. I Aphroditidae	
1. <i>Aphrodita talpa</i> Quatrefages, 1865	Orissa coast (1)
Fam. II Polynoidae	
2. <i>Gattyana deludens</i> Fauvel, 1932	Chandipur (1,3,5), off Paradip (5)
3. <i>Harmothoe dictyophora</i> (Grube, 1878)	Ganjam coast (1)
4. <i>Lepidonotus dictyolepis</i> Haswell, 1883	Puri (3)
5. <i>Lepidonotus jacksoni</i> Kinberg, 1858	Ganjam coast (1)
6. <i>Lepidonotus tenuisetosus</i> (Gravier, 1901)	Off Puri (1) Mahanadi estuary (4)
Fam. III Sigalionidae	
7. <i>Euthalenessa djiboutiensis</i> (Gravier, 1901)	Off Puri (1)
Fam. IV Amphinomidae	
8. <i>Chloeia flava</i> (Pallas, 1766)	Konarak sea coast (9)
9. <i>Chloeia parva</i> Baird, 1870	Chandipur (1)
10. <i>Eurythoe parvecarunculata</i> Horst, 1912	Chilka lake (1) Gopalpur (3) Mahanadi estuary (4)
Fam. V Pisionidae	
11. <i>Pisione complexa</i> Alikunhi, 1947	Puri and Konarak sea coast (6, 9)
12. <i>Pisione gopalai</i> (Alikunhi, 1941)	Puri (9)
13. <i>Pisionidens indica</i> (Aiyar & Alikunhi, 1940)	Puri (9)
Fam. VI Phyllodocidae	
14. <i>Eteone barantollae</i> Fauvel, 1932	Bhitorkanika estuary (3)
15. <i>Eteone flava</i> (Fabricius, 1780)	Puri, Burhabalang river, Chandipur (3)
16. <i>Eteonides elongata</i> (Southern, 1914)	Puri (6, 9)
17. <i>Eulalia (Eumida) sanguinea</i> Oersted, 1843)	Puri (3)
18. <i>Phyllodoce (anaitides) madeirensis</i> Langerhans, 1880	Bhitarkanika estuary (3)

Species	Locality
Fam. VII Hesionidae	
19. <i>Hesione pantherina</i> Risso, 1826	Chilka lake (1)
20. <i>Hesionides arenaria</i> Friedrich, 1937	Puri and Konarak sea coast (6, 9)
21. <i>Hesionides gohari</i> Hartmann-Schroder, 1960	Puri and Konarak Sea coast (6, 9)
22. <i>Hesionides similis</i> Rao, 1978	Gopalpur (7)
23. <i>Microphthalmus urofimbratus</i> Alikunhi, 1943	Puri (9)
Fam. VIII Pilargidae	
24. <i>Ancistrosyllis constricta</i> Southern, 1921	Chilka lake (2)
25. <i>Ancistrosyllis rigida</i> Fauvel, 1919	Orissa coast (1)
26. <i>Talehsapia annandalei</i> Fauvel, 1932	Baitarani river beach, Chandbali and Talichua (3)
Fam. IX Syllidae	
27. <i>Autolytus orientalis</i> Willey, 1905	Chandipur (1)
28. <i>Eusyllis homocirrhata</i> Hartmann-Schroder	Konarak sea coast (6, 9)
29. <i>Exogone</i> sp.	Konarak sea coast (9)
30. <i>Parapionosyllis</i> sp.	Konarak sea coast (6, 9)
31. <i>Petitia amphophthalma</i> Siewing, 1955	Puri and Konarak sea coast (6, 9)
32. <i>Sphaerosyllis bengalensis</i> Rao and Ganapati 1966	Konarak sea coast (6, 9)
33. <i>Sphaerosyllis</i> sp.	Puri (9)
Fam. X Nereidae	
34. <i>Dendronereides heteropoda</i> Southern, 1921	Burhabalang river beach (3) and Chandipur (5)
35. <i>Dendronereis arborifera</i> Peters, 1854	Bitarkanika estuary (3) Chandipur (5)
36. <i>Leonates persica</i> Wesenberg-Lund, 1949	Bhitarkonika estuary (3)
37. <i>Lycastonereis indica</i> Rao, 1981	Baitarani river beach, Chandbali (8)
38. <i>Namalycastis fauveli</i> Rao, 1981	Haripur, Baitarani river beach, Chandbali (8)
39. <i>Namalycastis indica</i> (Southern, 1921)	Bhasra Is. & Kespur, Chilka lake (5) Chilka (2)

Species	Locality
40. <i>Nereis (Neanthes) chilkaensis</i> Southern, 1921	South end of Lake Chilka (1) ; Barkud Is. & Kaligai Is., Lake Chilka (5)
41. <i>Nereis (Neanthes) chingrihatensis</i> Fauvel, 1932	Chandipur (3)
42. <i>Nereis (Neanthes) glandicincta</i> Southern, 1921	Mahanadi estuary (4)
43. <i>Nereis (Neanthes) indica</i> Kinberg, 1866	Mahanadi estuary (4) and Gopalpur (5)
44. <i>Nereis (neanthes) operata</i> Stimpson, 1856	Mahanadi estuary (4)
45. <i>Nereis (Neanthes) succinea</i> Frey and Leuckart, 1847	Mahanadi estuary (4)
46. <i>Nereis (Neanthes) willey</i> Day, 1934	Puri (3)
47. <i>Nereis (Nereis) persica</i> Fauvel, 1911	Gopalpur & Chandipur (5)
48. <i>Nereis</i> sp.	Puri & Konarak sea coast (9)
49. <i>Perinereis aibuhitensis</i> Grube, 1878	Mahanadi estuary (4)
50. <i>Perinereis cultrifera</i> (Grube, 1840)	Mahanadi estuary (4) & Gopalpur (5)
51. <i>Perinereis nigropunctata</i> (Horst, 1924)	Mahanadi estuary (4) & Gopalpur (5)
52. <i>Perinereis nuntia</i> (Savigny, 1818)	Chnadipur (1)
53. <i>Perinereis vancaurica</i> (Ehlers, 1868)	Mahanadi estuary (4)
54. <i>Pseudonereis variegata</i> (Grube, 1857)	Gopalpur (3, 5)
55. <i>Tylonereis bogoyawlenskyi</i> Fauvel, 1911	Chandipur (5).
56. <i>Tylonereis fauveli</i> Southern, 1921	Chilka Lake (2)
Fam. XI Nephtyidae	
57. <i>Nephtys oligobranchia</i> Southern, 1921	Chilka Lake (2) ; Bhitarkanika (3) & Chandipur (5)
58. <i>Nephtys polybranchia</i> Southern, 1921	Chilka Lake (2)
Fam. XII. Glyceridae	
59. <i>Glycera alba</i> (Muller, 1788)	Ganjam coast (1) ; Kasafal, Chandipur (5) & Puri & Konarak sea coast (9)
60. <i>Glycera lancadivae</i> Schmarda, 1861	Gopalpur (3, 5) ; Puri & Chandipur (5) & Puri & Konarak Sea coast (9)

Species	Locality
61. <i>Glycera rouxii</i> Audouin & Milne-Edwards, 1833	Chandipur (1, 5)
62. <i>Glycera tessellata</i> Grube, 1863	Off Puri (1) and Gopalpur & Chandipur (5)
63. <i>Glycinde oligodon</i> Southern, 1921	Chilka Lake (2)
Fam. XIII Onuphidae	
64. <i>Diopatra cuprea</i> (Bosc, 1802)	Chandipur (5)
65. <i>Diopatra neapolitana</i> delle Chiaje, 1841	Chandipur (1, 3) and Puri (9)
66. <i>Onuphis aucklandensis</i> Augner, 1924	Off Puri (1)
67. <i>Onuphis eremita</i> Audouin & Milne-Edwards, 1833	Puri (3, 9) and Gandhalba beach near Konarak (5)
Fam. XIV Eunicidae	
68. <i>Eunice tentaculata</i> Quatrefages, 1865	Puri (9)
69. <i>Eunice</i> sp.	Konarak sea coast (9)
70. <i>Marphysa corallina</i> (Kinberg, 1865)	Gopalpur (3)
71. <i>Marphysa gravelyi</i> Southern, 1921	Chilka lake (2)
72. <i>Marphysa macintoshi</i> Crossland, 1903	Gopalpur (3) & Mahanadi estuary (4)
73. <i>Marphysa mossambica</i> (Peters, 1854)	Mahanadi estuary (4)
74. <i>Marphysa</i> sp.	Puri (9)
Fam. XV Lumbrineridae	
75. <i>Lumbrineris impatiens</i> Claparede, 1868	Ganjam coast (1) & Puri (9)
76. <i>Lumbrineris notocirrata</i> (Fauvel, 1932)	Orissa coast (1) & Chandipur (5)
77. <i>Lumbrineris polydesma</i> (Southern, 1921)	Chiria Is., Chilka Lake (2) Chandipur (3, 5) and Talichuna (5)
78. <i>Lumbrineris simplex</i> (Southern, 1921)	Chilka Lake (2)
Fam. XV Orbiniidae	
79. <i>Scoloplos marsupialis</i> Southern, 1921	Manikpatna Is., Chilka Lake (2)
Fam. XVI Spionidae	
80. <i>Laonice cirrata</i> (Sars, 1851)	Off Puri (1)

Species	Locality
81. <i>Malacoceros indicus</i> (Fauvel, 1928)	Chilka Lake (5)
82. <i>Nerinides</i> sp.	Paradip (5)
83. <i>Polydora (Polydora) ciliata</i> (Johnston, 1838)	Chandipur (1) & Talichua (3, 5)
84. <i>Polydora (Polydora) hornelli</i> Willey, 1905	Chilka lake (2)
85. <i>Prionospio krusadensis</i> Fauvel, 1929	Konarak sea coast (9)
86. <i>Scolecopsis squamata</i> (Muller, 1806)	Konarak sea coast (9)
Fam. XVII Disomidae	
87. <i>Disoma orissae</i> Fauvel, 1932	Off Paradip (1)
Fam. XVIII Chaetopteridae	
88. <i>Phyllochaetopterus socialis</i> Claparede, 1870	Chandipur (1)
Fam. XIX Cirratulidae	
89. <i>Tharyx multifilis</i> Moore, 1909	Baitarani river beach, Hari-pur Chandbali (3)
Fam. XX Opheliidae	
90. <i>Ophelina acuminata</i> Ersted, 1843 (= <i>Ammotrypane aulogaster</i> Rathke, 1843)	Orissa coast (1)
91. <i>Travisia arborifera</i> Fauvel, 1932	Off Puri (1)
Fam. XXI Sternaspidae	
92. <i>Sternaspis scutata</i> (Renier, 1807)	Ganjam coast (1)
Fam. XXII Capitellidae	
93. <i>Heteromastus similis</i> Southern, 1921	Chilka lake (2)
94. <i>Notomastus giganteus</i> Moore, 1906	Off Puri (1)
Fam. XXIII Maldanidae	
95. <i>Euclymene annandalei</i> Southern, 1921	Chilka lake (2)
Fam. XXIV Oweniidae	
96. <i>Myriochele picta</i> Southern, 1921	Chilka lake (2)
97. <i>Owenia fusiformis</i> Delle Chiaje, 1844	Chandipur (3, 5)
Fam. XXV Ampharetidae	
98. <i>Amage bioculata</i> Moore, 1906	Off Puri
99. <i>Amphicteis gunneri</i> (Sars, 1838)	Orissa coast (1)

Species	Locality
Fam. XXVI Terebellidae	
100. <i>Lanice socialis</i> (Willey, 1905)	Chandipur (5)
101. <i>Loimia medusa</i> (Savigny, 1820)	Kasafal near Chandipur and Chandipur (5) ; Puri (9)
102. <i>Streblosoma persica</i> (Fauvel, 1908)	Konarak sea coast (5)
103. <i>Terebellides stroemi</i> Sars, 1835	Ganjam coast (1)
Fam. XXVII Sabellidae	
104. <i>Laonome indica</i> Southern, 1921	Chilka Lake (2)
105. <i>Manayunkia spongicola</i> Southern, 1921	Chilka Lake (2)
Fam. XXVIII Serpulidae	
106. <i>Hydroides exaltatus</i> (Marenzeller, 1884)	Chandipur (5)
107. <i>Serpula vermicularis</i> Linnaeus, 1767	Orissa coast (1)

*1. Fauvel (1932), 2. Southern (1921), 3. Soota & Rao (1977), 4. Julka & Rao (1976), 5. Present paper, 6. Rao (1969), 7. Rao (1979), 8. Rao (1981) and 9. Nagabhushanam & Rao (1969).

TETRIGIDAE : ORTHOPTERA : INSECTA (GROUSE LOCUSTS)

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INTRODUCTION

Walker (1871), Bolivar (1887, 1902 & 1918), Brunner (1893), Hancock (1904, 1907, 1909, 1910, 1912, 1913 & 1915), Kirby (1914), Hebard (1929) and Günther (1938 & 1939) have studied the Indian Tetrigidae. However, there is no detailed reference to the tetrigids from the state of Orissa in their studies. The present work was undertaken to prepare a report on the faunal composition of Tetrigidae from Orissa and the studies are primarily based on the wealth of material collected by various survey parties of Zoological Survey of India, under a special programme to explore the fauna of Orissa and on some of the old collections of the group present in the Survey.

The present report is the first one on the grouse-locusts of Orissa and deals with thirteen species distributed over two subfamilies and seven genera. Eight species marked with asterisks are recorded for the first time from Orissa. *Paratettix tricarinatus* Bolivar is being reported for the first from Indian faunal limites.

SYSTEMATIC ACCOUNT

Order	ORTHOPTERA
Suborder	CAELIFERA
Superfamily	TETRIGOIDEA
Family	TETRIGIDAE

Key to the Genera

1. Posterior angles of lateral lobes of pronotum acutely produced outwards and spined; first segment of posterior tarsi generally longer than the third.	...	2
— Posterior angles of lateral lobes of pronotum rarely acutely spined; first segment of posterior tarsi generally not longer than the third.	...	3

2. Apical margin of posterior tibiae and first segment of posterior tarsi with wide lamellar expansions. ...	<i>Euscelimena</i> Günther
— Apical margin of posterior tibiae and first segment of posterior tarsi not lamellated. ...	<i>Thoradonta</i> Hancock
3. Vertex and eyes obviously raised above the level of pronotum ; antennae inserted between the lower border of eyes. ...	--- 4
— Vertex and eyes very little or not at all raised above the level of the pronotum ; antennae scarcely placed below the middle of eyes. ...	... 5
4. Vertex narrower than an eye and truncate, frontal costa ; arcuately produced between the middle of the eyes ; antennae inserted below the middle of eyes ; median carina of pronotum not undulated ; posterior femora with less conspicuous nodosities on the external pagina. ...	<i>Euparatettix</i> Hancock
— Vertex still narrower than an eye ; antennae inserted distinctly below the inferior margin of eyes ; median carina of pronotum a little or very well undulated ; posterior femora with distinct nodosities on external pagina. ...	<i>Ergatettix</i> Kirby
5. Body generally smooth or a little granulose ; vertex equal to or a little narrower than an eye, generally expanded, subtransverse or triangularly carinated in front ; abbreviated carinae distinctly present ; median carina of pronotum percurrent, not at all interrupted. ...	<i>Hedotettix</i> Bolivar
— Body generally granulose or tuberculose ; vertex not expanded in front ; abbreviated carinae indistinctly present ; median carina of pronotum not percurrent. ...	--- 6
6. Vertex narrower and more narrowed in front ; the frontal carinulae interrupted internally or recurved ; dorsum of pronotum a little rugose, often bearing round or abbreviated line at tubercles ; median carina of pronotum very fine and very or not. ...	<i>Coptotettix</i> Bolivar
— Vertex narrower or equal or rarely wider than an eye, but not narrowed in front, with a concavity on either side ; median carina of pronotum a little raised but not wavy. ...	<i>Paratettix</i> Bolivar

Subfamily (i) SCELIMENINAE

* 1. *Euscelimena harpago* (Serville)

1839. *Tetrix harpago* Serville, *Histoire naturelle des Insectes Orthopteres*, : 763.

1938. *Euscelimena harpago* : Günther, *Mitt. zool. Mus. Berl.*, 23 : 364.

Material examined : 2 ♂♂, 2 ♀♀, Rairakhol, Sambalpur distt., 25 & 27.xii.1971, P. K. Maiti ; 1 ♀, Hirakud Dam, Sambalpur, 5.xi.1972, J. M. Sulka : 1 ♂, 2 ♀♀, Purnakot, Dhenkanal, 1.I.1979, D. P. Sanyal.

Distribution : India : Orissa (as above), Maharashtra, Karnataka, Tamilnadu, Madhya Pradesh, Bihar and Uttar Pradesh ; Sri Lanka.

Remarks : Specimens of this species are commonly found to occur on wet rocks and stones along the sides of streams and pools. Both adults and nymphs are known to feed on mosses and other lower forms of vegetation.

* 2 *Thoradonta apiculata* Hancock

1915. *Thoradonta apiculata* Hancock, *Rec. Indian Mus.*, 11 : 81-82.

Material examined : 1 ♂, Tensa colony, Sundargarh, 14.ix.1972. S. Khera.

Distribution : India : Orissa (as above) Assam, West Bengal & Tamilnadu ; Burma.

Remarks : This species is characterised by the wider vertex and the posteriorly directed spine of upper lobe of posterior angles of lateral lobes of pronotum.

* 3. *Thoradonta pruthii* Günther

1938. *Thoradonta pruthii* Günther, *Stettin. ent. Ztg.*, 99 : 129-130.

Material examined : 2 ♂♂, 1 ♀, Rairakhol, Sambalpur distt., 25 & 27.xii.1971. P. K. Maiti ; 1 ♂, Khasra Forest, Rampur, Sambalpur distt. 26.xii.1971, P. K. Maiti.

Distribution : India : Orissa (as above), Madhya Pradesh & Karnataka.

Remarks : It is characterised by wider vertex and transversely directed spine of upper lobe of posterior angles of lateral lobes of pronotum.

Subfamily (ii) TETRIGINAE

4. *Euparatettix histricus* (Stål)

1860. *Tetrix histrica* Stål, *Freg. Eugenes Resa Orth.*, : 347.

1941. *Euparatettix histricus*, Günther, *Stettin. ent. Ztg.*, 102 : 150.

Material examined : 3 ♂♂, Barkuda Island, Chilka Lake, Ganjam distt., 24.x.1919, N. Annandale, Z.S.I. Regn. Nos. 1671-73 ; 1 ♂, 1 ♀, Bonaigarh,

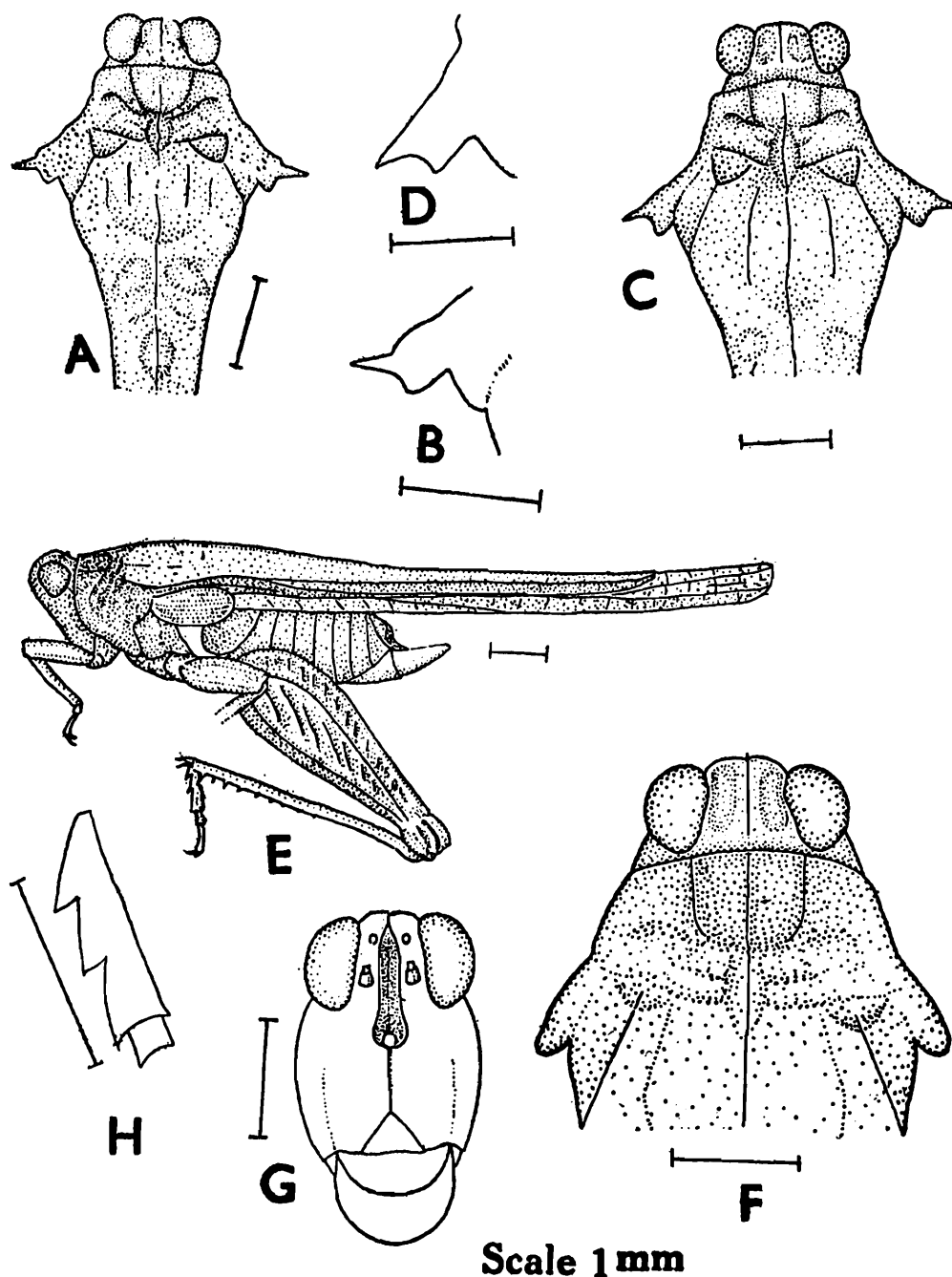


Fig. 1. A. Top view of head and thorax of *Thoradonta pruthii* Günther. B. Posterior angles of lateral lobes of pronotum of *T. pruthii* Günther. C. Top view of head and thorax of *Thoradonta apiculata* Hancock. D. Posterior angles of lateral lobes of *T. apiculata* Hancock. E. Dorso-lateral view of *Hedotettix gracilis* (De Haan). F. Top view of head and thorax of *H. gracilis* (De Haan). G. Front view of *H. gracilis* (De Haan). H. Posterior tarsal segments of *H. gracilis* (De Haan).

Sundargarh distt., 15.xii.1971, P. K. Maiti ; 1 ♀, Bhabani Hill, Sundargarh distt., 15.vii.1971, P. K. Maiti ; 1 ♂, 1 ♀, Dhanupali, Sambalpur, 22.xii.1971, P. K. Maiti ; 1 ♀, Sambalpur, 25.xii.1971, P. K. Maiti ; 1 ♀, Rairakhol, Sambalpur distt., 27.xii.1971, P. K. Maiti ; 3 ♂♂, 3 ♀♀, Hatisalpara, Bolangir, 30.xii.1971, P. K. Maiti ; 1 ♀, Salapali, Bolangir, 1.i.1972, P. K.

Maiti ; 6♂♂, 1♀, Gaundrial village, Bolangir, 2.i.1972, *P. K. Maiti* ; 2♂♂, Subulia Khasra Forest, Sundarga, 10.i.1972, *P. K. Maiti* ; 1♂, 3♀♀, Circuit House, Keonjhargarh, Keonjhar distt., 20 & 23.ix.1972, *K. Rai* ; 1♂, Dhenkanal, 5.x.1972, *K. Rai* ; 1♂, Sambalpur (at light), 6.xi.1972, *J. M. Julka* ; 2♂♂, Bolangir (at light), 6.xi.1972, *J. M. Julka* ; 2♂♂, Joshipur Clay Mines, 12.xi.1972, *J. K. Sen* ; 1♀, Dhenkanal, 28.xi.1972, *T. K. Sen* ; 1♂, Taptapani, Ganjam distt., 14.iii.1974, *R. K. Kacker* ; 1♂, Nandankanan, Cuttack, 24.iii.1974, *R. K. Kacker*.

Distribution : India : West Bengal, Meghalaya, Bihar, Orissa (as above and Puri) and Tamilnadu ; Sri Lanka ; Kalimantan ; Andalus ; Philippines ; Java ; Malaya Islands ; N. Caledonia ; N. Australia.

Remarks : A very common species found throughout India. It is characterised by its larger size, a little exserted head, convex dorsum and less elevated median carina on shoulders.

* 5. *Euparatettix personatus* (Bolivar)

1887. *Paratettix personatus* Bolivar, *Annls Soc. ent. Belg.*, **31** : 278.

1904. *Euparatettix personatus*, Hancock, *Spolia zeylan.*, **2** : 145.

Material examined : 1♂, Bonaigarh, Sundargarh distt., 13.xii.1971, *P. K. Maiti* ; 1♂, Bhabahi Hill, Sundargarh distt., 15.xii.1971, *P. K. Maiti* ; 1♂, Dhanupali, Sambalpur, 22.xii.1971, *P. K. Maiti* ; 1♂, Salapali, Bolangir, 1.i.1972, *P. K. Maiti* ; 1♂, Jharsuguda, Sambalpur distt., 7.i.1972, *P. K. Maiti*, 1♀, 10.i.1972, *P. K. Maiti*, 3♂♂, Bishalvari Reserve Forest, Sundargarh, 9.i.1972, *P. K. Maiti*, 3♂♂, Subulia Khasra Forest, Sundargarh, 10.i.1972, *P. K. Maiti*.

Distribution : India : Throughout India ; Sri Lanka ; Burma ; Philippines ; Java.

Remarks : It is closely related with *Euparatettix histricus* (Stål). The inferior surface of hind femur and the apical one third part of hind tibiae are dark brown.

*6. *Paratettix tricarinatus* (Bolivar)

1887. *Paratettix tricarinatus* Bolivar, *Annls Soc. ent. Belg.*, **31** : 282.

Material examined : 1♂, Barkuda Island, Chilka Lake, Ganjam distt., 1-6.ix.1919, *N. Annandale*, Z. S. I. Regn. No. 1655/H2 ; 1♀, Dhanupali, Sambalpur, 22.xii.1971, *P. K. Maiti* ; 1♂, Rampur, Sambalpur distt., 26.xii.1971, *P. K. Maiti* ; 1♂, Rairakhol, Sambalpur distt., 27.xii.1971, *P. K. Maiti* ; 1♂, Sundimundi village, Rairakhol, Sambalpur distt., 28.xiii.1971, *P. K.*

Maiti ; 5 ♂♂, 3 ♀♀, Hatisalpara, Bolangir, 30.xii.1971, *P. K. Maiti* ; 5 ♂♂, 1 ♀, Gaundrial village, Bolangir, 2.i.1972, *P. K. Maiti* ; 3 ♂♂, 1 ♀, Bolangir, 3.i.1972, *P. K. Maiti* ; 3 ♂♂, 1 ♀, Jharsuguda, Sambalpur distt., 7.i.1972, *P. K. Maiti* ; 1 ♂, 1 ♀, Subulia Khasra Forest, Sundargarh, 10.i.1972, *P. K. Maiti* ; 1 ♀, P.W.D. Bunglow, Dhenkanal, 5.x.1972, *K. Rai* ; 1 ♂, Sundargarh, 24.x.1972, *J. M. Julka* ; 2 ♂♂, 1 ♀, Bolangir (at light), 9 & 11.xi.1972, *J. M. Julka* ; 1 ♂, 1 ♀, Joshipur Clay Mines, 12.xi.1972, *J. K. Sen* ; 1 ♀, Titlagarh, Bolangir distt., 14.xi.1972, *J. M. Julka* ; 2 ♀♀, Cuttack, 16.i.1974, *S. Biswas* ; 1 ♀, Purnakot, Dhenkanal, 1.i.1976, *D. P. Sanyal*.

Distribution : India : Orissa (as above) ; Philippines.

Remarks : Zoological Survey of India has several examples of this species. These examples were collected from Andaman Islands and were identified by late Dr. Klaus Günther. However, it is recorded here for the first time from India.

*7. *Paratettix cingalensis* (Walker)

1871. *Tetrix cingalensis* Walker, *Cat. Derm. Salt. Brit. Mus.*, 5 : 827.

1914. *Paratettix cingalensis* : Kirby, *Fauna Brit. India, Orth. (Acridiidae)*, : 63.

Material examined : 1 ♀, Barkuda Island, Chilka Lake, Ganjam distt., 8.ix.1920, *N. Annandale*, Zoological Survey of India, Z. S. I. Regn. No. 6864/H2 ; 1 ♂, Barkuda Island, Chilka Lake, *C. Dover*, Z. S. I. Regn. No. 6865/H2 ; 1 ♂, near Tarini Devi Temple, Ghatgaon, Keonjhar distt., 19.viii.1972, *S. K. Mitra* ; 1 ♂, Inspection Bunglow, Angul, Dhenkanal distt., 30.ix.1972, *K. Rai*.

Distribution : India : Tamilnadu, Kerala, Maharashtra, and Madhya Pradesh ; Sri Lanka ; Taiwan ; Hainan ; Kalimantan ; Andalus ; Malaya ; Mindanao. It is also studied from Karnataka in India.

Remarks : Two examyles (1 ♂ & 1 ♀) collected from Barkuda Island, as stated above and identified by L. Chopard as *Mazarredia cristulata* Bolivar were examined and found to be *Paratettix cingalensis* (Walker).

*8. *Coptotettix conspersus* Hancock

1915. *Coptotettix conspersus* Hancock, *Rec. Indian Mus.*, 11 : 119.

Material examined : 1 ♂, Bhabani Hill, Sundargarh distt., 15.xii.1971, *P. K. Maiti*.

Distribution : India : Assam, West Bengal and Uttar Pradesh ; Sri Lanka.

Remarks : Median carina of pronotum distinct, interrupted and with clear depressions.

9. *Coptotettix fossulatus* Bolivar

1887. *Coptotettix fossulatus* Bolivar, *Annls Soc. ent. Belg.*, **31** : 188, 287-8.

1914. *Coptotettix fossulatus* : Kirby, *Fauna Brit. India, Orth. (Acridiidae)*, : 76.

Material examined : 1 ♀, Balugaon, Puri distt., 12-30.vii.1913, N. Annandale, Z. S. I. Regn. No. 2189/20 ; 1 ♀, near Dayarsani Temple and Bangriposi Inspection Bungalow, Bisoi, Mayurbhanj distt., 13.vii.1972, S. K. Mitra.

Distribution : India : Orissa ; Sri Lanka.

Remarks : The specimen collected from Bisoi is slightly larger in size than the others. One example, which is registered in the National Collection under the name of *Coptotettix parvulus* Hancock bears the following labels : "*Coptotettix parvulus* Hancock ; Balugaon, Puri distt., 21-30.vii.1918, N. Annandale ; Z. S. I. Regn. No. 2188/20". This specimen was examined and found to be a nymph of *Coptotettix fossulatus* Bolivar.

10. *Hedotettix gracilis* (De Haan)

1842. *Acridium (Tetrix) gracile* De Haan, *Temminck, Verhandel., Orth.*, : 167.

1914. *Hedotettix gracilis* : Kirby, *Fauna Brit. India, Orth. (Acridiidae)*, : 72.

Material examined : 1 ♀, Barakuda Island, Chilka Lake, Ganjam dist., Sept. 1920, N. Annandale, Z.S.I. Regn. No. 6867/H2 ; 1 ♀, Baripada, Mayurbhanj distt., 14.xii.1955, T. G. Vazirani ; 2 ♀ ♀, Panposh, Raurkela, Sundargarh distt., 8.xii.1971, P. K. Maiti ; 1 ♂, (nymph), 4 ♀ ♀, Chhner village, Panposh, Raurkela, Sundargarh distt., 11.xii.1971, P. K. Maiti ; 3 ♂ ♂, 4 ♀ ♀, Bonaigarh, Sundargarh distt., 13-17.xii.1971, P. K. Maiti ; 1 ♀, Mahanadi Rivier Bed, Sambalpur, 19.xii.1971, P. K. Maiti ; 3 ♂ ♂, 1 ♀, Dhanupali village, Sambalpur, 22.xii.1971, P. K. Maiti ; 2 ♀ ♀, Khasra Forest, Rampur, Sambalpur district., 26.xii.1971, P. K. Maiti ; 1 ♂, Rairakhol, Sambalpur distt., 27.xii.1971, P.K. Maiti ; 4 ♂ ♂, 3 ♀ ♀, Hatisalpara, Bolangir, 30.xii.1971, P. K. Maiti ; 3 ♂ ♂, 1 ♀, Salapali, Bolangir, 1.i.1972, P. K. Maiti ; 1 ♂, Gaundrial village Bolangir, 2.i.1972, P. K. Maiti ; 1 ♀, Engineering college campus, campus, Jharsuguda, Sambalpur distt., 7.i.1972, P. K. Maiti ; 1 ♂, Bishalvari Research Forest, Sundargarh distt., 9.i.1972, P. K. Maiti ; 1 ♂, 4 ♀ ♀, Subulia Khasra Forest, Sundargarh, 10.i.1972, P. K. Maiti ; 1 ♀, Ansupa Lake area, Cuttack, 29.viii.1972, S. K. Mitra ; 3 ♀ ♀, Katra, Bangriposi, Mayurbhanj distt., 15 & 16.ix.1972, K. Rai ; 4 ♂ ♂, 7 ♀ ♀, Circuit House, Keonjhargarh, Keonjhar distt., 20 & 26.ix.1972, K. Rai ; 1 ♀, Bankapatuli, Keonjhargarh, Keonjhar distt., 23.ix.1972, K. Rai ; 2 ♀ ♀, Silwan, Keonjhargarh, Keonjhar distt., 25.ix.1972, K. Rai ; 1 ♀, Sambalpur, 26.ix.1972, S. Khera ; 1 ♀, Soras, Keonjhargarh, Keonjhar distt., 26.ix.1972, K. Rai ; 11 ♂ ♂, 4 ♀ ♀, Inspection Bungalow, Angul, Dhenkanal distt., 29 & 30.ix.1972, K. Rai ; 8 ♂ ♂, 6 ♀ ♀, P.W.D. Bungalow, Bolangir, 30.ix.1972, S. Khera ;

8 ♂♂, 4 ♀♀, P.W.D. Bunglow, Dhenkanal, 5.x.1972, *K. Rai*; 2 ♀♀, Sundargarh (at light), 23.x.1972, *J. M. Julka*; 1 ♂, 1 ♀, Sambalpur (at light), 3 & 6.xi.1972, *J. M. Julka*; 1 ♂, 3 ♀♀, Bolandgir (at light), 9—11.xi.1972, *J. M. Julka*; 1 ♀, Joshipur Clay Mines, 12.x.1972, *J. K. Sen*; 1 ♀, Atei Reserve Forest, Keonjhar distt., 31.iii.1973, *S. K. Gupta*; 1 ♀, Bhagwanpur, 2 Kms east of Nandankanan, 24.iii.1974, *R. K. Kacker*; 1 ♀, Biological garden, Nandankanan, 25.iii.1974, *R. K. Kacker*.

Distribution : India : (Throught India); Burma; Sri Lanka; Bangladesh; Andalus; Celebes; Vietnam; Taiwan; Thailand; Java.

Remarks : Both male and female specimens of this species show dimorphism in the length of pronotum and wings. The microform specimens generally have the raised median carina of pronotum. In one case the macroform specimen has white longitudinal lines on the pronotum. Sometimes one narrow, dark brown oblique spot is present on either side in front, or behind, or both in front and behind the shoulders. In some specimens the hind femur has dark brown oblique spots on the superior margin.

11. *Hedotettix attenuatus* Hancock

1904. *Hedotettix attenuatus* Hancock, *Spolia zeylan.*, 2 : 108.

Material examined : 2 ♂♂, 1 ♀, Sur Lake, near Puri, 19.viii.1911, *N. Annandal* and *F. H. Gravely*, Z.S.I. Regen. Nos. 1361/20 and 1394/20; 3 ♂♂, Konarak, Puri, 15 & 18.iii.1973, *V. K. Permkumar*.

Distribution : India : Orissa & Assam; Sri Lanka.

Remarks : This species is very close to the preceding-one and can be differentiated from it by its slender body, narrow vertex and narrowly sulcate frontal costa.

12. *Ergatettix dorsifera* (Walker)

1871. *Tettix dorsifera* Walker, *Cat. Derm. Salt. Brit. Mus.*, 5 : 825.

1929. *Ergatettix dorsifera* : Hebard, *Revue suisse Zool.*, 36 : 588.

Material examined : 2 ♀♀, Angul, Dhenkanal distt., 30.xi to 2.xii.1955, *T. G. Vazirani*; 1 ♀, Balasore, 1.xii.1955, *T. G. Vazirani*; 1 ♀, Panposh, Raurkela, Sundargarh distt., 8.xii.1971, *P. K. Maiti*; 1 ♂, 1 ♀, Dhanupali village, Sambalpur, 20.xii.1971, *P. K. Maiti*; 1 ♂, Khasra Forest, Rampur, Sambalpur distt., 26.xii.1971, *P. K. Maiti*; 3 ♂♂, Hatisalpara, Bolangir, 30.xii.1971, *P. K. Maiti*; 1 ♀, Barsuan, Raurkela, Sundargarh distt., 13.ix.1972, *S. Khera*; 1 ♀, Bangriposi, Mayurbhanj distt., 13.ix.1972, *K. Rai*; 1 ♀, Jhar-suguda, Sambalpur distt., 18.ix.1972, *S. Khera*; 1 ♀, Circuit House, Keonjhar-garh, Keonjhar distt., 20.ix.1972, *K. Rai*; 1 ♀, Ranibagicha, Sundargarh,

21.ix.1972, *S. Khera* ; 1 ♂, Barahal, Keonjhar, Keonjhar distt., 25.ix.1972, *K. Rai* ; 2 ♂♂, P.W.D. Bunglow, Dhenkanal, 5.x.1972, *K. Rai* ; 7 ♂♂, 9 ♀♀, Sundargarh, 23 & 24.x.1972, *J. M. Julka* ; 1 ♂, Rajbari, Sundargarh, 26.x.1972, *S. Khera* ; 2 ♂♂, Sundargarh (at light), 6.xi.1972, *J. M. Julka* ; 23 ♂♂, 14 ♀♀, Bolangir (at light), 9.xi.1972, *J. M. Julka* ; 3 ♂♂, Titlagarh, Bolangir, 14.xi.1972, *J. M. Julka* ; 1 ♂, Cuttack, 16.i.1974, *S. Biswas*.

Distribution : India : Maharashtra, Uttar Pradesh, Orissa, West Bengal, Assam, Bihar, Madhya Pradesh, Tamilnadu and Karnataka ; Burma ; Nepal ; Bangladesh ; Sri Lanka ; Java ; Andalus.

Remarks : Female specimens have prominent undulated median carina of pronotum. In all the specimens, one dark brown band is present on each side behind the shoulders, which may or may not join the band of opposite side. Sometimes the whole shoulders including the front part is covered with dark brown colour, and the dark brown band here becomes more deeper in colouration.

13. *Ergatettix guntheri* Steinmann

1912. *Euparatettix nodulosus* Hancock, *Mem. Dep. Agric. India, ent. Ser.*, 4 : 155.

1970. *Ergatettix guntheri* : Steinmann, *Acta zool. hung.*, 16 : 234.

Material examined : 1 ♂, Puri, 20-21.i.1908, Museum Collection, Z. S. I. Regn. No. 56/17 ; 1 ♀, Balassore, 1.xii.1955, *T. G. Vazirani* ; 1 ♂, Angul, Dhenkanal distt., 30.xi to 2.xii.1955, *T. G. Vazirani* ; 1 ♂, 1 ♀, Chhner village, Panposh, Raurkela, Sundargarh distt., 11.xii.1971, *P. K. Maiti* ; 1 ♀, Bonai-garh, Sundargarh distt., 13.xii.1971, *P. K. Maiti* ; 2 ♀♀, Dhanupali village, Sambalpur, 22.xii.1971, *P. K. Maiti* ; 1 ♂, Haldinallah & vicinity, Sambalpur, 27.xii.1971, *P. K. Maiti* ; 3 ♀♀, Rairakhol, Sambalpur distt., 27.xii.1971, *P. K. Maiti* ; 1 ♂, Sundimunda village, Rairakhol, Sambalpur distt., 28.xii.-1971, *P. K. Maiti* ; 2 ♂♂, 3 ♂♀, Hatisalpara, Bolangir, 30.xii.1971, *P. K. Maiti* ; 1 ♂, 1 ♀, Salapali, Bolangir, 1.i.1972, *P. K. Maiti* ; 3 ♂♂, 3 ♀♀, Gaundrial village, Bolangir, 2.i.1972, *P. K. Maiti* ; 1 ♂, 1 ♀, Sundargarh, 10.i.1972, *P. K. Maiti* ; 2 ♂♂, Subulia Khasra Forest, Sundargarh, 10.i.1972, *P. K. Maiti* ; 1 ♂, Balijuri village, Sundargarh, 11.i.1972, *P. K. Maiti* ; 2 ♀♀, Baripada, Mayurbhanj distt., 5 & 9.viii.1972, *S. K. Mitra* ; 2 ♂♂, 1 ♀, Angul, Dhenkanal distt., 30.ix.1972, *K. Rai* ; 2 ♂♂, 6 ♀♀, Sundargarh, 23, 24 & 28.x.1972, *J. M. Julka* ; 3 ♂♂, 2 ♀♀, Sambalpur (at light), 3 & 6.xi.1972, *J. M. Julka* ; 3 ♂♂, 3 ♀♀, Bolangir, 9.xi.1972, *J. M. Julka* ; 1 ♀, Joshipur Clay Mines, 12.xi.1972, *J. K. Sen* ; 2 ♂♂, 1 ♀, Titlagarh, Bolangir, 14.xi.1972, *J. M. Julka* ; 1 ♀, Biol. Fishery Research Unit Campus, Balugaon (Puri), 18.iii.1974, *R. K. Kacker*.

Distribution : India : Uttar Pradesh, Bihar, Orissa (as above and Puri), West Bengal, Maharashtra ; Sri Lanka.

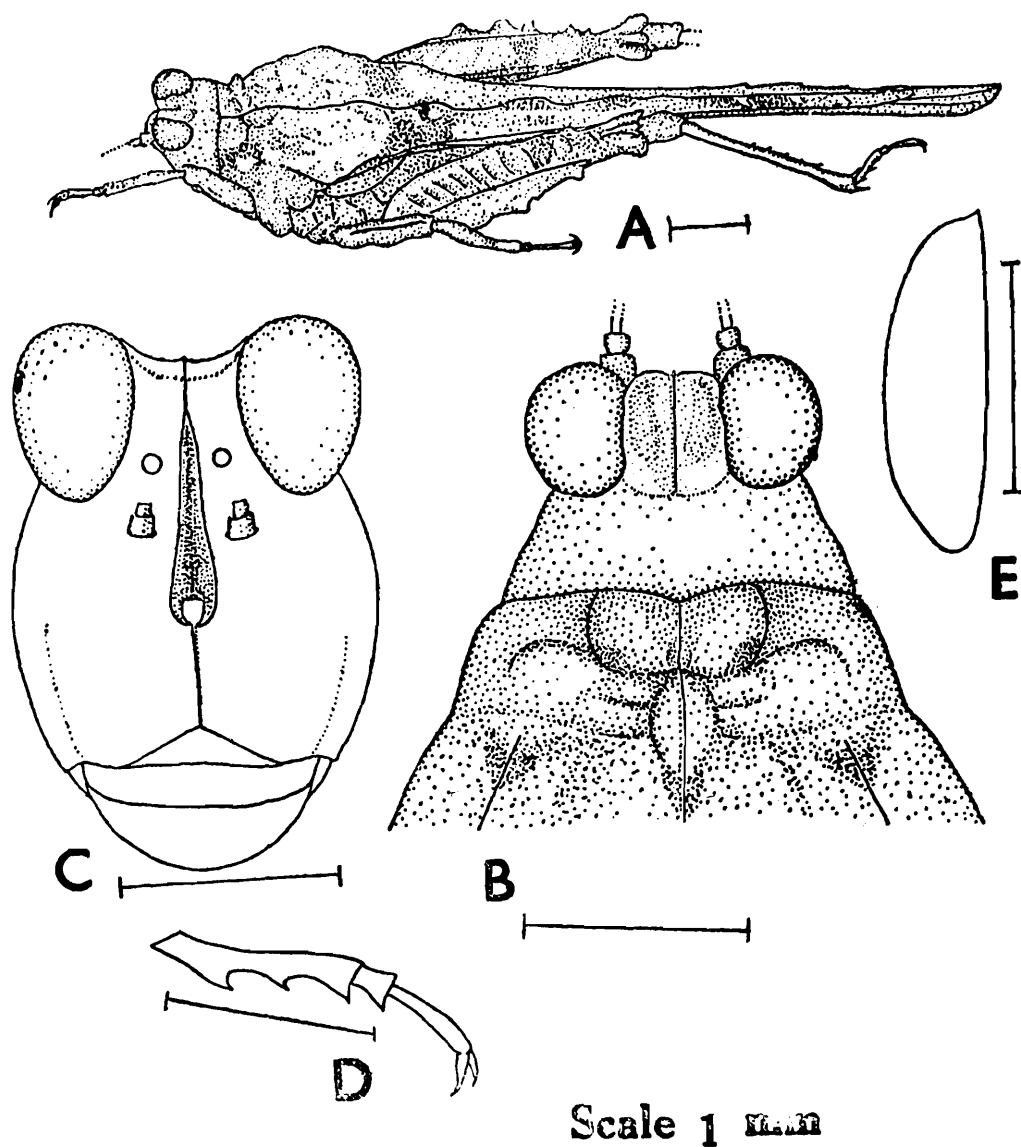


Fig. 2. A. Dorso-lateral view of *Ergatettix guntheri* Steinmann. B. Top view of head and thorax of *E. guntheri* Steinmann. C. Front view of head of *E. guntheri* Steinmann. D. Posterior tarsal segments of *E. guntheri* Steinmann. E. Tegmen of *E. guntheri* Steinmann.

Remarks : It is closely related to the preceding species. In some examples the pronotum is dark brown except the middle part of the shoulder.

SUMMARY

Thirteen species of tetrigids are reported here. Eight species are being recorded for the first time from Orissa, and one species is being reported for the first time from India. The distributional records of the species are also given.

ACKNOWLEDGEMENTS

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REFERENCES

- BOLIVAR, I. 1887. Essai sur les Acridiens de la tribu des Tettigidae. *Annls Soc. ent. Belg.*, **31** : 175-313.
- BOLIVAR, I. 1902. Les Orthopteres de St. Joseph's College, a Trichinopoly (Sud de l' Inde). 3e partie. *Annls Soc. ent. Fr.*, **70** : 580-634.
- BOLIVAR, I. (1917) 1918. Contribucion al conocimiento de la fauna indica Orthoptera (Locustidae vel Acrididae). *Revta R. Acad. cienc. exact. fis. nat. madr.*, **16** : 278-289.
- BRUNNER VON WATTENWYL, C. 1893. Revision du systeme des Orthopters. *Annali Mus. civ. Stor. nat. Giacomo Doria*, **33** : 6-230.
- GÜNTHER, K. 1938a. Revision der Acrydiinae I Sectiones Tripetalocerae, Discotettigiae, Lophotettigiae, Cleostratae, Bufonidae, Cladonotae, Scelimeniae Verae. *Mitt. zool. Mus. Berl.*, **23** : 299-437.
- GÜNTHER, R. 1938b. Revision der Acrydiinae (Orth.) II Scelimenae spuriae. *Stettin. ent. Ztg.*, **99** : 117-148, 161-230.
- GÜNTHER, K. 1939. Revision der Acrydiinae (Orthoptera) III Section Amorphi (Metrodora Bolivar, 1887, aut.). *Abh. Ber. Mus. Tierk. Volkerk. Dresden*, **20** (A) Zool. (N. F.) BDI : 16-355.
- HANCOCK, J. L. 1904. The Tetrigidae of Ceylon. *Spolia zeylan.*, **2** : 97-157.
- HANCOCK, J. L. 1907. Studies of the Tetriginae in the Oxford University Museum. *Trans. R. ent. Soc. Lond.*, 1907, : 213-244.
- HANCOCK, J. L. 1909. Further studies of the Tetriginae in the Oxford University Museum. *Trans. R. ent. Soc. Lond.*, 1908, : 387-426.
- HANCOCK, J. L. 1910. Third paper on the Tetriginae in the Oxford University Museum. *Trans. R. ent. Soc. Lond.*, 1910, : 346-365.
- HANCOCK, J. L. 1912. Tetriginae (Acridiinae) in the Agricultural Research Institute, Pusa, Bihar, with the descriptions of new species. *Mem. Dep. Agric. India ent. Ser.*, **4** (No. 2) : 151-160.
- HANCOCK, J. L. 1913. Zoological results of the Abor Expedition, Orthoptera. *Rec. Indian Mus.*, **8** : 311-316.

- HANCOCK, J. L. 1915. Indian Tetriginæ. *Rec. Indian Mus.*, **11** : 55-132.
- HEBARD, M. 1929. Acrydiinæ (Orthoptera, Acrididae) of Southern India. *Revue suisse Zool.*, **36** : 565-592.
- KIRBY, W. F. 1914. *The fauna of British India, including Ceylon and Burmah. Orthoptera (Acrididae)*. ix+276 pp.
- WALKER, F. 1871. *Catalogue of the specimens of Dermaptera and Saltatoria in the British Museum part V. Tettigidae and supplements to earlier parts* : 811-850.

INSECTA : ISOPTERA (A CHECK-LIST)

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INTRODUCTION

Besides Silvestri (1923), who worked out the Isoptera (Termites) of a small island i. e., Barkuda Island in the Chilka Lake, there had been no consolidated work on the termite fauna of the state of Orissa until we (1982) worked out the Orissa survey collections and reported the occurrence of 31 species belonging to the families Kalotermitidae, Rhinotermitidae and Termitidae and also discussed distribution of these insects in the four natural divisions of the state.

This present check-list of termites of Orissa, giving district-wise distribution of species has been prepared at the suggestion of Dr. B. K. Tikader, Director and Dr. O. B. Chhotani, Scientist 'D' so that the information on Orissa termites is also available in this particular volume on the fauna of Orissa, India.

A CHECK-LIST OF ORISSA TERMITES

Family I. KALOTERMITIDAE

1. *Bifiditermes pinto* (Kemner)

1932. *Kalotermes pinto* Kemner, *Ent. Tidsk.*, 53 (2-3) : 143-146.

Distribution : India : Orissa : Barkuda Island, Chilka Lake, Ganjam District. Also Sri Lanka.

2. *Cryptotermes dudleyi* Banks

1918. *Cryptotermes dudleyi* Banks, *Bull. Am. Mus. nat. Hist.*, 38 (Art. 17) : 660-661.

Distribution : India : Orissa (Barkuda Island, Chilka Lake, Ganjam District), West Bengal, Andaman and Nicobar Islands, Kerala, Goa. Also widely distributed in Oriental, Australian, Papuan, Ethiopian and Neotropical zoogeographical regions. For details vide Chhotani, 1970.

Family II. RHINOTERMITIDAE

3. *Coptotermes heimi* (Wasmann)

1902. *Arrhinotermes heimi* Wasmann, *Zool. Jb. Syst.*, 17 (1) : 104.

Distribution : India : Orissa (Ganjam, Puri, Cuttack, Sambalpur, Sundargarh, Bolangir and Balasore Districts). Widely distributed throughout India, Pakistan and Bangladesh. For details vide Roonwal and Chhotani, 1962.

4. *Coptotermes travians* Haviland

1898. *Termes* (*Coptotermes*) *travians* Haviland, *J. Linn. Soc. Lond. (Zool.)*, **26** (169) : 391-392.

Distribution : India : Orissa (Puri District), Assam, West Bengal. Also Bangladesh, Burma, Malayasia, Singapore and Indonesia (Java, Sumatra). For details vide Roonwal and Chhotani 1962.

5. *Heterotermes balwanti* Mathur & Chhotani

1969. *Heterotermes balwanti* Mathur & Chhotani, *J. Timb. Dev. India*, **15** (4) : 5-8, 10.

Distribution : India : Orissa (Puri and Ganjam Districts), Goa.

Family III. TERMITIDAE

6. *Speculitermes cyclops* Wasmann

1902. *Speculitermes cyclops* Wasmann, *Zool. Jb. Syst.*, **17** (1) : 160-162.

Distribution : India : Orissa (Mayurbhanj District), Assam, Madhya Pradesh, Maharashtra, Rajasthan, Uttar Pradesh. Burma record needs confirmation.

7. *Speculitermes sinhalensis* Roonwal & Sen-Sarma

1960. *Speculitermes cyclops sinhalensis* Roonwal & Sen-Sarma, *Contr. Syst. Orient. Termites* (ICAR Ent. Monogr. 1) : 23-26.

Distribution : India : Orissa (Puri and Mayurbhanj Districts), Madhya Pradesh, Tamil Nadu, Karnataka. Also Sri Lanka.

8. *Eurytermes assmuthi assmuthi* Wasmann

1902. *Eurytermes assmuthi* Wasmann, *Zool. Jb. Syst.* **17** : 124-125.

Distribution : India : Orissa (Barkuda Isl., Chilka Lake, Ganjam District), Maharashtra, Madhya Pradesh.

9. *Eurytermes assmuthi modestior* Silvestri

1923. *Eurytermes assmuthi modestior* Silvestri, *Rec. India Mus.*, **25** : 228-229.

Distribution : India : Orissa (Barkuda Isl., Chilka Lake, Ganjam District).

10. *Microcerotermes annandalei* Silvestri

1923. *Microcerotermes annandalei* Silvestri, *Rec. Indian Mus.*, **25** : 225-228.

Distribution : India : Orissa (Ganjam, Puri and Mayurbhanj Districts).

11. Microcerotermes beelsoni Snyder

1933. *Microcerotermes beelsoni* Snyder, *Proc. U. S. natn. Mus.*, **82** (16) : 12-14.

Distribution : India : Orissa (Sundargarh District), Uttar Pradesh, Madhya Pradesh, Haryana, Delhi, Punjab. Also Pakistan.

12. Angulitermes ramanii Bose and Das

1982. *Angulitermes ramanii* Bose and Das, *Rec. zool. Surv. India*, **80** : 198, 203-205.

Distribution : India : Orissa (Barkuda Isl., Chilka Lake, Ganjam, District).

13. Dicuspiditermes obtusus (Silvestri)

1923. *Capritermes obtusus* Silvestri, *Rec. Indian Mus.*, **25** : 229-232.

Distribution : India : Orissa (Barkuda Isl., Chilka Lake, Ganjam District), Madhya Pradesh.

14. Macrotermes convulsionarius (König)

1779. *Termes convulsionarii* König, *Beschaft. Berlin Ges. Naturf. Freunde*, **4** : 24.

Distribution : India : Orissa (Ganjam District), Tamil Nadu, Kerala, Karnataka. Also Sri Lanka. For detailed distribution, see Bose, 1984.

15. Odontotermes assmuthi Holmgren

1913. *Odontotermes (Odontotermes) assmuthi* Holmgren, *J. Bombay nat. Hist. Soc.*, **22** (1) : 112-113.

Distribution : India : Orissa (Mayurbhanj, Keonjhar, Sambalpur and Ganjam Districts) and all over India. Also Pakistan and Bangladesh. Thakur, 1981 for detailed distribution.

16. Odontotermes bellahunisensis Holmgren & Holmgren

1917. *Odontotermes (Cyclotermes) bellahunisensis* Holmgren & Holmgren, *Mem. Dep. Agric. India (Ent.)*, **5** (3) : 150-151.

Distribution : India : Orissa (Mayurbhanj, Keonjhar, Cuttack and Puri Districts), Karnataka, Rajasthan, Tamil Nadu,

17. Odontotermes brunneus (Hagen)

1858. *Termes brunneus* Hagen, *Linn. Ent.*, **12** : 183-186.

Distribution : India : Orissa (Ganjam and Kalahandi Districts), Andhra Pradesh, Bihar, Karnataka, Maharashtra, Rajasthan, Tamil Nadu.

18. *Odontotermes ceylonicus* (Wasmann)

1902. *Termes ceylonicus* Wasmann, *Zool. Jb. Syst.*, **17** (1) : 112-113.

Distribution : India : Orissa (Kalahandi District). Peninsular India and also Sri Lanka.

19. *Odontotermes feae* (Wasmann)

1896. *Termes feae* Wasmann, *Annali Mus. civ. Stor. nat. Genova*, (2) **16** : 625-626.

Distribution : India : Orissa (Ganjam District), a widely distributed species in India. Also Bangladesh, Burma, Thailand and Vietnam.

20. *Odontotermes guptai* Roonwal & Bose

1962. *Odontotermes bellahunisensis guptai* Roonwal & Bose, *J. Bombay nat. Hist. Soc.*, **58** (3) : 588-593.

Distribution : India : Orissa (Ganjam District).

21. *Odontotermes horni* (Wasmann)

1902. *Termes horni* Wasmann, *Zool. Jb. Syst.*, **17** (1) : 111.

Distribution : India : Orissa (Sambalpur. Bolangir and Sundergarh Districts). Also widely distributed in Southern and Eastern India and far East.

22. *Odontotermes indicus* Thakur

1981. *Odontotermes indicus* Thakur, *Indian For. Rec.*, (N. S.) *Ent.*, **14** (2) : 70-75.

Distribution : India : Orissa (Koraput, Sundergarh Districts) ; also throughout India except eastern part. Thakur (1976, 1981) has given distribution of the species in India and also in different zones of the Indian subregion.

23. *Odontotermes microdentatus* Roonwal and Sen-Sarma

1960. *Odontotermes microdentatus* Roonwal and Sen-Sarma, *Contrib. Syst. Orient Termites* (ICAR Ent. Monogr. 1) : 33-39.

Distribution : India : Orissa (Mayurbhanj District), also Bihar, Himachal Pradesh, Madhya Pradesh and Uttar Pradesh.

24. *Odontotermes obesus* (Rambur)

1842. *Termes obesus* Rambur, *Historie naturelle des insectes, Ne'vropte'res* : 304.

Distribution : India : Orissa (all through), also throughout India, Pakistan and Bangladesh.

25. *Odontotermes orissae* (Snyder)

1934. *Termes (Cyclotermes) Orissae* Snyder, *Indian For. Rec.*, **20** (11) : 10-11.

Distribution : India : Orissa (Goilkara Porohat Division, Bolangir ? District).

Remarks : Krishna (1965) treats this species as a synonym of *obesus* Rambur but according to Thakur (1981) it is a valid species.

26. *Odontotermes redemanni* (Wasmann)

1893. *Termes redemanni* Wasmann, *Wien. Ent. Zeit.*, **12** (7) : 239.

Distribution : India : Orissa (Ganjam District) ; also common throughout peninsular and eastern India and Sri Lanka.

27. *Odontotermes wallonensis* (Wasmann)

1902. *Termes obesus wallonensis* Wasmann, *Zool. Jb. Syst.*, **17** (1) : 106-109.

Distribution : India : Orissa, (Sambalpur, Sundergarh Districts) ; also found throughout Madhya Pradesh, Maharashtra, Gujarat, Rajasthan, Uttar Pradesh and southern India.

28. *Euscaiotermes primus* Silvestri

1923. *Odontotermes (Euscaiotermes) primus* Silvestri, *Rec. Indian Mus.*, **25** : 221-223.

Distribution : India : Orissa (Ganjam District).

29. *Microtermes obesi* Holmgren

1911. *Microtermes obesi* Holmgren, *J. Bombay nat. Hist. Soc.*, **21** (1) : 787-788.

Distribution : India : Orissa (Sundargarh, Sambalpur and Ganjam Districts) and widely distributed throughout India. Also Pakistan, Sri Lanka, Burma and Thailand.

30. *Nasutitermes fletcheri* (Holmgren and Holmgren)

1917. *Eutermes (Eutermes) fletcheri* Holmgren and Holmgren, *Mem. Dept. Agric. India (Ent.)*, **5** : 161-1622.

Distribution : India : Orissa (Puri District), Tamil Nadu.

31. *Trinervitermes biformis* (Wasmann)

1902. *Eutermes biformis* Wasmann, *Zool. Jb. Syst.*, **17** (1) : 133-135.

Distribution : India : Orissa (Ganjam District), West Bengal, Andhra Pradesh, Karnataka, Madhya Pradesh, Maharashtra, Rajasthan, Tamil Nadu and Kerala.

KEY TO SOLDIER TERMITES OF ORISSA

(ex Bose and Das, 1982)

1 (4)	Head without fontanelle and frontal gland	---	KALOTERMITIDAE
2 (3)	Head capsule long and not phragmotic ; mandibles comparatively long	...	<i>Bifiditermes</i> Krishna
	[Anterior broader part of postmentum bilobed and covering about half its total length]	...	<i>B. pinto</i> (Kemner)
3 (2)	Head capsule short and phragmotic ; mandibles comparatively short	...	<i>Cryptotermes</i> Banks
	[Head-length to base of mandibles 1.60-1.80 mm, width of head 0.90-1.35 mm ; mandibles with prominent dentition]	---	<i>C. dudleyi</i> Banks
4 (1)	Head with fontanelle and frontal gland		
5 (10)	Pronotum flat	...	RHINOTERMITIDAE
6 (7)	Head-capsule rectangular, fontanelle small, situated on dorsum of head	...	<i>Heterotermes</i> Froggatt
	[Small species ; head-length 1.08-1.25 mm, head-width 0.66-0.88 mm]	...	<i>H. balwanti</i> Mathur & Chhotani
7 (6)	Head oval, fontanelle large, situated just behind clypeus	---	<i>Coptotermes</i> Wasmann
8 (9)	Minimum width of postmentum greater (0.25-0.34 mm), contraction index 0.63-0.76	...	<i>C. heimi</i> (Wasmann)
9 (8)	Minimum width of postmentum smaller (0.20-0.29 mm), contraction index 0.57-0.69	...	<i>C. travians</i> Haviland
10 (5)	Pronotum saddle-shaped	...	TERMITIDAE
11 (14)	Mandibles degenerate, head produced into rostrum		
12 (13)	Soldiers dimorphic	...	<i>Trinervitermes</i> Holmgren
	[Head width 1.30-1.36 mm ; number of antennal segments 13]	...	<i>T. biformis</i> (Wasmann)
13 (12)	Soldiers monomorphic	...	<i>Nasutitermes</i> Dudley
	[Head-length with rostrum 1.25-1.36 mm, head-width 0.78-0.83 mm ; number of antennal segments 12]	...	<i>N. fletcheri</i> (Holmgren & Holmgren)
14 (11)	Mandibles well developed ; head not produced into rostrum		
15 (48)	Mandible symmetrical		
16 (19)	Mandibles serrated, without any prominent teeth	...	<i>Microcerotermes</i> Silvestri

- 17 (18) Pronotum with well developed notch at anterior margin. Head-length 1.63-1.66 mm, head-width 0.95-1.00 mm ... *M. annandalei* Silvestri
- 18 (17) Pronotum without or with a weak median notch at anterior margin. Head-length 1.25-1.30 mm, head-width 0.80-0.82 mm, Head-index (width/length) 0.58-0.61 ... *M. beezoni* Snyder
- 19 (16) Mandibles not serrated, with or without teeth or crenulations
- 20 (21) Left mandible with a prominent notch at middle ... *Euscaiotermes primus* Silvestri
- 21 (20) Left mandible without any notch
- 22 (23) Mandibles thin, without any teeth or crenulations. Soldiers smaller than workers ... *Microtermes* Wasmann
[Mandibles weakly hooked; labrum lanceolate, broader at tip] ... *M. obesi* Holmgren
- 23 (22) Mandibles thick and stout; left with teeth or crenulations
- 24 (27) Left mandible with two widely separated teeth; labrum triangular ... *Eurytermes* Wasmann
- 25 (26) Larger species (head 2.0 mm long and 1.30 mm wide); mandibles 0.83-0.87 mm long ... *E. assmuthi assmuthi* Wasmann
- 26 (25) Smaller species (head 1.70 mm long and 1.08 mm wide); mandibles 0.78 mm long ... *E. assmuthi modestior* Silvestri
- 27 (24) Left mandible with a single variably placed tooth or crenulations in basal half
- 28 (29) Labrum with a hyaline tip; left mandible with crenulations in the basal half ... *Macrotermes* Holmgren
[Soldier major; head-length 4.15-4.20 mm, head-width 4.10-4.25 mm] ... *M. estherae* (Desneux)
- 29 (28) Labrum without a hyaline tip; left mandible with a variably placed tooth ... *Odontotermes* Holmgren
- 30 (31) Mandibles very straight, tooth on left mandible minute ... *O. microdentatus* Roonwal & Sen-Sarma
- 31 (30) Mandibles curved or sabre-shaped, tooth on left mandible prominent
- 32 (41) Head oval to subrectangularly oval; antennae darker distally
- 33 (36) Mandibles short, index left mandible-length/head-length 0.52-0.57
- 34 (35) Anterior margin of pronotum rounded and posterior margin with a weak median depression ... *O. guptai* Roonwal & Bose

- 35 (34) Anterior margin of pronotum and posterior margin straight ... *O. bellahunisensis* Holmgren & Holmgren
- 36 (33) Mandibles long, index left mandible-length/head-length 0.60-0.70
- 37 (38) Left mandibular tooth forwardly placed, index tooth distance from tip/mandible length 0.30-0.37 ... *O. redemanni* (Wasmann)/
O. obesus (Rambur)
- 28 (37) Left mandibular tooth backwardly placed, index tooth distance from tip/mandible length 0.39-0.46
- 39 (40) Mandibles strongly incurved in front from middle ; left mandibular tooth index 0.39-0.42 ; larger species ... *O. brunneus* (Hagen)
- 40 (39) Mandibles comparatively less so incurved from distal third ; left mandibular tooth index 0.41-0.46 ; smaller species ... *O. wallonensis* (Wasmann)
- 41 (32) Head capsule subrectangular ; antennae uniformly coloured
- 42 (43) Tooth on left mandible distinctly acute, making an angle of 60° ... *O. indicus* Thakur
- 43 (42) Tooth on left mandible laterally directed, making an angle of 90°
- 44 (45) Smaller species. Head-length 1.55-2.20 mm ; head sides subparallel ... *O. ceylonicus* (Wasmann)
- 45 (44) Larger species. Head-length 2.30-2.60 mm ; head-sides weakly convex, or converging in front
- 46 (47) Head-capsule parallel sided, somewhat convex medially ... *O. horni* (Wasmann)
- 47 (46) Head-capsule converging anteriorly ... *O. feae* (Wasmann)
- 48 (15) Mandibles asymmetrical or rod like
- 49 (50) Head-with frontal protuberance ; mandibles rod-like...
[Frontal gland large : head-length 1.18-1.20 mm, mandible-length 1.18-1.25 mm ; labrum anteriorly deeply incurved] ... *Angulitermes* Sjöstedt
A. ramanii Bose and Das
- 50 (49) Head without frontal protuberance ; mandibles strongly asymmetrical, left mandible strongly twisted in the middle ... *Dicuspidermes* Krishna
[Labrum deeply concave with antero-lateral processes ; head 2.00 mm long ; antero-lateral corners of head rounded] ... *D. obtusus* (Silvestri)

SUMMARY

A list of termites (31 species), reported from Orissa, is given along with their distribution in the state and elsewhere. The species belong to 15 genera included in the families Kalotermitidae (2 genera, 2 species), Rhinotermitidae (2 genera, 3 species) and Termitidae (11 genera, 26 species). A running key for the families, genera and species is also provided.

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REFERENCES

- BOSE, G. 1984. Termite fauna of southern India. *Occ. Pap. Rec. zool. Surv. India*, No. 49 : ix + ± 270.
- BOSE, G. AND DAS, B. C. 1982. Termite fauna of Orissa state, eastern India. *Rec. zool. Surv. India*, 80 : 197-213.
- KRISHNA, K. 1965. Termites, (Isoptera) of Burma. *Am. Mus. Novit.*, No. 2210 : 1-34.
- ROONWAL, M. L. AND CHHOTANI, O. B. 1962. *Indian Species of the Genus Coptotermes* : 1-115 (Ent. Monogr. 2, ICAR. 10. 32). Delhi (Publ. Manager Publication)
- SILVESTRI, F. 1923. The Fauna of an island in the Chilka Lake. 1. The termites of Barkuda Island. *Rec. Indian Mus.*, 25 (2) : 221-232.
- THAKUR, M. L. 1976. Zoogeography of termite genus *Odontotermes* Holmgren in the Indian region (Isoptera : Termitidae : Macrotermitinae). *Indian Forester*, 102 (8) : 498-505.
- THAKUR, M. L. 1981. Revision of the termite genus *Odontotermes* Holmgren (Isoptera : Termitidae : Macrotermitinae) from India. *Indian For. Rec. (N. S.) Ent.*, 14 (2) : iv + 1-183.

INSECTA : ORTHOPTERA : GRYLLOIDEA AND TRIDACTYLOIDEA

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INTRODUCTION

Chopard (1969) in his volume on Grylloidea under Fauna of India series has recorded some species from Orissa based on his earlier work of 1924 on fauna of an Island in the Chilka Lake (Barkuda Island, Chilka Lake, Orissa).

Besides this work no serious efforts have been made to study these groups of insects from the State. The present work was initiated to make a systematic study of the cricket fauna of Orissa, chiefly based on the collections made by various survey parties of the Zoological Survey of India from 1971 to 1974 under the scheme of the Department for a general faunistic survey of Orissa. It deals with 38 species of crickets and one species of pigmy mole-cricket distributed over six families and 23 genera. Twentythree species marked with asterisks are being recorded for the first time from Orissa. *Teleogryllus bicoloripes* Chopard is recorded here for the first time from Indian faunal limits. This is the first comprehensive report on the crickets of Orissa.

SYSTEMATIC ACCOUNT

Key to genera of Grylloidea and Tridactyloidea of Orissa

1. Body small to large sized ; antennae longer than body, many segmented ; tarsi 3 segmented ; fore legs may or may not be modified for digging ; hind legs enlarged for jumping ; hind tibiae normal. ...	2
— Body small sized ; antennae short, with 12 or fewer segments ; fore legs normal ; hind legs with enlarged femora ; hind tibiae modified for burrowing and moving on sandy and watery surfaces ; tarsi 1 or 2 segmented. ...	
	<i>Tridactylus</i> Olivier
2. Anterior legs short, modified for digging. ...	<i>Gryllotalpa</i> Latreille
— Anterior legs normal. ...	3
3. Second segment of hind tarsi compressed and small. ...	4
— Second segment of hind tarsi depressed. ...	8
4. Body not very soft ; head not long and horizontal ; tegmina not transparent ; anterior tibiae without oval tympanum on either side ; posterior femora not much swollen ; posterior tibiae without denticles between the spines. ...	5

— Body very soft ; head long and horizontal ; tegmina transparent ; anterior tibiae with a large oval tympanum on either side ; posterior femora swollen ; posterior tibiae serrulated at base and between the spines...	<i>Oecanthus</i> Serville	
5. Spines of posterior tibiae immovable and without hairs. ...	...	6
— Spines of posterior tibiae movable, pubescent. ...	...	17
6. Body almost shining ; ocelli placed in a straight line ; posterior femora long, usually as long as tibia and tarsus together. ...	...	7
— Body usually pubescent ; ocelli placed in a triangle. ...	...	8
7. Size large ; anterior metatarsi very short : ovipositor very short, ...	<i>Brachytrypes</i> Serville	
— Size medium ; anterior metatarsi moderately long ; anterior and median tibiae ciliated with long hairs ; ovipositor usually longer. ...	<i>Gymnogryllus</i> Saussure	
8. Both sexes with convex face. ...		9
— Face flattened at least in male. ...	...	16
9. Head with narrow frontal rostrum. ...	...	10
— Head with wide frontal rostrum. ...	...	11
10. Body pubescent ; head somewhat flattened above ; ovipositor long. ...	<i>Gryllodes</i> Saussure	
— Head rounded, small ; tegmina very ample in male ; ovipositor reduced. ...	<i>Itaropsis</i> Chopard	
11. Body very convex ; female with short lateral tegmina. ...	<i>Gryllopsis</i> Chopard	
— Body not so convex ; female with more or less perfectly developed tegmina, never reduced to small lateral pads. ...	...	12
12. Medium sized ; body and legs pubescent ; colouration variable ; head with or without a transverse yellow band between the ocelli ; epiphallus deeply emarginate posteriorly forming H-shaped structure. ...	<i>Modicogryllus</i> Chopard	
— Large to medium sized ; body and legs pubescent or glabrous ; colouration variable ; head without a transverse yellow band between the ocelli ; epiphallus not deeply emarginate posteriorly, nor H-shaped ; posterior margin with three lobes of approximately equal size. ...	...	13
13. Size large ; body and legs glabrous ; anterior projections of the ectoparamere approximately equal. ...	<i>Gryllus</i> Linnaeus	
— Size large to medium ; body and legs pubescent ; colour variable ; internal anterior projection of the ectoparamere much longer than the external anterior projection. ...	...	14
14. Body medium to large ; virga (in male) with transverse parameral muscle insertion crest. ...	...	15

— Body medium sized ; virga (in male) without transverse parameral muscle insertion crest. ...	<i>Platygryllus</i> Chopard
15. Size medium : posterior femora short and thick ; mesal lobes with their apices between the bases of the ectoparameres ; endoparameres J-shaped. ...	<i>Plebeigryllus</i> Chopardd
— Size large ; posterior femora normal ; mesal lobes with their apices between the apices of the ectoparameres ; endoparameres C-shaped. ...	<i>Teleogryllus</i> Chopard
16. Male with flattened or somewhat concave face, but forehead without any prolongation. ...	<i>Velarifictorus</i> Chopard
— Face of the male strongly flattened and forehead more or less strongly prolonged. ...	<i>Loxoblemmus</i> Saussure
17. Tegmina of male provided with a clear mirror ; legs not very long. ...	<i>Pteronemobius</i> J. & Bø
— Tegmina venation similar in both sexes ; legs very long. ...	<i>Paranemobius</i> Saussure
18. Posterior tibiae non-serrulated, armed with three spines on each margin ; very small and delicate insects. ...	... 19
— Posterior tibiae serrulated between the spines. ...	... 22
19. Tegmina glabrous or almost glabrous, (male) with or without distinct mirror. ...	... 20
— Tegmina covered with fine hairs, (male) with perfect mirror. ...	<i>Amusurgus</i> Brunner
20. Tegmina venation quite different in both sexes, showing always in the male a very clear anal field and mirror ; pronotum narrowing and rounded in front. ...	<i>Homoeoxipha</i> Saussure
— Tegmina venation similar in both sexes. ...	... 21
21. Tegmina presenting false veins between the principal veins which make them appear finely striated. ...	<i>Trigonidium</i> Rambur
— Tegmina without false veins between the principal veins. ...	<i>Metioche</i> Stål
22. Tegmina of male with well developed mirror. ...	<i>Madasumma</i> Walker
— Tegmina with similar venation in both sexes ; veins more or less oblique and irregular. ...	<i>Euscyrtus</i> Guér

Suborder ENSIFERA

Superfamily GRYLLOIDEA

Family I. GRYLLOTALPIDAE

1. *Gryllotalpa africana* Beauvois1905. *Gryllotalpa africana* Beauvois, *Ins. Afr. Amer.*, : 229.1967. *Gryllotalpa africana* : Chopard, *Orth. Cat.*, Part 12 : 449.

Material examined : 4 ♂♂, 1 ♀, Central Rice Research Institute, Cuttack, 22 & 24.xii.1970, *S. Khera* ; 1 ♂, Forest Rest House Panposh, Raurkela, Sundargarh distt., 9.xii.1971, *P. K. Maiti* ; 1 ♀, Bonaigarh, Sundargarh distt., 13.xii.1971, *P. K. Maiti* ; 1 ♂ (nymph), Dhanupali village, Sambalpur, 22.xii.1971, *P. K. Maiti* ; 1 ♀ (nymph), Mirzapur village, near Bataranguri, Chandipur, Balasore distt., 25.i.1972, *V. K. Premkumar* ; 3 ♂♂, 1 ♀, Circuit House, Keonjhar, Keonjhar distt., 20 & 26.ix.1972, *K. Rai* ; 1 ♂, Inspection Bungalow, Angul, Dhenkanal distt., 29.ix.1972, *K. Rai* ; 1 ♀, Inspection Bungalow, Dhenkanal, 7.x.1972, *K. Rai* ; 2 ♂♂, 1 ♀, Rajbari, Sundargarh, 23.x.1972, *J. M. Julka* ; 1 ♀, P. W. D. Bungalow, Sundargarh, 24.x.1972, *J. M. Julka* ; 1 ♂, 12 Kms. on way to Raurkela, Sundargarh, 25.x.1972, *J. M. Julka* ; 1 ♀, Kaliyugeswar Island, Chilka Lake, 22.iii.1973, *V. K. Premkumar*.

Distribution : India : Jammu & Kashmir, Himachal Pradesh, Uttar Pradesh, Bihar, West Bengal, Assam, Meghalaya, Orissa, Tamilnadu, Pondichery, Karnataka, Kerala, Arunachal Pradesh, Andaman Islands ; Bhutan ; Nepal ; Pakistan ; Sri Lanka ; Burma ; Malaya ; Singapore.

Remarks : A very common and widely distributed species found in India and is known to cause damage to the crops of potato, paddy and tea.

Family II. GRYLLIDAE

* 2. *Brachytrypes portentosus* (Lichtenstein)

1796. *Acheta portentosa* Lichtenstein, *Cat. Mus. zool.*, 3 : 86.

1931. *Brachytrypes portentosus* : Chopard, *Bull. Raffles Mus.*, No. 6 : 128.

1969. *Brachytrypes portentosus* : Chopard, *Fauna of India, Orthopt. Grylloid.*, 2 : 16.

Material examined : 1 ♀, Circuit House, Keonjhar, Keonjhar distt., 19.ix.1972, *K. Rai* ; 1 ♂, 1 ♀, Inspection Bungalow, Angul, Dhenkanal distt., 30.ix.1972, *K. Rai* ; 1 ♀, P. W. D. Bungalow, Dhenkanal, 7.x.1972, *K. Rai*.

Distribution : India : Orissa (as above), Arunachal Pradesh, Assam, Meghalaya, Nagaland, West Bengal, Bihar, Uttar Pradesh, Karnataka, Tamilnadu ; Bangladesh ; Burma ; Malaya ; China ; Singapore ; Java ; Andalus ; Philippines.

Remarks : We have also examined specimens of this species from Nagaland. It is known to cause damage to various young plantations.

3. *Brachytrypes orientalis* (Burmeister)

1832. *Gryllus orientalis* Burmeister, *Handb. Ent.*, 2 : 735.

1969. *Brachytrypes orientalis* : Chopard, *Fauna of India, Orthopt., Grylloid.*, 2 : 17.

Material examined : 1 ♀, Ghatgaon, Keonjhar distt., 17.viii.1972, *S. K. Mitra* ; 1 ♀, Barsuan, Sundargarh distt., 13.ix.1972, *S. Khera* ; 2 ♀♀, Hindustan Steel Ltd. Rest House, Barsuan, Sundargarh distt., 14.ix.1972, *S. Khera*.

Distribution : India : Assam, Meghalaya, West Bengal, Orissa, Tamilnadu, Karnataka ; Sri Lanka ; Burma ; Malaya.

Remarks : It is known to cause damage to paddy, jute, citrus plants, tobacco, tea and other various garden plants. The specimens from Orissa are larger in size from those described earlier by Chopard (1969).

*** 4. *Gymnogryllus minor* Chopard**

1969. *Gymnogryllus minor* Chopard, *Fauna of India, Orthopt., Grylloid.* 2 : 29.

Material examined : 2 ♂♂, Nimapara, Bhubaneswar, 24.vii.1984, *N. Das* ; 1 ♀, Nimapara, Bhubaneswar, 30.x.1984, *N. Das*.

Distribution : India : Assam, Meghalaya, Madhya Pradesh, Maharashtra, Goa, Karnataka, Kerala, Tamilnadu, Orissa (as above), Bihar ; Burma ; Java ; South Vietnam.

Remarks : Head and pronotum black except in one specimen in which head is reddish. Mirror divided in the middle by a curved vein. First and second pairs of legs, in black variety, are with yellowish tinge while the third pair lacks the yellow spot at apex. The species is recorded from Haryana and Rajasthan (India) also for the first time.

*** 5. *Gymnogryllus fascipes* Chopard**

1969. *Gymnogryllus fascipes* Chopard, *Fauna of India, Orthopt., Grylloid.* 2 : 30.

Material examined : 3 ♂♂, 2 ♀♀, Sundargarh (at light), 23, 24 & 26.x.1972, *J. M. Julka*.

Distribution : India : Orissa (as above), Madhya Pradesh.

*** 6. *Gryllus bimaculatus* De Geer**

1773. *Gryllus bimaculatus* De Geer, *Mem. Ins.*, 3 : 521.

1969. *Gryllus bimaculatus* : Chopard, *Fauna of India, Orthopt. Grylloid.* 2 : 35.

Material examined : 1 ♀, Tuala village, 8 Kms. off P. W. D. Bungalow, Deogarh, Sambalpur distt., 6.vi.1972, *D. P. Sanyal* ; 1 ♀, Top of hillock, behind P. W. D. Bungalow, Deogarh, Sambalpur distt., 9.vi.1972, *D. P. Sanyal* ; 1 ♀, Kendumuri, Bangriposi, Mayurbhanj distt., 13.ix.1972, *K. Rai* ; 1 ♀, Katra, Bangriposi, Mayurbhanj distt., 16.ix.1972, *K. Rai* ; 1 ♀, Konark, Puri distt., 18.iii.1973, *V. K. Premkumar* ; 2 ♀♀, Banki, Sundargarh, 29.iii.1973, *T. K. Sen* ; 1 ♀, Nandankanan, Cuttack distt., 25.iii.1974, *R. K. Kacker* ; 1 ♂, Bhubaneswar, 14.iii.1984, *N. Das* ; 2 ♀♀, Bhubaneswar, 24.iii.1984, *N. Das* ; 1 ♂, 2 ♀♀, Nimapara, Bhubaneswar, 24.iv.-11.v.1984, *N. Das*.

Distribution : India (widely distributed all over the country) ; Sri Lanka ; Burma ; Malaya ; Singapore.

Remarks : This species is known to cause damage to paddy. The specimens from Katra differs from the typical ones in having brownish head and pronotum and shorter head. In some specimens only head and pronotum are black, while the rest of the body is brown. Base of elytra either without the yellow spot or faintly marked by it. It is also recorded from Haryana and Assam States of India for the first time.

7. *Teleogryllus testaceus* (Walker)

1869. *Gryllus testaceus* Walker, *Cat. Derm. Salt. Brit. Mus.*, 1 : 38

1967. *Teleogryllus testaceus* : Chopard, *Orth. Cat.*, Part 10 : 93.

Material examined : 1 ♀, Mahakhand village, Bolangir, 30.v. 1972, D. P. Sanyal ; 1 ♀, Baripada (Stadium), Mayurbhanj distt., 5.viii.1972, S. K. Mitra ; 2 ♂ ♂, 2 ♀ ♀, Circuit House, Keonjhar, Keonjhar distt., 19, 23 & 26.ix.1972, K. Rai ; 1 ♂, Hirakud dam, Sambalpur, 25.ix.1972, S. Khera ; 1 ♂, P. W. D. Inspection Bungalow, Bolangir, 30.ix.1972, S. Khera ; 2 ♂ ♂, 2 ♀ ♀, Inspection Bungalow, Angul, Dhenkanal distt., 1 & 3.x.1972, K. Rai ; 1 ♂, 1 ♀, Shankarpur, Dhenkanal, 7.x.1972, K. Rai ; 2 ♀ ♀, P. W. D. Bungalow, Dhenkanal, 7.x.1972, K. Rai ; 1 ♂, Sambalpur, 3.xi.1972, J. M. Julka ; 1 ♀, Bhubaneswar, 25.x.1984, N. Das.

Distribution : India : Arunachal Pradesh, West Bengal, Bihar, Orissa, Madhya Pradesh, Uttar Pradesh, Karnataka, Kerala, Tamilnadu and Andaman Islands ; Sri Lanka ; Burma ; Malaya ; Java ; Philippines ; Kalimantan : Indo-China.

8. *Teleogryllus mitratus* (Burmeister)

1838. *Gryllus mitratus* Burmeister, *Hanb. Ent.*, 2 : 724.

1967. *Teleogryllus mitratus* : Chopard, *Orth. Cat.*, Part 10 : 98.

Material examined : 5 ♂ ♂, 3 ♀ ♀, Circuit House, Keonjhar, Keonjhar distt., 19, 20, 23 & 26.ix.1972, K. Rai ; 1 ♂, Tharpara, Angul, Dhenkanal distt., 30.ix.1972, K. Rai ; 1 ♂, Inspection Bungalow, Angul, Dhenkanal distt., 2.x.1972, K. Rai ; 1 ♀, Baripada, Keonjhar distt., 5.iv.1973, S. K. Gupta.

Distribution : India : Arunachal Pradesh, Assam, Meghalaya, Manipur, Sikkim, West Bengal, Orissa, Bihar, Uttar Pradesh, Madhya Pradesh, Tamilnadu and Andaman Islands ; Bhutan ; Tibet ; Sri Lanka ; Malaya ; Philippines ; Japan.

*9. *Teleogryllus gracilipes* (Saussure)

1877. *Gryllus gracilipes* Saussure, *Mem. Soc. Geneve*, 25 : 160.

1967. *Teleogryllus gracilipes* : *Orth. Cat.*, Part 10 : 100.

Material examined : 1 ♂, Inspection Bungalow, Angul, Dhenkanal distt., 3.x.1972, K. Rai.

Distribution : India : Madhya Pradesh, Orissa (as above), Assam ; East Africa.

***10. *Teleogryllus bicoloripes* Chopard**

1961. *Teleogryllus bicoloripes* Chopard, *Eos, Madr.*, **37** : 277.

1967. *Teleogryllus bicoloripes* : Chopard, *Orth. Cat.*, Part 10 : 100.

Material examined : 1♂, Circuit House, Keonjhar, Keonjhar distt., 25.ix.1972, K. Rai.

Distribution : India : Orissa (as above) ; Burma.

Remarks : Chopard (1961) erected a new genus *Teleogryllus* and included a number of species previously described under the genus *Gryllus* Linne, and also his proposed new ms. species *Gryllus bicoloripes* (in press). Unfortunately the Fauna volume on Grylloidea was published later in 1969. In view of Chopard's remarks in his paper (1961) we prefer to treat this species under the genus *Teleogryllus* in spite of its publication in 1969 under the genus *Gryllus*. This species is recorded here for the first time from India.

***11. *Teleogryllus longipennis* (Saussure)**

1877. *Gryllus longipennis* Saussure, *Mem. Soc. Geneve*, **25** : 161.

1967. *Teleogryllus longipennis* : Chopard, *Orth. Cat.* Part 10 : 100.

Material examined : 1♀, Aasua, Bangriposi, Mayurbhanj distt., 15.ix.1972, K. Rai ; 2♂♂, 9♀♀, Circuit House, Keonjhar, Keonjhar distt., 19, 23, & 25.ix.1972, K. Rai ; 1♂, Inspection Bungalow, Angul, Dhenkanal distt., 29.ix.1972, K. Rai.

Distribution : India : Uttar Pradesh, Orissa (as above), Bihar and Maharashtra ; Sri Lanka.

***12. *Platygryllus melanocephalus* (Serville)**

1839. *Gryllus melanocephalus* Serville, *Ius. Orth.*, : 342.

1967. *Platygryllus melanocephalus* : Chopard, *Orth. Cat.*, Part 10 : 93.

Material examined : 1♀, Rajbari, Sundargarh, 26.x.1972, J. M. Julka.

Distribution : India : Bihar, West Bengal, Orissa (as above), Madhya Pradesh, Uttar Pradesh, Himachal Pradesh, Jammu & Kashmir ; Nepal.

Remarks : General colouration is black shining.

***13. *Modicogryllus blennus* (Saussure)**

1877. *Gryllodes blennus* Saussure, *Mem. Soc. Geneve*, **25** : 215.

1967. *Modicogryllus blennus* : Chopard, *Orth. Cat.*, Part 10 : 82.

Material examined : 1♂, Bhubaneswar, 6.x.1984, N. Das.

Distribution : India : Rajasthan, Uttar pradesh, West Bengal, Orissa (as above), Assam, Tamilnadu ; Burma ; Sri Lanka ; Malaya ; Java.

14. *Modicogryllus confirmatus* (Walker)

1859. *Acheta confirmata* Walker, *Ann. Nat. Hist.*, (3) 4 : 221.

1967. *Modicogryllus confirmatus* : Chopard, *Orth. Cat.*, Part 10 : 80.

Material examined : 1 ♂, Bonaigarh, Sundargarh distt., 13.xii.1971, P. K. Maiti ; 1 ♀, South of Paradip Port Guest House, Cuttack distt., 30.i.1972, V. K. Premkumar ; 1 ♂, 4 ♀ ♀, Baripada, Mayurbhanj distt., 6-9.viii.1972, S. K. Mitra ; 1 ♂, 2 ♀ ♀, Katra, Bangriposi, Mayurbhanj distt., 14-17.ix.1972, K. Rai ; 2 ♂ ♂, 17 ♀ ♀, Circuit House, Keonjargarh, Keonjhar distt., 19-20 & 25.ix.1972, K. Rai ; 1 ♀, Silwan, Keonjargarh, Keonjhar distt., 25.ix.1972, K. Rai ; 1 ♂, 2 ♀ ♀, Hirakud dam, Sambalpur, 25.ix.1979, S. Khera ; 3 ♂ ♂, Inspection Bungalow, Anguul, Dhenkanal distt., 29 & 30.ix.1972, K. Rai ; 1 ♀, P. W. D. Bungalow, Sambalpur, 29.ix.1972, S. Khera ; 2 ♀ ♀, Inspection Bungalow, Dhenkanal, 2 & 3.x.1972, K. Rai ; 1 ♂, Shankarpur, Dhenkanal, 7.x.1972, K. Rai ; 2 ♀ ♀, Near Back Water, Gopalpur, Ganjam distt., 11.x.1972, Y. Chaturvedi ; 1 ♂, Sambalpur, 6.xi.1972, J. M. Julka ; 1 ♀, Bisoi, Mayurbhanj distt., 23.iii.1973, S. K. Gupta ; 1 ♂, 1 ♀, Taptapani, Ganjam distt., 12.iii.1974, R. K. Kacker ; 2 ♂ ♂, 5 ♀ ♀, Balugaon, Puri distt., 18.iii.1974, R. K. Kacker ; 2 ♂ ♂, 1 ♀, Nandankanan, Cuttack distt., 22.iii.1974, R. K. Kacker ; 1 ♂, 2 ♀ ♀, Bhubaneswar, 9.v & 30.v.1984, N. Das.

Distribution : India : Throughout the country ; Nepal ; Burma ; Bangladesh ; Sri Lanka ; Malaya ; Thailand ; Indo-China.

Remarks : Female specimens from Gopalpur differs from the typical specimens in having black body colouration.

15. *Plebeiogryllus guttiventris* (Walker)

1871. *Gryllus guttiventris* Walker, *Cat. Derm. Salt. Brit. Mus.*, 5 (Suppl.) : 6.

1967. *Plebeiogryllus guttiventris* : Chopard, *Orth. Cat.*, part 10 : 94.

Material examined : 1 ♀, Panposh, Raurkela, Sundargarh distt., 7.xii.1971, P. K. Maiti ; 3 ♀ ♀, Sambalpur, 22.xii.1971, P. K. Maiti ; 2 ♀ ♀, Hathisalpara, Bolangir, 30.xii.1971, P. K. Maiti ; 1 ♂, Saplapali, Bolangir, 1.i.1972, P. K. Maiti ; 4 ♀ ♀, Gaundrial village, 5 kms West of Bolangir, 2.i.1972, P. K. Maiti ; 2 ♂ ♂, Khasra Forest, Sundargarh, 10.i.1972, P. K. Maiti ; 2 ♀ ♀, Bonaigarh, Sundargarh distt., 19.vi.1972, D. P. Sanyal ; 1 ♂, near Kalunjia, Panposh, Raurkela, Sundargarh distt., 22.vi.1972, D. P. Sanyal ; 1 ♂, Baripada, Mayurbhanj distt., 6.viii.1972, S. K. Mitra ; 3 ♀ ♀, Basantapur, Baripada, Mayurbhanj distt., 9.viii.1972, S. K. Mitra ; 2 ♀ ♀, Reserve Forest, Ghatgaon, Keonjhar distt., 23.viii.1972, S. K. Matra ; 1 ♂, Ghatgaon, Keonjhar distt., 26.viii.1972, S. K. Mitra ; 2 ♂ ♂, 2 ♀ ♀, Kendramuri, Bangriposi,

Mayurbhanj distt., 13.ix.1972, *K. Rai* ; 5 ♂♂, 13 ♀♀, Katra, Bangriposi, Mayurbhanj distt., 14-17.ix.1972, *K. Rai* ; 3 ♂♂, 6 ♀♀, Gosanipal, Bangriposi, Mayurbhanj distt., 15.ix.1972, *K. Rai* ; 43 ♂♂, 105 ♀♀, Circuit House Keonjhargarh, Keonjhar distt., 19, 20, 23, & 25.ix.1972, *K. Rai* ; 3 ♂♂, (nymphs), Jagannathpur, Keonjhargarh, 22.ix.1972, *K. Rai* ; 1 ♀, Tanagerpada, Keonjhargarh, 24.ix.1972, *K. Rai* ; 1 ♂, Silwan, Keonjhargarh, 25.ix.1972, *K. Rai* ; 1 ♂, Hirakud dam, Sambalpur, 25.ix.1972, *S. Khera* ; 48 ♂♂, 68 ♀♀, Inspection Bungalow, Angul, Dhenkanal distt., 29-30.ix.1972, *K. Rai* ; 1 ♂, Tharpara, Angul, Dhenkanal distt., 30.ix.1972, *K. Rai* ; 1 ♂, 1 ♀, Nisa, Angul, Dhenkanal distt., 1.x.1972, *K. Rai* ; 10 ♀♀, P.W.D. Bungalow, Dhenkanal, 5 & 7.x.1972, *K. Rai* ; 1 ♀, near Back Water, Gopalpur, Ganjam distt., 11.x.1972, *Y. Chaturvedi* ; 3 ♂♂, 11 ♀♀, Sambalpur, 3 & 6.xi.1972, *J. M. Julka* ; 2 ♀♀, Hirakud dam, Sambalpur, 5.xi.1972, *J. M. Julka* ; 1 ♂, 11 ♀♀, Bolangir, 9.xi.1972, *J. M. Julka* ; 1 ♂, Champagarh, 7 kms S. W. of Lulung Forest Rest House, Mayurbhanj distt., 9.xi.1972, *J. K. Sen* ; 2 ♂♂, Purnakot, Dhenkanal, 30.ix.1972, *J. K. Sen* ; 1 ♀, Banki, Sundergarh, 29.iii.1973, *T. K. Sen* ; 1 ♀, Anandapur, Keonjhar distt., 2.iv.1973, *S. K. Gupta* ; 1 ♀, Dhenkanal, 9.iv.1973, *S. K. Gupta* ; 1 ♀, Angul, Dhenkanal distt., 10.iv.1973, *S. K. Gupta* ; 2 ♀♀, 4 Kms north of Forest Rest House, Chandili, Koraput distt., 28.xi.1973, *D. P. Sanyal* ; 1 ♀, Chandriganga Dak Bungalow, Cuttack distt., 16.i.1974, *S. Biswas* ; 1 ♂, 2 ♀♀, Nimapara, Bhubaneswar, 6.x.1984, *N. Das*.

Distribution : India : Bihar, Madhya Pradesh, Uttar Pradesh, Maharashtra, Goa, West Bengal, Orissa, Karnataka, Kerala, Tamilnadu ; Burma ; Sri Lanka.

Remarks : Both brown and deep brown forms are available.

16. *Plebeiogryllus* sp.

Material examined : 1 ♂, 2 ♀♀, Silwan, Keonjhargarh, Keonjhar distt., 25.ix.1972, *K. Rai*.

Remarks : These specimens are not referred to any species. They are very near to *P. guttiventris* (Walker) but differ in the following characters : Elytra not covering the abdomen, brown in colour and shining ; mirror as broad as long, not divided clearly but a thin, small vein present in the middle ; oblique veins 3 in number, 2nd broken in the middle, 3rd divided from the base itself and joining the 2nd in the upper part, chord vein joining the diagonal vein at three places ; apical field consisting of more or less square cells ; and having 5-6 veins ; lateral field with 5 close veins ; and one branch of SC ; wings caudate. The elytra of female is equal in length to that of male ; Wings not visible.

*** 17. *Gryllopsis furcata* (Saussure)**

1877. *Grylloides furcatus* Saussure, *Mem. Soc. Geneve*, 25 : 231.

1969. *Gryllopsis furcata* : Chopard, *Fauna of India, Orthopt., Grylloid.*, 2 : 79.

Material examined : 1 ♀, 4 Kms. north of Forest Rest House, Badrama Reserve Forest, Sambalpur distt., 2.vi.1972, D. P. Sanyal.

Distribution : India : Madhya Pradesh, Uttar Pradesh, Orissa (as above), Andhra Pradesh, Karnataka, Tamilnadu ; Burma.

18. *Grylloides sigillatus* (Walker)

1869. *Gryllus sigillatus* Walker, *Cat. Derm. Salt. Brit. Mus.* 1 : 46.

1969. *Grylloides sigillatus* : Chopard, *Fauna of India, Orthopt., Grylloid.*, 2 : 85.

Material examined : 1 ♂, Bonaigarh, Sundargarh, 17.xii.1971, P. K. Maiti ; 1 ♀, Matkai Reserve Forest, Bolangir distt., 30.xii.1971, P. K. Maiti ; 2 ♂ ♂, 3 ♀ ♀, Salapali, Bolangir, 1.i.1972, P. K. Maiti ; 3 ♂ ♂, 3 ♀ ♀, Gaundrial village, Bolangir, 2.i.1972, P. K. Maiti ; 1 ♀, near Railway Station, Bolangir; 3.i.1972, P. K. Maiti ; 1 ♂, environs of Asana, Mayurbhanj distt., 16.viii.1972, S. K. Mitra ; 1 ♂, Monuda, Bangriposi, Mayurbhanj distt., 14.ix.1972, K. Rai ; 2 ♂ ♂, Gosanipal, Bangriposi, Mayurbhanj distt., 15.ix.1972, K. Rai ; 1 ♀, Inspection Bungalow, Angul, Dhenkanal distt., 30.ix.1972, K. Rai ; 3 ♂ ♂, Tikerpara, Angul, Dhenkanal distt., 2.x.1972, K. Rai ; 1 ♀, Sambalpur (at light), 6.xi.1972, J. M. Julka ; 1 ♀, Gopalpur, Ganjam distt., 1.iv.1973, V. K. Premkumar ; 1 ♂, 1 ♀, Taptapani, Ganjam distt., 15.iii.1974, R. K. Kacker ; 1 ♂, Bhubaneswar, 24.iv.1984, N. Das.

Distribution : Cosmotropical. In India it is recorded from Jammu & Kashmir, Punjab, Uttar Pradesh, Rajasthan, Madhya Pradesh, Orissa, Andhra Pradesh, Tamilnadu, Karnataka, Kerala, Assam, West Bengal, Bihar, and Andaman Islands.

Remarks : Few examples which were collected from Angul and Taptapani are winged forms. Elytra has one oblique vein in some specimens from Taptapani instead of two.

*** 19. *Itaropsis tenella* (Walker)**

1869. *Gryllus tenellus* Walker, *Cat. Derm. Salt. Brit. Mus.*, 1 : 37.

1967. *Itaropsis tenella* : Chopard, *Orthopt. Cat.*, Part 10 : 116.

Material examined : 1 ♂, 2 ♀ ♀, Barsuan, Sundargarh distt., 13. & 14.ix.1972, S. Khera ; 2 ♀ ♀, Circuit House, Keonjhar, Keonjhar distt., 25.ix.1972, K. Rai.

Distribution : India : Maharashtra, Goa, Karnataka, Kerala, Tamilnadu, Orissa (as above), Uttar Pradesh ; Sri Lanka ; Malaya.

*** 20. Velarifictorus aspersus (Walker)**

1869. *Gryllus aspersus* Walker, *Cat. Derm. Salt. Brit. Mus.*, 1 : 39.

1967. *Velarifictorus aspersus* : Chopard, *Orthopt. Cat.*, Part 10 : 122.

Material examined : 1 ♂, along the bank of Mahanadi river, 4 Kms. west of Forest Rest House, Tikerpara, Dhenkanal distt., 23.i.1975, S. Biswas.

Distribution : India : Jammu & Kashmir, Uttar Pradesh, Maharashtra, Karnataka, Andhra Pradesh, Orissa (as above), West Bengal, Assam & Meghalaya ; Burma ; Sri Lanka ; Malaya, Selangor ; Singapore ; Java, Kalimantan ; Annam (Vietnam) ; China ; Hongkong.

Remarks : Elytra not reaching upto the last segment of abdomen. Wings shortly developed.

***21. Loxoblemmus equestris Saussure**

1877. *Loxoblemmus equestris* Saussure, *Mem. Soc. Geneve*, 25 : 252.

1969. *Loxoblemmus equestris* : Chopard, *Fauna of India, Orthopt., Grylloid.*, 2 : 122.

Material examined : 1 ♂, 2 ♀ ♀, Sambalpur (at light), 3 & 6.xi.1972, J. M. Julha.

Distribution : India : Arunachal Pradesh, Assam, Meghalaya, Bihar, Orissa (as above), Jammu & Kashmir, Karnataka, Tamilnadu, Punjab and Andaman Islands ; Sri Lanka ; Burma ; Malaya ; Java ; Celebes.

***22 Loxoblemmus detectus (Serville)**

1839. *Platyblemmus detectus* Serville, *Ins. Orth.*, : 356.

1969. *Loxoblemmus detectus* : Chopard, *Fauna of India, Orthopt. Grylloid.*, 2 : 123.

Material examined : 1 ♀, Inspection Bungalow, Angul, Dhenkanal distt., 2.x.1972; K. Rai.

Distribution : India : Arunachal Pradesh, Sikkim, Bihar, Orissa (as above), Uttar Pradesh, Andaman Islands ; Sri Lanka ; Malaya ; Pahang ; Johore.

***23. Loxoblemmus haani Saussure**

1877. *Loxoblemmus haani* Saussure, *Mem. Soc. Geneve*, 25 : 257.

1969. *Loxoblemmus haani* : Chopard, *Fauna of India, Orthopt. Grylloid.*, 2 : 124.

Material examined : 3 ♂ ♂, Circuit House, Keonjhar, Keonjhar distt., 19, 20 & 26.ix.1972; K. Rai.

Distribution : India : Arunachal Pradesh, Orissa (as above), West Bengal.

Remarks : It is very close to the preceding species, from which it differs in the shape of rostrum.

24. Pteronemobius taprobanensis (Walker)

1869. *Trigonidium taprobanense* Walker, *Cat. Derm. Salt. Brit. Mus.*, 1 : 102.

1969. *Pteronemobius taprobanensis* : Chopard, *Fauna of India, Orthopt. Grylloid.*, 2 : 163.

Material examined : 1 ♀, Bonaigarh, Sundargarh distt., 15.xii.1971, P. K. Maiti ; 3 ♀ ♀, Circuit House, Keonjhar, Keonjhar distt., 25.ix.1972, K. Rai ; 5 ♂ ♂, 4 ♀ ♀, Inspection Bungalow, Angul, Dhenkanal distt., 30.ix.1972, K. Rai ; 1 ♀, Sambalpur, 3.xi.1972, J. M. Julka.

Distribution : India : Arunachal Pradesh, Assam, Meghalaya, West Bengal, Orissa, Bihar, Rajasthan, Uttar Pradesh, Karnataka, Tamilnadu, Maharashtra, Andaman Islands ; Bangladesh ; Sri Lanka ; Malaya ; Burma,

Remarks : A common and widely distributed species in India. Attracted to light at night.

25. Pteronemobius concolor (Walker)

1871. *Eneoptera concolor* Walker, *Cat. Derm. Salt. Brit. Mus.* 5 (Suppl.), : 10.

1969. *Pteronemobius concolor* : Chopard, *Fauna of India, Orthopt. Grylloid.*, 2 : 160.

Material examined : 3 ♂ ♂, 4 ♀ ♀, Bonaigarh, Sundargarh distt., 14.xii.1971, P. K. Maiti ; 9 ♂ ♂, 6 ♀ ♀, Inspection Bungalow, Angul, Dhenkanal distt., 2.x.1972, K. Rai ; 1 ♀, Nandankanan, Cuttack distt., 23.iii.1974, R. K. Kacker.

Distribution : India : Assam, West Bengal, Orissa, Maharashtra, Rajasthan, Uttar Pradesh, Karnataka, Tamilnadu and Andaman Islands ; Sri Lanka ; Burma ; Malaya.

*** 26. Pteronemobius bicolor (Saussure)**

1877. *Nemobius bicolor* Saussure, *Mem. Soc. Geneve*, 25 : 98.

1969. *Pteronemobius bicolor* : Choyard, *Fauna of India, Orthopt. Grylloid.*, 2 : 166.

Material examined : 1 ♂, Inspection Bungalow, Angul, Dhenkanal distt., 30.ix.1972, K. Rai ; 1 ♂, Jharsuguda, Sambalpur distt., 31.x.1972, J. M. Julka ; 1 ♂, Baripada, Mayurbhanj distt., 5.iv.1973, S. K. Gupta ; 3 ♀ ♀, Angul, Dhenkanal distt., 10.iv.1973, S. K. Gupta.

Distribution : India : Bihar, West Bengal, Orissa (as above), Madhya Pradesh, Uttar Pradesh, Karnataka, Tamilnadu ; Sri Lanka ; Burma ; Thailand.

*** 27. Pteronemobius csikii (Bolivar)**

1901. *Nemobius csikii* Bolivar, *Zichy zool. Ergebn.*, 2 : 243.

1969. *Pteronemobius csikii* : Chopard, *Fauna of India, Orthopt. Grylloid.*, 2 : 165.

Material examined : 1 ♂, Sundargarh, 23.x.1972, J. M. Julka.

Distribution : India : Arunachal Pradesh, Assam, Bihar, Orissa (as above), Madhya Pradesh, Uttar Pradesh, Rajasthan, Haryana, Karnataka, Tamilnadu ; Sri Lanka ; Burma ; China.

Remarks : A rare species in Orissa though it is fairly well distributed in India.

28. *Pteronemobius fascipes* (Walker)

1869. *Eneoptera fascipes* Walker, *Cat. Derm. Salt. Brit. Mus.*, 1 : 67.

1969. *Pteronemobius fascipes* : Chopard, *Fauna of India, Orthopt. Grylloid.*, 2 : 164.

Material examined : 1 ♀, Panposh, Raurkela, Sundargarh distt., 8.xii.1971, P. K. Maiti ; 1 ♂, 2 ♀ ♀, Bonaigarh, Sundargarh distt., 13 & 14.xii.1971, P. K. Maiti ; 1 ♀, 5kms. SW of Bonaigarh Court, Sundargarh distt., 15.xii.1971, P. K. Maiti ; 1 ♀, Dhanupali, 3 kms South of Sambalpur Jail, 22.xii.1971, P. K. Maiti ; 2 ♀ ♀ ; Gaundrial village, 5kms SW of Bolangir, 2.i.1972, P. K. Maiti ; 3 ♂ ♂, 1 ♀, Subulia Khasra Forest, 4 kms NE of Sundargarh 10.i.1972, P. K. Maiti ; 1 ♀, Athgarh & Environs, Cuttack distt., 28.viii.1972, S. K. Mitra ; 1 ♀, Circuit House, Keonjhar, Keonjhar distt., 25.ix.1972, K. Rai ; 10 ♂ ♂, 8 ♀ ♀, Inspection Bungalow, Angul, Dhenkanal distt., 30.ix.1972, K. Rai ; 2 ♀ ♀, P. W. D. Bungalow, Dhenuanal, 5.x.1972, K. Rai ; 1 ♂, 2 ♀ ♀, Sundargarh, 23.x.1972, J. M. Julka ; 1 ♀, Sambalpur, 6.xi.1972, J. M. Julka ; 1 ♂, Bolangir, 9.xi.1972, J. M. Julka ; 1 ♀, Atei Reserve Forest, Keonjhar distt., 30.iii.1973, S. K. Gupta ; 1 ♂, Taptapani, Ganjam distt., 12.iii.1974, R. K. Kacker ; 2 ♀ ♀, Bio. Fishery Research Unit Campus, Puri, 18.iii.1974, R. K. Kacker.

Distribution : India : Arunachal Pradesh, Assam, Bihar, Meghalaya, Sikkim, West Bengal, Orissa, Uttar Pradesh, Madhya Pradesh, Maharashtra, Himachal Pradesh, Haryana, Jammu & Kashmir, Kerala, Karnataka and Tamilnadu ; Sri Lanka ; Burma ; Java.

*29. *Paranemobius pictus* (Saussure)

1877. *Pseudonemobius pictus* Saussure, *Mem. Soc. Geneve*, 25 : 67.

1969. *Paranemobius pictus* : Chopard, *Fauna of Orthopl. Grylloid.*, 2 : 174.

Material examined : 1 ♂ (nymph), Nallah and Vicinity, 4 kms SE of Rairakhol, Sambalpur distt., 27.xii.1972, P. K. Maiti ; 1 ♀, Katra Rest Shade, Bangriposi, Mayurbhanj distt., 15.ix.1972, K. Rai ; 1 ♂, 1 ♀, Circuit House, Keonjhar, Keonjhar distt., 19 & 25.ix.1972, K. Rai ; 5 ♀ ♀, Inspection Bungalow, Angul, Dhenkanal distt., 30.ix & 2.x.1972, K. Rai ; 1 ♀, Sundargarh, 23.x.1972, J. M. Julka ; 1 ♂, Sambalpur, 6.xi.1972, J. M. Julka ; 1 ♂, Bolangir, 9.xi.1972, J. M. Julka ; 1 ♂, 1 ♀, Taptapani, Ganjam distt., 15.iii.1974, R. K. Kacker.

Distribution : India : Jammu & Kashmir, Madhya Pradesh, Orissa (as above), Maharashtra, Bihar, Karnataka, Kerala, Tamilnadu ; Sri Lanka.

Family III. OECANTHIDAE

***30. *Oecanthus indicus* Saussure**

1878. *Oecanthus indicus* Saussure, *Mem. Soc. Geneve*, **25** : 454.

1969. *Oecanthus indicus* : Chopard, *Fauna of India, Orthopt. Grylloid.*, **2** : 267.

Material examined : 1 ♀, Sambalpur (at light), 6.xi.1972, *J. M. Julka* ; 2 ♀ ♀, Taptapani, Ganjam distt., 14 & 15.iii.1974, *R. K. Kacker* ; 1 ♀, Botanical Garden, Nandankanan, Puri, 27.iil.1974, *R. K. Kacker*.

Distribution : India : Arunachal Pradesh, Bihar, Orissa (as above) West Bengal, Maharashtra, Madhya Pradesh, Tamilnadu and Andaman Islands ; Sri Lanka ; Malaya Archipelage ; philippine Islands.

***31. *Oecanthus bilineatus* Chopard**

1937. *Oecanthus bilineatus* Chopard, *Indian Forest. Rec., N. S.*, **3** : 26.

1969. *Oecanthus bilineatus* : Chypard, *Fauna of India, Orthopt. Grylloid.*, **2** : 269.

Material examined : 1 ♀, Top of hillock, behind P.W.D. Bungalow, Deogarh, Sambalpur distt., 9.vi.1972, *D. P. Sanyal*.

Distribution : India : Orissa (as above), Rajasthan and Tamilnadu.

Family IV. TRIGONIDIIDAE

32. *Trigonidium cicindeloides

1839. *Trigonidium cicindeloides* Rambur, *Faune Andal.*, **2** : 39.

1969. *Trigonidium cicindeloides* : Chopard ; *Fauna of India, Orthopt. Grylloid.*, **2** : 304.

Material examined : 1 ♀, Panposh, Raurkela, Sundargarh distt., 8.xii.1971, *P. K. Maiti* ; 1 ♀, Farsatola village, Raurkela, Sundargarh distt., 9.xii.1971, *P. K. Maiti* ; 1 ♀, Bijoy Ramchandrapur, Baripada, Mayurbhanj distt., 10.viii.1972. *S. K. Mitra*.

Distribution : India : Arunachal pradesh, Assam, Bihar, West Bengal, Orissa (as above), Tamilnadu and Andaman Islands ; Sri Lanka ; Malaya ; Burma.

33. *Trigonidium humbertianum* (Saussure)

1878. *Homoeoxiphus humbertianus* Saussure, *Mem. Soc. Geneve*, **25** : 468.

1969. *Trigonidium humbertianum* : Chopard, *Fauna of India, Orthopt. Grylloid.*, **2** : 305.

Material examined : 1 ♀, Bonaigarh (near Court), Sundargarh distt., 13.xii.1972, *P. K. Maiti* ; Manbhanj, Bangriposi, Mayurbhanj distt., 17.ix.1972, *K. Rai*.

Distribution : India : Maharashtra, Bihar, Assam, Orissa, Tamilnadu, Kerala and West Bengal ; Sri Lanka.

Remarks : This species is very close to *Trigonidium cicindeloides* Rambur, but differs in having larger and less convex tegmina; caudate wings and perforated anterior tibiae.

34. *Homoeoxipa* sp.

Material examined : 1♂, State Agriculture Farm Cuttak, 23.xii.1970, S. Khera.

Remarks : Being a damaged specimen, could not be identified upto the specific level.

35. *Amusurgus* sp.

Material examined : 1♀, P. W. D. Bungalow, Dhenkanal, 5.x.1972, K. Rai.

Remarks : In absence of male specimen it is not possible to go upto the specific level.

36. *Metioche* sp.

Material examined : 1♂, 1♀, Panposh, Raurkela, Sundargarh distt., 8.xii.1971, P. K. Maiti.

Remarks : It is nearer to *Metioche gigas* (Bolivar) but differs in the general shape and colouration of the body which may be the variation.

Family V. ENEOPTERIDAE

37. *Madasuma* sp.

Material examined : 1♂, Barsuan H. S. L. Rest House, Sundargarh distt., 12.ix.1972, S. Khera.

Remarks : The above single specimen differs from the known species of the genus *Madasumma* Walker, in respect of and in view of lack of sufficient material it is not possible to fix its specific identity.

*38. *Euscyrtus hemelytrus* (Haan)

1842. *Gryllus* (*Eneoptera*) *hemelytrus* Haan, *Temminck Verhandel. Orth.*, : 231.

1969. *Euscyrtus hemelytrus* : Chopard, *Fauna of India, Orthopt. Grylloid.*, 2 : 392.

Material examined : 3♂♂, 10♀♀, Central Rice Research Inst. Cuttack, 21, 23 & 24.xii.1970, S. Khera ; 1♀, Anandapur, Keonjhar distt., 2.iv.1973, S. K. Gupta.

Distribution : India : West Bengal, Assam, Orissa, Andaman Islands ; Sri Lanka ; Burma ; Malaya ; Java ; Batavia ; Moluccas ; North Australia.

Remarks : These specimens were collected from the paddy fields. Rare macropterous form was found at Anandapur.

Suborder CAELIFERA

Superfamily TRIDACTYLOIDEA

Family I. TRIDACTYLIDAE

***39. *Tridactylus thoracicus* Guér**

1844. *Tridactylus thoracicus* Guér, *Icon. R. An.*, 3 : 336.

1925. *Tridactylus thoracicus* : Chopard, *Ann. Mag. nat. Hist.*, (9) 15 : 506.

Material examined : 1 ♂, 1 ♀, Circuit House, Keonjhar, Keonjhar distt., 25.ix.1972, *K. Rai* ; 30 ♂♂, 50 ♀♀, Inspection Bungalow Angul, Dhenkanal distt., 30.ix.-2 & 3.x.1972, *K. Rai* ; 5 ♂♂, 10 ♀♀, Inspection Bungalow Dhenkanal, 5.x.1972, *K. Rai*.

Distribution : Widely distributed in the Indo-Malayan region. In India, it is reported earlier from Bihar and Madhya Pradesh.

SUMMARY

The present report deals with 39 species of Grylloidea and Tridactyloidea. Twentythree species are being recorded for the first time from the State of Orissa. The distribution of each species is also given.

ACKNOWLEDGEMENTS

We offer our grateful thanks to Dr. B.K. Tikader, former Director, Zoological Survey of India, for his keen interest and encouragement in this work, and to Dr. S. K. Bhattacharya, Scientist D, Entomology Division for courtesies. Thanks are also due to Dr. A. P. Kapur, former Director, Zoological Survey of India, and Dr. S. Khera, former joint Director-in-charge, Z. S. I. for their keen interest in the faunal exploration of Orissa. We are also thankful to officers of the Survey for collection of this interesting material from Orissa.

REFERENCES

- CHOPARD, L. 1924. The fauna of an Island in the Chilka Lake. The Dermaptera and Orthoptera of Barkuda Island. *Rec. Indian Mus.*, 26 : 165-191.
- CHOPARD, L. 1928. Revision of the Indian Gryllidae. *Rec. Indian Mus.*, 30 : 1-36.
- CHOPARD, L. 1936. The Tridactylidae and Gryllidae of Ceylon. *Ceylon J. Sc.*, B 20 : 9-87.
- CHOPARD, L. 1967. *Orthopterorum Catalogus*, part 10 : 1-211.
- CHOPARD, L. 1969. *The Fauna of India and The Adjacent Countries*, Orthoptera, Grylloidea, 2 : 1-421.

INSECTA : EPHEMEROPTERA

V. D. SRIVASTAVA AND K. K. RAY

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INTRODUCTION

The present work is based on the study of Ephemeroptera material from Orissa present in the Zoological Survey of India, Calcutta. It includes two species of family Baetidae, one of Caenidae, one of Ephemeridae and one of Heptageniidae. The last mentioned family is represented by *Rhithrogena parva* (Ulmer) which is a new record for the species and a sole representative of the genus from India. Prior to this, Chopra (1924) reported four species from the area viz., *Cloeon marginale* (Hagen) and *Cloeon variegatum* Chopra (Baetidae); *Caenis perpusilla* Walker (Caenidae); and *Eatonigenia indica* (Chopra) (Ephemeridae) and Hafiz (1937) subsequently recorded the occurrence of *Eatonigenia indica* (Chopra) from Chilka (Orissa). Thus Orissa Ephemeroptera fauna was known to comprise five species. With this present study the number of species from Orissa now stands at six and key for the identification of these species is provided in this contribution.

SYSTEMATIC ACCOUNT

Family I. BAETIDAE

1. *Cloeon Marginale* (Hagen)

1858. *Cloe marginalia* Hagen, *Verh. zool.-bot. Ges. Wien*, 8 : 47.

1924. *Cloeon marginalis* : Chopra. *Rec. Indian Mus.*, 26 : 419.

1965. *Cloeon marginale* : Fernando, *Bull. Freshwater Fish Res. Stn. Ceylon*, 17 : 187.

Material examined : 5 ♂♂, 5 ♀♀, Ghatgaon, Keonjhar District, coll. S. K. Mitra, 21.v.1972 (in alcohol).

Measurements (4 exs.) : Body-length : ♂ 4-4.2 mm ; ♀ 4.1-4.3 mm. Forewing length : ♂ 4-4.1 mm ; ♀ 4.1-4.2 mm.

Distribution : India : Orissa (Keonjhar, Ganjam Districts) West Bengal, Maharashtra. Also Bangladesh, Sri Lanka, N. Vietnam (Tongking), Taiwan, Indonesia and Philippines.

2. *Cloeon variegatum* Chopra

1924. *Cloeon variegatum* Chopra, *Rec. Indian Mus.*, 26 : 420.

1957. *Cloeon variegatum* : Van Bruggen, *Nova Guinea* (N. S.), 8 : 37.

Material examined : 4 ♂♂, 4 ♀♀, Barsuan, Sundergarh District, coll. S. Khera, 14.ix.1972 (in alcohol).

Measurements (4 exs.) : Body-length : ♂ 4-4.1 mm ; ♀ 4.1-4.2 mm.
Forewing length : ♂ 4-4.2 mm ; ♀ 4.2-4.4 mm.

Distribution : India : Orissa (Sundergarh, Ganjam), West Bengal.

Family II. CAENIDAE

3. *Caenis perpusilla* Walker

1853. *Caenis perpusilla* Walker, *List. Neuropt. Ins. Brit. Mus.* : 585.

1965. *Caenis perpusilla* Walker, Fernando. *Bull. Freshwater Fish. Res. Stn. Ceylon*, **17** : 187.

Material examined : 6 ♂♂, 6 ♀♀, Purnakota, Dhenkanal District : coll. R. L. Chowdhury, 2.iii.1975, (in alcohol) :

Measurements (4 exs.) : Body-length : ♂ 2.2-2.3 mm. ; ♀ 2.3-2.4 mm.
Forewing length : ♂ 2.4 mm.-2.5 mm ; ♀ 2.5-2.6 mm.

Distribution : India : Orissa (Ganjam), Bangladesh, Sri Lanka.

Family III. EPHEMERIDAE

4. *Ephemera* sp.

Material examined : 1 ♀ Lulang, Mayurbhanj District ; coll. R. L. Chowdhury, 17.ii.1975 (in alcohol).

Measurements : Body length : 9 mm ; Forewing length 12 mm.

Remarks : Specimen examined shows some interesting variation from the recorded species of the genus but since it needs further confirmation based on more specimens ; it has presently been described as *Ephemera* sp.

Family IV. HEPTAGENIDAE

5. *Rhithrogena parva* (Ulmer)

(Figs. 1-3)

1912. *Ecdyurus parvus* Ulmer, *Ent. Mitt.*, **1** : 574.

1969. *Rhithrogena parva* (Ulmer), Ueno. *Oriental Ins.*, **3** (9) : 234-235.

Material : 1 ♂ and 1 ♀. Talbandh, Mayurbhanj District ; coll. R. L. Chowdhury, 6.iii.1975.

Description : A brief description and figures of this newly recorded species of the genus from India are given here.

Male : A medium sized slender species. Body length 5 mm, forewing expanse 7 mm. Head and vertex yellowish black ; antenna yellowish brown ; ocellus black ; eyes black and placed closely ; thorax brownish black with darker markings ; wings almost transparent, cross veins also transparent

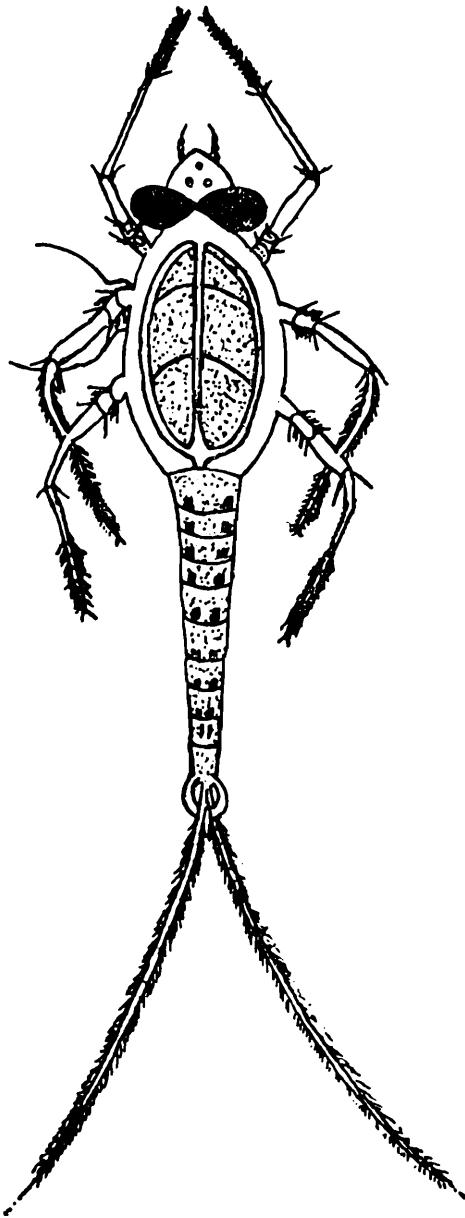


Fig. 1. *Rhithrogena parva* (Ulmer) ♂.

costal margin of forewing transsluscent tinged with yellowish white and less hairy ; tibiae longer than foretarsus ; foretarsus 5 segmented of which 1 as long as 2, 3 and 5 subequal 4 the shortest ; claws dissimilar, hind tarsal joints from longest to shortest 5, 1, 2, 4, 3 ; abdominal tergites from I-IX with mid dorsal dark markings, tergites pale yellow, sternum yellow ; genitalia and tails yellowish and with scanty hairs.

Female : A thickly built species. Body length 5.4 mm. Forewing 9 mm. Eyes not so closely placed as in male ; Wings clearer than male and the mid dorsal dark stripe on abdominal tergites absent. Otherwise as in male.

Distribution : India : Orissa (Mayurbhanj District) ; also Taiwan, Ryukyu Islands and Java.

Remarks : It is a new record for the species as well as for the genus from India. From the Indian subcontinent, however, genus was known only by *R. basiri* Ali (1971) from Swat, Pakistan.

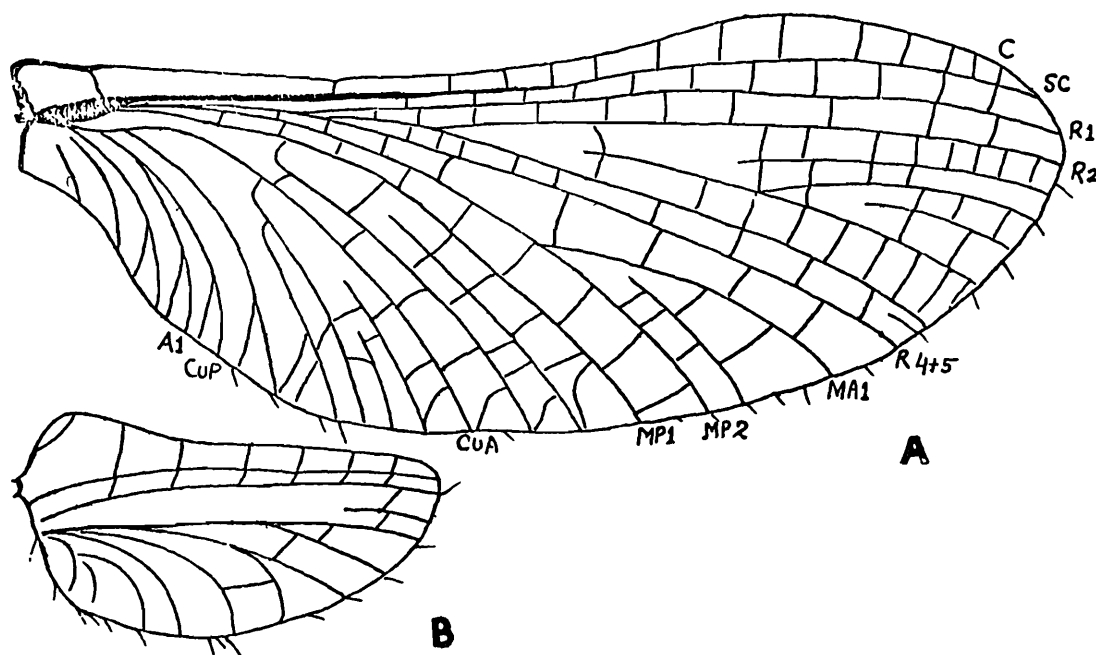


Fig. 2. *Rithrogena parva* (Ulmer) ♂.

A. forewings ; B. Hindwing ; C. Costa ; A1, Anal first ; CuA, Cubital anterior ; CuP, Cubital Posterior ; MA1, Median anterior 1 ; MP₁, MP₂, Median Posterior one & two ; R₁, R₂, R₄₊₅ Radius one, two, four+five.

KEY TO THE SPECIES OF EPHEMEROPTERA FROM ORISSA

1. Smaller species (2.3 mm—4.4 mm).	...	...	2
Bigger species (5 mm—9 mm).	...	...	4
2. Forewings with longitudinal veins and few crossveins, hind wings absent. Legs with 5 segmented tarsi. Male with normal eyes.	...	<i>Caenis</i> Stephens	
(Body white with narrow sooty black lines across head and side of prothorax).	...	(<i>C. perpusilla</i> Walker)	
Forewings with longitudinal veins and several crossveins and with free intercalaries, hind wings reduced. Legs with 3 segmented tarsi. Male with turbinate eyes.	...	<i>Cloeon</i> Leach 3	
3. Wings vitreous and bistre-brown in marginal and submarginal areas in female and reddish brown dorsum of posterior abdomen in male.	...	<i>Cloeon marginale</i> (Hagen)	
Wings transparent and iridescent on marginal and submarginal areas, dorsum of abdomen luteous.	...	<i>Cloeon variegatum</i> Chopra	
4. Posterior margin of head between eyes in female almost straight.	...	...	5
Posterior margin of head slightly emarginate.	...	...	6

5. Posterior margin of pronotum deeply excavated at median area. Eyes of male large and contiguous apically, without distinct cross veins at and below bulla, stigmatic area without anastomosed cross veins, in hind wing M_2 & M_1 not detached basally though fork of R_5 present. ...

Rhithrogena Eaton

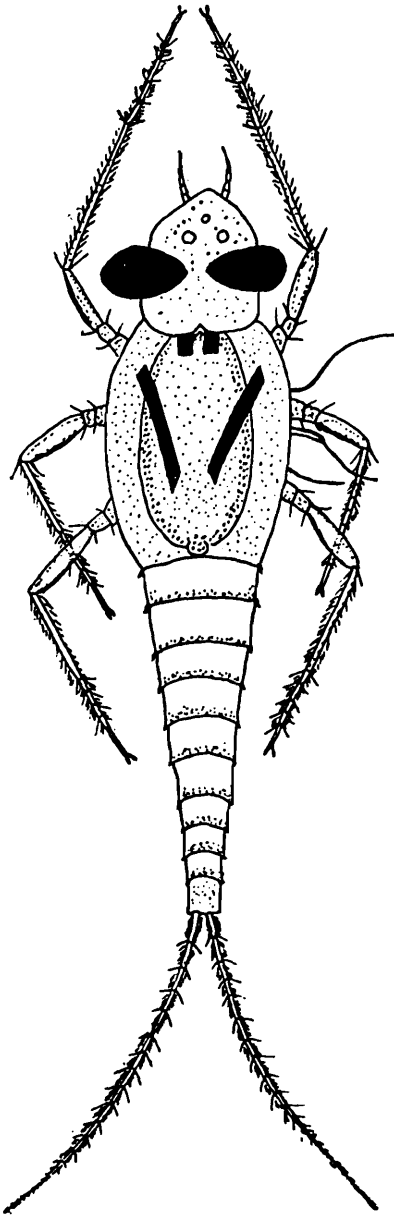


Fig. 3. *Rhithrogena parva* (Ulmer) ♀.

(Distinct brownish black margins on dorsum of thorax and on abdominal tergites of ♀, later markings in ♀ absent.) ...

R. parva (Ulmer)

Posterior margin of pronotum not excavated at the median area. Eyes of male small and separated apically, with distinct crowding of cross veins at and below bulla, stigmatic area with anastomosed cross veins, in hind wing M_2 often detached from M at base and directed downwards towards cu. ...

Ephemerella Linnaeus
(*Ephemerella* sp)

6. Eyes of male moderate to large in size, approximated apically. No crowding of cross veins at bulla, stigmatic area of one or both wings may be dark margined.... *Eatonigenia* Ulmer
(Mid dorsal white ridge on thorax, pronotum yellow minutely spotted, mesonotum brown and metanotum light orange) ... [*Eatonigenis indica* (Chopra)]

SUMMARY

Five species of Ephemeroptera (2 of Baetidae and one each of Caenidae, Ephemeridae and Heptageniidae) are reported from Orissa. The species *Rithrogena parva* (Ulmer) reported here from India for the first time, is briefly described and figured.

ACKNOWLEDGEMENTS

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REFERENCES

- ALI, S. R. 1971. Certain mayfly nymphs (order : Ephemeroptera) of Azad Kashmir and Swat. *Pakistan J. Sci.*, **23** (5 & 6) : 209-14.
- BRUGGAN, A. C. VAN 1957. On two species of Mayflies from Wissel Lakes, Central New Guinea (Ephemeroptera). *Nova Guinea* (N. S.), **8** : 31-39.
- CHOPRA, B. 1924. The fauna of an island in Chilka Lake. The Ephemeroptera of Barkuda island. *Rec. Indian Mus.*, **26** : 415-422.
- FERNANDO, C. H. 1965. A guide to the freshwater fauna of Ceylon—Suppl. 2. *Bull. Freshwater Fish. Res. Sta. Ceylon*, **17** : 177-211.
- HAFIZ, H. A. 1937. The Indian Ephemeroptera (Mayflies) of the suborder Ephemeroidea. *Rec. Indian Mus.*, **37** : 351-375.
- HAGEN, H. A. 1858. Synopsis der Neuroptera Ceylons. *Verh. Ges. Wien*, **8** : 471-488.
- UENO, M. 1969. Mayflies from various regions of South East Asia. *Original Ins.*, **3** (3) : 221-238.
- ULMER, G. 1912. Sauter's Formosa. Ausbeute Ephemeriden. *Ent. Mitteil.*, **1** : 369-375.
- WALKER, F. 1853. Catalogue of the species of Neuropterous insects in the collection of the British Museum. Part III. Termitides and Ephemeridae : 533-585.
- Fauna of Orissa : State Fauna Series 1 : 129-134, 1987* (Publ. Zool. Surv. India).

INSECTA : ODONATA

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INTRODUCTION

Odonata fauna of Orissa state, located between latitudes 17°49'-22°33'N and longitudes 81°27'-87°57'E, was hitherto not much known. Laidlaw (1915), while working out collection from Chilka lake, had recorded only 8 species of Odonates, of which 3 were Zygopterans and 5 Anisopterans and Fraser and Dover (1922) recorded 28 species from Barkuda island. Fraser (1933, 34, 36) in his fauna volumes, reported 36 species from Peninsular India/South India and one specifically from Orissa. Thus 29 species of Odonates from Orissa were recorded prior to this work. Some other species reported from greater Bengal (Erstwhile Bengal), may also be from area of present Orissa, though no specific indication is available.

The present study is based on a large series of Odonate collections from all the 13 districts of Orissa made by several survey parties of Zoological Survey of India over a number of years. This has resulted in reporting of a total of 48 species, of which 14 belong to Coenagrionidae, 4 to Lestidae and 1 to Agriidae among the zygopterous odonates, while anisopterans are represented by 3 Gomphidae, 2 Aeshnidae, 1 Macrodiplactidae and 22 Libellulidae. Of these, 29 species are new records for Orissa. With this present study, now 58 Odonate species are known to occur in Orissa. Detailed distribution of each species presently studied is indicated. A key to 58 species is also provided, based on Fraser (1933, 34, 36, 57).

SYSTEMATIC ACCOUNT

Order ODONATA

Suborder ZYGOPTERA

Family I. COENAGRIONIDAE

1. *Ceriagrion coromandelianum* (Fabricius)

1798. *Agrion coromandelianum* Fabricius, *Ent. Syst. Suppl.* : 287.
1915. *Ceriagrion coromandelianum* : Laidlaw, *Mem. Ind. Mus.* 5 : 180.
1922. *Ceriagrion coromandelianum* : Fraser & Dover. *Rec. Indian Mus.*, 24 : 309.
1933. *Ceriagrion coromandelianum* : Fraser, *Fauna Brit. India Odonata* I : 315, 316.

Material examined : 1♂, 1♀, Nandan Kanan, Puri, 27.iii.1974 (R. K. Kacker & Party); 1♂, 1♀, Anandapur, Keonjhar, 2.iv.1973 (S. K. Gupta & Party); 2♂♂, 1♀, Koraput, 23-30.ix.1973 (D. P. Sanyal & Party); 1♀, Kaliyugeswar Isl., Chilka Lake, Ganjam, 19.iii.1974 (R. K. Kacker & Party); 1♂, Banki, Sundargarh, 29.iii.1973 (T. K. Sen & Party).

Distribution : India : Orissa (Ganjam, Keonjhar, Koraput, Puri and Sundargarh Districts) and widely distributed. Also Sri Lanka, Burma, Indochina, Malaysia and Southern China.

2. *Ceriagrion rubiae* Laidlaw

1916. *Ceriagrion rubiae* Laidlaw, *Rec. Indian Mus.*, 12 : 132-3.

1933. *Ceriagrion rubiae* : Fraser, *Fauna Brit. India, Odonata*, I : 318, 319.

Material examined : ♂, Pottangi, Koraput, 24.ii.1972 (K. V. S. Rao & Party).

Distribution : India : Orissa (new record Koraput district), Karnataka (Coorg south of Kanara), Maharashtra (western ghats upto Khandala).

3. *Ceriagrion olivaceum* Laidlaw

1914. *Ceriagrion olivaceum* Laidlaw, *Rec. Indian Mus.*, 8 : 345-46.

1933. *Ceriagrion olivaceum* : Fraser, *Fauna Brit. India, Odonata*, I : 324-326.

Material examined : 1♀, Nandan Kanan, Puri, 27.iii.1974. (R. K. Kacker & Party); 1♀, Titlagarh, Bolangir, 16.xi.1972 (J. M. Julka & Party); 1♂, Anandapur, Keonjhar, 18.iii.1973 (S. K. Gupta & Party); 1♂, Keonjhar, 1.iv.1973 (R. K. Kacker & Party); 1♀, Kaliyugeswar, Chilka Lake, Ganjam, 14.iii.1974 (R. K. Kacker & Party).

Distribution : India : Orissa (new record, Bolangir, Ganjam, Keonjhar, Mayurbhanj, Puri districts), Assam, West Bengal, Himachal Pradesh, Kerala, Maharashtra, Also Burma.

4. *Coenagrion dyeri*

1919. *Agriocnemis dyeri* Fraser, *Rec. Indian Mus.*, 16 : 451-452.

1923. *Coenagrion dyeri* Fraser, *J. Bombay nat. Hist. Soc.*, 29 : 748.

1933. *Cenegrion dyeri* : Fraser, *Fauna Brit. India, Odonata* I : 413-415.

Material examined : 2♀♀, Titlagarh, Bolangir, 14.ix.1972 (J. M. Julka & Party); 1♀, Kaliyugeswar, Chilka, Ganjam (R. K. Kacker & Party).

Distribution : India : Orissa (New record, Bolangir, Ganjam Districts), Madhya Pradesh, Uttar Pradesh, Karnataka. Also Burma.

5. *Ischnura senegalensis* (Rambur)

1850. *Agrion senegalensis* Rambur, *Ins. Nevrop* : 276.

1915. *Ischnura senegalensis* : Laidlaw, *Mem. Indian Mus.* 5 : 180.

1922. *Ischnura senegalensis* : Fraser & Dover, *Rec. Indian Mus.*, 24 (3) : 310.

1933. *Ischnura senegalensis* : Fraser, *Fauna Brit. India, Odonata* I : 848-85.

Material examined : 2♂♂, Balasore, 8.xii.1955 (T. G. Vazirani & Party) ; 1♂, Kaliyugeswar, Chilka Lake, Ganjam, 19.iii.1974 (R. K. Kacker & Party) ; 1♀, Rambha, Ganjam, 31.xii.1973 (R. L. Chowdhury & Party).

Distribution : India : Orissa (Balasore, Ganjam Districts), Himachal Pradesh, Maharashtra, Manipur, Rajasthan, Andaman, Uttar Pradesh, West Bengal. Also Burma, Sri Lanka and extends eastwards as far as Phillippines, Japan and Westwards throughout African continent.

6. *Ischnura elegans* (Vander Linden)

1923. *Agrion elegans* Vander Linden. *Opusc. Sci.*, 4 : 104.

1933. *Ischnura elegans* : Fraser, *Fauna Brit. India, Odonata* I : 351-354.

Material examined : 1♂, Central Rice Research Institute, Rice field, Cuttack, 6.xii.1965 (A. P. Kapur & G. S. Arora).

Distribution : India : Orissa (Cuttack District, new record). Also Pakistan (Baluchistan), British Isle across Europe.

7. *Ischnura forcipata* Morton

1907. *Ischnura forcipata* Morton, *Trans. R. ent. Soc. Lond.*, 306.

1933. *Ischnura forcipata* : Fraser, *Fauna Brit. India, Odonata*, I : 354-357.

Material examined : 1♂, Bolangir, 10.xi.1972 (J. M. Julka & Party).

Distribution : India : Orissa (Bolangir District), Himachal Pradesh, West Bengal, Uttar Pradesh, Punjab. Also Pakistan (Quetta). It is a new record for Orissa.

8. *Ischnura delicata* (Hagen)

1954. *Agrion delicata* Hagen, *Verh. zool.-bot. Ges. Wien*, 8 : 479.

1933. *Ischnura delicata* : Fraser, *Fauna Brit. India, Odonata*, I : 360-362.

Material examined : 1♂, Sambalpur, 31.x.1972 (J. M. Julka and party).

Distribution : India : Orissa (Sambalpur District), widely distributed throughout India. Also Australia, Borneo, Burma, Philippines, Malaysia, New Guinea, Sri Lanka. It is a new record for Orissa.

9. *Ischnura mildredae* Fraser

1927. *Ischnura mildredae* Fraser, *Rec. Indian Mus*, 29 : 88.

1933. *Ischnura mildredae* : Fraser, *Fauna Brit. India, Odonata*, I : 366-368.

Material examined : 4 ♂♂, Bolangir, 9.xi.1972 (*J. M. Julka and Party*).

Distribution : India : Orissa (Bolangir District). Also Burma. Recorded for the first time from India.

10. *Enallagma parvum* Selys

1876. *Enallagma parvum* Selys, *Bull. Acad. Belg.* (2) : 537.

1933. *Enallagma parvum* : Fraser, *Fauna Brit. India, Odonata*, I : 376-378.

Material examined : 1 ♂, Titlagarh, Bolangir, 16.xi.1972 (*J. M. Julka and Party*) ; 1 ♀, Balugaon, Puri, 30.xii.1973 (*R. L. Chowdhury and Party*) ; 2 ♀♀, Central Rice Research Institute, Cuttack, 6 xii.1965 (*A. P. Kapur and G. S. Arora*), 1 ♀, Angul, Dhenkanal, 9.iv.1973 (*S. K. Gupta and Party*).

Distribution : India : Orissa (Bolangir, Cuttack, Dhenkanal, Puri Districts), Great Nicobar, Gujarat, Madhya Pradesh, Manipur, Uttar Pradesh, West Bengal. Also Burma and Sri Lanka. It is a new record for Orissa.

11. *Aciagrion pallidum* Selys

1891. *Aciagrion pallidum* Selys, *Annali Mus. civ. Stor. nat. Genova*, (2) 10 (30) : 512-513.

1933. *Aciagrion pallidum* : Fraser, *Fauna Brit. India, Odonata*, I : 344-346.

Material examined : 1 ♀, Titlagarh, Bolangir, 17.xi.1972 (*J. M. Julka and Party*) ; 1 ♂, Kotagarh, Phulbani, 13.x.1973 (*D. P. Sanyal and Party*) ; 1 ♂, Champagarh, Betermpur, Puri, 10.i.1974 (*R. L. Chowdhury and Party*) ; 1 ♂, 2 ♂♂, Rambha, Ganjam, 31.xii.1973 (*R. L. Chowdhury and Party*) ; 1 ♂, Central Rice Research Institute Cuttack, 6.xii.1965 (*A. P. Kapur and G. S. Arora*).

Distribution : India ; Orissa (Bolangir, Cuttack, Ganjam Phulbari, Puri Districts), Assam, Maharashtra, Deccan plateau. Also Burma. It is a new record for Orissa.

12. *Agriocnemis lacteola* Selys

1877. *Agriocnemis lacteola* Selys, *Bull. Acad. Belg.* (2) 53 : 144.

1933. *Agriocnemis lacteola* : Fraser, *Fauna Brit. India, Odonata*, I : 381-383.

Material examined : 1 ♂, Rambha, Ganjam, 31.xii.1973 (*R. L. Chaudhury and Party*).

Distribution : India : Orissa (Ganjam District New Record), Assam, Bihar, Sikkim, West Bengal.

13. *Agriocnemis pygmaea* (Rambur)

1842. *Agrion pygmoea* Rambur, *Ins. Nevrop.* 278.

1922. *Agriocnemis pygmaea* : Fraser, *Rec. Indian Mus.* 4 : (3) : 309-310.

1933. *Agriocnemis pygmaea* : Fraser, *Fauna Brit. India, Odonata*, I : 398-401.

Material examined : 1 ♂, Balasore, 8.xii.1955 (T. G. Vazirani and Party) ; 1 ♂, Bolangir, 10.xi.1972 (J. M. Julka and Party) ; 1 ♂, Champaron, 25 kms. s. of Betera, Puri (R. L. Chowdhury and Party) ; 1 ♀, 2 kms. south of Balugaon Camp., Puri, 30.i.1973 (R. L. Chowdhury and Party) ; 2 ♂ ♂, 2 ♀ ♀, Jeypore, Koraput, 4.xii.1973 (D. P. Sanyal and Party) ; 4 ♂ ♂, 5 ♀ ♀, Cuttack, 6.xii.1965 (A. P. Kapur and G. S. Arora).

Distribution : India : Orissa (Bolangir, Balasore, Cuttack, Koraput, Puri Districts), Assam, Great Nicobar, Himachal Pradesh, Kerala, Tamil Nadu, Manipur, Nicobar, Punjab, Rajasthan, Uttar Pradesh, West Bengal. Also Australia, Burma, China, Formosa, Java, Malaysia, North Guinea, Phillipins, Seychelles, Singapore, Sri Lanka.

14. *Onychargia atrocyana* Selys

1865. *Onychargia atrocyana* Selys, *Bull. Acad. Belg.* (2) 20 : 414.

1933. *Onychargia atrocyana* : Fraser, *Fauna Brit. India, Odonata*, I : 417-418.

Material examined : 1 ♂, Stn. No. 24, Bolangir, 9.xi.1972 (J. M. Julka and Party).

Distribution : India : Orissa (Bolangir District), Assam, Malabar, Kanara, Kerala, West Bengal. Also Burma, Sri Lanka. It is a new record for Orissa.

Family II. LESTIDAE

15. *Lestes elata* Hagen

1858. *Lestes elata* Hagen, *Verh. zool.-bot. Ges. Wien*, 8 : 478.

1922. *Lestes elata* : Fraser and Dover, *Rec. Indian Mus.*, 24 (3) : 311.

1933. *Lestes elata* ; Fraser, *Fauna Brit. India, Odonata*, I : 37-40.

Material examined : 1 ♂, 1 ♀, Chapragaon, Koraput, 23-24.ii.1974 (K. V. S. Rao and Party) ; 1 ♀, Central Rice Research Institute, Cuttack, 2.xii.1965 (A. P. Kapur and G. S. Arora) ; 1 ♂, 1 Km. n. of Balugaon Rly. Stn., Puri, 20.iii.1974 (R. K. Kacker & Party).

Distribution : India : Orissa (Cuttack, Koraput, Puri Districts), Karnataka, Peninsular India. Also Sri Lanka.

16. *Lestes viridula* Rambur

1844. *Lestes viridula* Rambur, *Hist. Nat. Neuropteres* 252, 253.

1933. *Lestes viridula* ; Fraser, *Fauna Brit. India, Odonata*, I ; 45-46.

Material examined : 9 ♀ ♀, Chappragaon, Koraput, 23.ii.1972 (K. V. S. Rao and Party) ; 7 ♂ ♂, 3 ♀ ♀, Titlagarh, Bolangir, 17.xi.1972 (J. M. Julka and Party) ; 1 ♀, Kotagarh, Phulbani, 12.xii.1973 (D. P. Sanyal and Party) ; 1 ♂, Champaron, 36 Kms. s. of Betera, Puri, 10.i.1974 (R. L. Chowdhury and Party) ; 1 ♂, Rampha, Ganjam, 31.xii.1973 (R. L. Chowdhury and Party) ; 1 ♂, Madnapur, Rampur, Kalahandi, 6.xi.1973 (D. P. Sanyal and Party) ; 2 ♂ ♂, Central Rice Research Institute, Cuttack, 2.xii.1965 (A. P. Kapur and G. S. Arora).

Distribution : India : Orissa (Bolangir, Cuttack Ganjam, Kalahandi, Koraput, Phulbani, Puri Districts) and widely distributed in Peninsular India, specially in the Deccan and Western parts. It is a new record for Orissa.

17. *Lestes nodalis* Selys

1891. *Lestes nodalis* Selys, *Annali. Mus. civ. Stor. nat. Genova* (2), (30) : 496-497.

1933. *Lestes nodalis* ; Fraser, *Fauna Brit. India. Odonata*, I ; 51-53.

Material examined : 1 ♂, 1 ♀, Asna, 8 Kms. S. E. of Bisat, Mayurbhanj, 18.viii.1972 (S. K. Mitra and Party).

Distribution : India : Orissa (Maurbhanj District), Assam and many parts of N. E. India. Also Burma. It is a new record for Orissa.

18. *Lestes Umbrina* Selys

1891. *Lestes umbrina* Selys, *Annali. Mus. civ. Stor. Genova*, (2) 10 (30) ; 497, 498.

1933. *Lestes umbrina* ; Fraser, *Fauna Brit. India. Odonata*, I ; 53-55.

Material examined : 1 ♂, 1 ♀, Champagarh, Betera, Puri, 10.i.1974 (R. L. Chowdhury and Party) ; 1 ♀, Jeypore, Koraput, 23.xi.1973 (D. P. Sanyal and Party).

Distribution : India : Orissa (Koraput, Puri Districts), Maharashtra, Uttar Pradesh, West Bengal. It is a new record for Orissa.

Family III. AGRIDAE

19. *Neurobasis c. chinensis* Linnaeus

1758. *Libellula chinensis* Linnaeus, *Syst. Nat.* I ; 545 n. 15.

1933. *Neurobasis c. chinensis* ; Fraser, *Fauna Brit. India, Odonata*, I ; 121-124.

Material examined : 1 ♂ ; Astia Banipoda; Mayurbhanj; 21.iii.1973 (S. K. Gupta and Party).

Distribution : India : Orissa (Mayurbhanj District); Assam; Kerala; Tamil Nadu; Kanara; West Bengal. Also Burma; Thailand; Sri Lanka. It is a new record for Orissa.

Suborder ANISOPTERA

Family I. GOMPHIDAE

20. *Anormogomphus heteropterus* Selys

1854. *Anormogomphus heteropterus* Selys, *Bull. Acad. Belg.*, 21 2 : 61.

1933. *Anormogomphus heteropterus* : Fraser, *Fauna Brit. India, Odonata*, I : 174-176.

Material examined : 1 ♀, Ponposh, Sundargarh, 24.iii.1973 (*T. K. Sen and Party*); 1 ♀, Angul, Purnakota, Dhenkanal, 2.x.1972 (*K. Rai and Party*).

Distribution : India : Orissa (Dhenkanal. Sundargarh Districts) Bihar. Also Pakistan. It is a new record for Orissa.

21. *Mesogomphus lineatus* (Selys)

1850. *Gomphus lineatus* Selys, *Rev. Odon* : 386.

1933. *Mesogomphus lineatus* : Fraser, *Fauna, Brit. India, Odonata*, I : 230-234.

Material examined : 1 ♂, 4 Kms. N. E. of Kotagarh, Phulbani, 15.xii.1973 (*D. P. Sanyal and Party*).

Distribution : India : Orissa (Phulbani District), Kerala; Karnataka, Tamil Nadu, Uttar Pradesh, West Bengal. It is a new record for Orissa.

22. *Ictinogomphus rapax* (Rambur)

1842. *Diastatomma rapax* Rambur, *Ins. Neurvop* : 169.

1934. *Ictinus rapax* : Fraser, *Fauna Brit. India, Odonata*, II : 373-376.

Material examined : 1 ♀, Rajbari, Sundargarh.

Distribution : India : Orissa (Sundargarh District), widely distributed throughout India except in desert areas. Also Burma, Malaysia, Sri Lanka. It is a new record for Orissa.

Family II. AESHNIDAE

23. *Gynacantha millardi* Fraser

1920. *Gynacantha millardi* Fraser, *J. Bombay nat. Hist. Soc.*, 32 : 147.

1936. *Gynacantha millardi* : Fraser, *Fauna Brit. India, Odonata*, III : 105, 106.

Material examined : 1 ♀, Harisankar Rl., Bolangir, 17.xii.1972 (*A. K. Mandal & Party*).

Distribution : India : Orissa (Bolangir District), Karnataka, Maharashtra. It is a new record for Orissa.

24. *Anax guttatus* (Burmeister)

1839. *Aeschna guttata* Burmeister, *Handb. Ent. vol.*, 2 : 840.

1922. *Anax guttatus* : Fraser & Dover, *Rec. Indian Mus.*, 24 (3) : 308, 309.

1936. *Anax guttatus* : Fraser, *Fauna Brit. India Odonata*, III : 140-142.

Material examined : 1 ♂, 1 ♀, Barsasan, Keonjhar, Keonjhar, 27.ix.1972 (K. Rai and Party).

Distribution : India : Orissa (Keonjhar District) widely distributed in plains of Assam, Karnataka, Kerala, Tamil Nadu, West Bengal and N. W. India. Also Burma, Thailand, Java, Sumatra.

Family III. MACRODIPIACTIDAE

25. *Urothemis s. signata*

1839. *Libellula sanguinea* Burmeister, *Handb. Ent.* 2 : 258.

1922. *Urothemis signata signata* Fraser & Dover, *Rec. Indian Mus.*, 24 (3) : 308.

1936. *Urothemis signata signata* : Fraser, *Fauna Brit. India, Odonata*, III : 422-444.

Material examined : 3 ♂♂, Tehshil village ; Titlagarh, Bolangir dist, 6.x.1972 (S. Khera and Party) ; 1 ♂, Biological park, Nandan Kanan, Cuttack.

Distribution : India : Orissa (Bolangir, Cuttack District), Kerala, Maharashtra, Tamil Nadu. Also Burma, Thailand, Sri Lanka.

Family IV. LIBELLULIDAE

26. *Cratilla lineata* (Brauer)

1878. *Orthemis lineata* Brauer, *Sitzungsber Akad. Wien.*, 11 : 9 (Sep.)

1936. *Cratilla lineata* : Fraser, *Fauna Brit. India Odonata*, 1II ; 286-288.

Material examined : 1 ♀, P. W. D. Inspection Bungalow, Ganjam, 13.iii.1974 (R. K. Kacker & Party) ; 1 ♀, Jharpura, No, 3, 30.ix.1972 (K. Rai and Party).

Distribution : India : Orissa (Ganjam District), Kerala, Karnataka, Tamil Nadu, West Bengal. Also Burma, Malaysia, New Guinea, Philippines, Sundaic Archipelago to Borneo. It is a new record for Orissa.

27. *Orthetrum sabina* (Drury)

1770. *Libellula sabina* Drury, *Ill. Exot. Ins.*, I, 48 ; Fig. 4 ; 114, 115.

1922. *Orthetrum sabina* ; Fraser & Dover, *Rec. Indian Mus.*, 24 (3) ; 305.

1936. *Orthetrum sabina* ; Fraser, *Fauna Brit. India, Odonata*, III ; 300-302.

Material examined : 1 ♂, Gobindapur Dist., 21.ix.1972 (K. Rai and Party); 1 ♀, Anandpur, Keonjhar, 14.iii.1973 (S. K. Gupta and Party) ; 1 ♂, Ghatgaon, Keonjhar, 22.iii.1973 (S. K. Gupta and Party) ; 1 ♂, Titlagarh, Bolangir, 16.xi.1972 (J. M. Julka and Party) ; 1 ♂, Amalpara, Dhenkanal, 15.x.1972 (K. Rai and Party), 1 ♂, 1 ♀, Ponposi, Sundargarh, 24.iii.1973 (T. K. Sen and Party) ; 1 ♀, 3 Kms. N. of Madanpur, Kotagarh, Phulbani, 7.xii.1973 (D. P. Sanyal and Party) ; 1 ♂, 1 ♀, 6 Kms. W. of Betera Camp, Puri, 10.i.1974

(*R. L. Chowdhury and Party*) ; 1 ♀, Mal Kangini, 105 Kms. S. W. of Jeypur, Koraput, 2.xii.1973 (*D. P. Sanyal and Party*) ; 2 ♂ ♂, Stn. No. 3, Cuttack, 3.xii.1955 (*T. G. Vazirani*).

Distribution : India : Orissa (Bolangir, Cuttack, Dhenkanal, Keonjhar, Koraput, Puri, Sundergarh Districts), Assam, Bihar, Himachal Pradesh, Manipur, Punjab, South Andaman, Uttar Pradesh, West Bengal. Also Australia, Mesopotamia, Nepal, Persia to Samoa, Somaliland.

28. *Orthetrum glaucum* (Brauer)

1965. *Libellula glauca* Brauer, *Verh. zool.-bot. Ges. Wien*, **15** ; 1012.

1936. *Orthetrum glaucum* ; Fraser, *Fauna Brit. India, Odonata*, III ; 307-309.

Material examined : 1 ♂, P.W.D. Bunglow, Ganjam District, 18.iii.1974 (*R. K. Kacker and Party*).

Distribution : India : Orissa (Ganjam District), commonly distributed, more so in west coast, Nilgiri Hills. Also extended to Philippines and Southward to Java. It is a new Record to Orissa.

29. *Orthetrum pruinosum neglectum* (Rambur)

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

1922. *Orthetrum pruinosum neglectum* ; Fraser & Dover, *Rec. Indian Mus.*, **24** (3) ; 305.

1936. *Orthetrum pruinosum neglectum* ; Fraser, *Fauna Brit. India, Odonata*, III ; 311-313.

Material examined : 1 ♂, 11 m. from P. W. D. Bunglow, Tapta, Ganjam, 13.iii.1974 (*R. K. Kacker and Party*) ; 1 ♂, Baijanpal Forest, Keonjhar, 30.iii.1973 (*S. K. Gupta and Party*) ; 1 ♂, Bank of Mahananda, Kujang, Cuttack, 16.i.1974 (*R. L. Chowdhury and Party*) ; 1 ♀, 3 Kms. N. of Kotagarh, Phulbani, 17.xii.1973 (*D. P. Sanyal and Party*).

Distribution : India : Orissa (Cuttack, Ganjam, Keonjhar, Phulbani Districts) and commonly occur in plains. Also Burma, Hongkong, Indochina, Sri Lanka, Tibet.

30. *Potamarcha obscura* (Rambur)

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

1915. *Potamarcha obscura* ; Laidlaw, *Mem. Indian Mus.* V, 108.

1922. *Potamarcha obscura* ; Fraser & Dover, *Rec. Indian Mus.*, **24** (3) ; 304.

1936. *Potamarcha obscura* ; Fraser, *Fauna Brit. India Odonata*, III ; 289-291.

Material examined : 1 ♂, 1 ♀, Jubilee town, Dhenkanal, 6.x.1972 ; 1 ♂, Ghatgaon, Keonjhar, 1.iv.73 (*S. K. Gupta and Party*) ; 1 ♀, Kaliyugeswar, Chilka Lake, Ganjam, 19.iii.1974 (*R. K. Kacker and Party*) ; 1 ♀, Biological Park, Nandan Kanan, Cuttack, 22.iii.1974 (*R. K. Kacker and Party*) ; 1 ♀, Meghasoni, Mayurbhanj, 19.iii.1973 (*S. K. Gupta and Party*) ; 1 ♀, Upaidhia,

Keonjhar, 31.iii.1973 (*S. K. Gupta and Party*) ; 3 ♀ ♀ , Chandarpur, Boiagir, 16.ix.1972 (*K. Rai and Party*) ; 1 ♂ , 6 m. N. of Betera Camp., Puri, 12.i.1974 (*R. L. Chowdhury and Party*).

Distribution : India : Orissa (Bolangir, Cuttack, Dhenkanal, Ganjam, Keonjhar, Maurbhanj, Puri Districts), widely distributed throught the country specially Himachal Pradesh, Madhya Pradesh, Uttar Pradesh, West Bengal. Also Formosa, Phillipyines, Sri Lanka, Tibet.

31. *Brachydiplax sobrina* (Rambur)

1842. *Libellula sobrina* Rambur, *Ins. Nevrop* ; 118, 64.

1915. *Brachydiplax sobrina* ; Laidlaw, *Mem. Indian Mus.*, 5 ; 180.

1922. *Brachydiplax sobrina* ; Fraser & Dover, *Rec. Indian Mus.* 24 (3) ; 304.

1936. *Brachydiplax sobrina* ; Fraser, *Fauna Brit. India, Odonata*, III ; 325-327.

Material examined : 1 ♂ , Biological Park, Nandan Kanan, Cuttack, 22.iii.1974 (*R. K. Kacker and Party*) ; 1 ♂ , Bhagwanpur, 2 Kms, E. of Nandan Kanan, Cuttak, 24.iii.1974 (*R. K. Kacker and Party*).

Distribution : India : Orissa (Cuttack District), Assam, Himachal Pradesh, Maharashtra, Punjab, Uttar Pradesh, West Bengal, Travencore through western coast of India. Also Burma and Sri Lanka.

32. *Acisoma panorpoides panorpoides* Rambur

1842. *Acisoma panorpoides* Rambur *Ins. Nevrop.* 28.

1936. *Acisoma panorpides panorpoides* ; Fraser, *Fauna Brit. India, Odonata*, III ; 330, 331.

Material examined : 1 ♂ , Stn. No. 27, Bolangir District, 11.xi.1972 (*J. M. Julka and Party*), 1 ♂ , Botanical Garden, Nandan Kanan, Puri District, 27.iii.1974 ; 1 ♀ , Bhagwanpur, 2 Kms. E. of Nandan Kanan, Cuttack, 24.iii.1974.

Distribution ; India : Orissa (Bolangir, Cuttack, Puri new record) Assam, Himachal Pradesh, Madhya Pradesh, Manipur, Punjab, Uttar Pradesh, West Bengal & also widely in western India. Also China, Japan, Java, Mouluccan Island, Sri Lanka to Philippines, Sumatra, Taiwan.

33. *Diplacodes nebulosa* (Fabricius)

1793. *Libellua nebulosa* Fabricius, *Ent. Syst.*, 2 ; 379.

1936. *Diplaeodes nebulosa* ; Fraser, *Fauna Brit. India, Odonata*, III ; 335, 336.

Material examined : 1 ♂ , Central Rice Research Institute, Cuttack, 6.xii.1965 (*A. P. Kapur and G. S. Arora*) ; 1 ♂ , Stn. No. 3, Bolangir, 3.x.1972 (*J. M. Julka and Party*) ; 1 ♂ , Angul Hortifarm, Dhenkanal, 9.iv.1973 (*S. K. Gupta and Party*).

Distribution : India : Orissa (Bolangir, Cuttack, Dhenkanal), Himachal Pradesh, Madhya Pradesh, Tamil Nadu, Uttar Pradesh, West Bengal. Also Sri Lanka to Australia and southwards to Java. It is a new record for Orissa.

34. *Diplacodes trivialis* (Rambur)

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

1922. *Diplacodes trivialis* ; Fraser and Dover, *Rec. Indian Mus.*, 24 (3) ; 304.

1936. *Diplacodes trivialis* ; Fraser, *Fauna Brit. India, Odonata*, III ; 336-338.

Material examined : 3 ♀ ♀, $\frac{1}{2}$ Km. from Balungaon Rly. Stn., Puri, 17.iii.1974 (R. K. Kacker and Party) ; 1 ♀, near PWD Bunglew, Ganjam, 15.iii.1974 (R. K. Kacker and Party) 1 ♂, 3 ♀ ♀, Kaliyugeswar, Chilka Lake, Ganjam, 19.iii.1974 (R. K. Kacker and Party) ; 1 ♂, 3 Kms. from Nandan Kanan, Cuttack, 23.iii.1974 (R. K. Kacker and Party) ; 1 ♂, Botanical Garden, Nandan Kanan, Puri District, 27.iii.1974 (R. K. Kacker and Party) ; 1 ♂, *Kushban*, 3 Kms. N. of Nandan Kanan, Puri, 27.iii.1974 (R. K. Kacker and Party) ; 2 ♂ ♂, 1 ♀, Raghunathpur, 3 Kms. from Nandan Kanan, Puri, 35.iii.1974 (R. K. Kacker and Party), 1 ♀, Kaliyugeswar, Chilka Lake Ganjam, 25.iii.1974 (R. K. Kacker and Party) ; 5 ♂ ♂, Titlagarh, Bolangir, 14.xi.1972 (J. M. Julka and Party) ; 4 ♀ ♀, Sankara Village, Sundargarh, 26.x.1972 (J. M. Julka and Party) ; 1 ♂, Stn. 23, Sambalpur, 3.ii.1972 ; 2 ♀ ♀, Bhatsai, Keonjhar, 30.ix.1972 (K. Rai and Party) ; 2 ♂ ♂, Angul Hortifarms, Dhenkanal, 9.iv.1973 (S. K. Gupta and Party) ; 1 ♂, Madanpur, Rampur, Kalahandi, 6.xii.1973 (D. P. Sanyal and Party).

Distribution : India : Orissa (Bolangir, Cuttack, Dhenkanal, Ganjam, Kalahandi, Keonjhar, Puri, Sambalpur, Sundergarh), Himachal Pradesh, Madhya Pradesh, Manipur, Punjab, South Andaman, Tamil Nadu, Uttar Pradesh, West Bengal, Also Australia, Burma, Nepal, Seychelles, Sri Lanka.

35. *Crocothemis servilia servilia* (Drury)

1770. *Libellula servilia* Drury, *Ill. Ex. Ins.*, I : 112.

1922. *Crocothemis servilia* ; Fraser and Dover, *Rec. Indian Mus.*, 24 (3) : 305.

1936. *Crocothemis s. servilia* ; Fraser, *Fauna Brit. India. Odonata*, III : 345-347.

Material examined : 1 ♂, Badrama R. Forest, Sambalpur, 4.xi.1972 (D. P. Sanyal and Party) ; 4 ♀ ♀, Biological Park, Nandan Kanan, Puri District, 26.iii.1974 (R. K. Kacker and Party) ; 2 ♀ ♀, Kaliyugeswar, Chilka Lake, Ganjam, 19.iii.1974 (R. K. Kacker and Party) ; 1 ♂, Kaliyugeswar, Chilka Lake, Ganjam, 18.iii.1974 (R. K. Kacker and Party) ; 1 ♂, Rajbari, Sundargarh Town, Sundargarh, 26.x.1972 (J. M. Julka and Party) ; 2 ♂ ♂, Titlagarh, Bolangir District, 16.xi.1972 (J. M. Julka and Party) ; 1 ♂, 3 ♀ ♀, Keonjhar-

garh, Keonjhar, 26.ix.1972 (*K. Rai and Party*) ; 2 ♀ ♀, Stn. No. 7. Sundargarh, 24.iii.1973 (*T. K. Sen and Party*) ; 1 ♀, Ins. Bunglow, PWD Dhenkanal, 7.x.1972 (*K. Rai and Party*) ; 1 ♂, 3 Kms. E. of F. R. H., Koraput, 26.xi.1973 (*D. P. Sanyal and Party*) ; 1 ♀, 3 Kms. S. E. of Madanpur, Rampur, Kalahandi, 8.xii.1973 (*D. P. Sanyal and Party*).

Distribution : India : Orissa (Bolangir, Dhenkanal, Ganjam, Kalahandi, Keonjhar, Koraput, Puri, Sambalpur, Sundergarh District), Bihar, Himachal Pradesh, Madhya Pradesh, Manipur, Punjab, Rajasthan, South Andaman and Portblair, Uttar Pradesh, West Bengal. Also Australia, Nepal Philippines, Sundaic Archipelago.

36. *Bradinopyga geminata* (Rambur)

1842. *Libellula geminata* Rambur, *Ins. Nevrop.*, : 90.

1936. *Bradinopyga geminata* ; Fraser, *Fauna Brit. India, Odonata*, III : 349-350.

Material examined : 1 ♂, Stn. No. 26, Bolangir, 10.xi.1972 (*J. M. Julka and Party*).

Distribution : India : Orissa (Bolangir Dist.) commonly distributed through plain specially in Peninsular region. It is a new record for Orissa.

37. *Brachythemis contaminata* (Fabricius)

1793. *Libellago contaminata* Fabricius, *Ent. Syst.* 2 : 382.

1922. *Brachythemis contaminata* : Fraser & Dover, *Rec. Indian Mus*, 24 (3) : 305.

1936. *Brachythemis contaminata* ; Fraser, *Fauna Brit. India, Odonata*, III : 365, 366.

Material examined : 1 ♂, Gobindapur, Keonjhar, 27.ix.1972 (*K. Rai and Party*) ; 1 ♂, Kushban, 3 Kms. W. of Nandan Kanan, Cuttack, 23.iii.1974 (*R. K. Kacker and Party*) ; 1 ♂, Stn. No. 11. D., Sundargarh Town, Sundargarh, 28.x.1972 (*J. M. Julka and Party*) ; 2 ♀ ♀, Sundargarh, 26.x.1972 (*J. M. Julka and Party*) ; 1 ♀, Titlagarh, Bolangir District, 14.xi.1972 (*J. M. Julka and Party*).

Distribution : India : Orissa (Bolangir, Cuttack, Keonjhar), Assam, Bihar, Himachal Pradesh, Madhya Pradesh, Punjab, Rajasthan, Uttar Pradesh, West Bengal. Also Sri Lanka and extending east of China, Java, Formosa, Philippines and Sumatra.

38. *Neurothemis fulvia* (Drury)

1773. *Libellula fulvia* Drury, *Ill. Exot. Ins.*, II : 85.

1936. *Neurothemis fulvia* : Fraser, *Fauna Brit. India, Odonata*, III : 353, 354.

Material examined : 1 ♂, Koihen-towe Garden, Angul, Dhenkanal, 7.iv.1973 (*S. K. Gupta and Party*) ; 1 ♀, Nakjhari, 18 Kms. South of Madanpur Rampur, Kotagarh, Kalahandi, 10.xii.1973 (*D. P. Sanyal and Party*) ; 1 ♀, Dhatpara, 10 Kms. South of Betera, Puri District, 9.i.1974 (*R. L. Chowdhury and Party*).

Distribution : Orissa (first record, Bolangir, Kalahandi, Phulbani, Puri District), commonly distributed in wet and semiwet areas of the country. Also Buama, Indo-China, Malacca, Thailand.

39. *Neurothemis intermedia intermedia* (Rambur)

1842. *Libellula intermedia*, Rambur, *Ins. Nevrop* : 91.

1936. *Neurothemis intermedia intermedia* : Fraser, *Fauna Brit. India, Odonata*, III : 357, 358.

Material examined : 1 ♂, Stn. No. 29, Sambalpur District, 7.xi.1922 (*J. M. Julka and Party*) ; 1 ♀, Sundargarh Town, Sundargarh, 27.x.1972 (*J. M. Julka and Party*) ; 1 ♀, on the way to Angul, Tulka, Dhankanal, 12.iv.1973 (*S. K. Gupta and Party*) ; 1 ♂, 1 ♀, 4 Kms. from Kotagarh, Phulbani District, 13.x.1973 (*D. P. Sanyal and Party*) ; 1 ♀, 5 Kms. E. of Betera Camp., Puri Dist., 11.i.1974 (*R. L. Chowdhury and Party*) ; 1 ♀, 4 Kms. South of Chandrapur, Koraput dist., 30.oi.1973 (*D. P. Sanyal and Party*) ; 1 ♂, Chopragaon, Koraput District, 23.ii.1972 (*K. V. S. Rao and Party*).

Distribution : India : Orissa (new record, Dehnkanal, Koraput, Phulbani, Puri, Sambalpur, Sundargarh), Bihar, Great Nicobar, Madhya Pradesh, Peninsular India, Punjab, Uttar Pradesh. Also Burma, Indo-China, Malacca, Sri Lanka.

40. *Neurothemis tullia tullia* (Drury)

1773. *Libellula tullia* Drury, *Ill. Exot. Ins.*, 2 : 85.

1936. *Neurothemis tullia tullia* : Fraser, *Fauna Brit. India, Odonata*, III : 360-362.

Material examined : 1 ♀, Botanical garden, Nandan Kanan, Puri, District, 27.iv.1974 (*R. K. Kacker and Party*) ; 1 ♂, Bhagwanpur, 2 Kms. E. of Nandan Kanan, Cuttack District, 24.iii.1974 (*R. K. Kacker and Party*) ; 1 ♂, Raghunathpur, Nandan Kanan, Puri District, 24.iii.1974 (*R. K. Kacker and Party*).

Distribution : India : Orissa (Cuttack, Puri Districts) ; Bihar Himachal Pradesh, Maharashtra, Peninsular India, Punjab, Uttar Pradesh, West Bengal coast of India.

41. *Trithemis festiva* (Schneider)

1842. *Libellago festiva* Rambur, *Ins. Vevrop.*, : 92.

1936. *Trithemis festiva* : Fraser, *Fauna Brit. India, Odonata*, III : 387-389.

Material examined : 1 ♂, Astia, Mayurbhanj, 21.iii.1973 (*S. K. Gupta and Party*) ; 1 ♀, 3 Kms. S.W. of Jayapara, Koraput District, 3.xii.1973 (*D. P. Sanyal and Party*).

Distribution : India : Orissa (Koraput, Mayurbhanj Districts) commonly distributed throughout plains of the country. Also Burma, Sri Lanka. It is a new record for Orissa.

42. Trithemis pallidinervis (Kirby)

1889. *Sympetrum pallidinervis* Kirby, *Trans. Zool. Soc. Lond.*, 12 ; 287.

1936. *Trithemis pallidinervis* ; Fraser, *Fauna Brit. India, Odonata*, III ; 389-391.

Material examined : 2♂♂, Agricultural Farm, Cuttack, 23.xii.1972 (S. Khera and Party) ; 1♂, 1♀, Stn. No. 27, 11.xi.1972 (J. M. Julka and Party) ; 2♂♂, Ponposh, Sundargarh, 24.iii.1973 (T. K. Sen and Party) ; 1♂, 1♀, Biological Park, Nandan Kanan, Puri District, 26-28.iii.1974 (R. K. Kacker and Party) ; 1♂, Angul, Dehkanal, 1955 (T. G. Vazirani).

Distribution : India : Orissa (Cuttack, Dhenkanal, Puri, Sundargarh Districts). Assam, Bihar, Himachal Pradesh, Punjab, South Andaman, Uttar Pradesh, West Bengal. Also Burma, Formosa, Philippines, Sri Lanka.

43. Rhyothemis variegata variegata (Linnaeus)

1763. *Libellula variegata* Linnaeus, *Amoenitates Acad.*, 6 ; 412.

1922. *Rhyothemis variegata variegata* ; Fraser and Dover, *Rec. Indian Mus.*, 24 (3) : 307.

1926. *Rhyothemis variegata variegata* ; Fraser, *Fauna Brit. India, Odonata*, III ; 423, 424.

Material examined : 1♂, 1♀, Biological Park, Nandan Kanan, Cuttack, 22-23.iii.1974 (R. K. Kacker and Party) ; 1♂, Raghunathpur, 2 Kms. E. of Nandan Kanan, Puri District 26.iii.1974 (R. K. Kacker and Party) ; 1♀, Nisa, Angul, Dhenkanal, 1.x.1972 (K. Rai and Party).

Distribution : India : Orissa, Dhenkanal, Puri Districts). Assam, Bihar, Himachal Pradesh, West Bengal. Also Malaysia, Philippines, Sri Lanka.

44. Tholymis tillarga (Fabricius)

1798. *Libellula tillarga* Fabricius, *Ent. Syst. Suppl.* 285.

1922. *Tholymis tillarga* ; Fraser & Dover, *Rec. Indian Mus.*, 24 (3) : 307.

1936. *Tholymis tillarga* ; Fraser, *Fauna Brit. India, Odonata*, III ; 411-413.

Material examined : 1♀, Circuit House, Keonjhar, Keonjhar, 19.x.1972 (K. Rai and Party).

Distribution : India Orissa (Ganjam, Keonjhar Districts), Himachal Pradesh, Madhya Pradesh, Punjab, South Andaman and Nicobar, Uttar Pradesh, West Bengal. Also Australia, Burma, Madagascar, Oceania, Tropical Africa, Sri Lanka.

45. Pantala flavescens (Fabricius)

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

1915. *Pantala flavescens* ; Laidlaw, *Mem. Indian Mus.*, 5 ; V, 180.

1922. *Pantala flavescens* ; Fraser & Dover, *Rec. Indian Mus.*, 24 (3) ; 306.

1936. *Pantala flavescens* ; Fraser, *Fauna Brit. India, Odonata*, III ; 414-416.

Material examined : 1 ♀, Balugaon, Puri District 20.ix.1950 (*B. S. Chauhan and Party*) ; 1 ♂, 4 ♀ ♀, Stn. 15, Badrama R. Forest, Sambalpur, 6.vi.1972 (*D. P. Sanyal and Party*) ; 1 ♀, Sundargarh Town, Sundargarh, 24.x.1972 (*J. M. Julka and Party*) ; 1 ♀, Stn. No. 26, Bolangir District, 3.ii.1972 (*J. M. Julka and Party*) ; 2 ♂ ♂, 1 ♀, Angul, Dhenkanal, 2.x.1972 (*K. Rai and Party*) ; 1 ♂, Meghasoni, Mayurbhanj, 19.iii.1973 (*S. K. Gupta and Party*) ; 1 ♂, 2 ♀ ♀, Barabhadrapur, Keonjhar, Keonjhar, (*K. Rai and Party*).

Distribution : India : Orissa (Bolangir, Dhenkanal, Keonjhar, Mayurbhanj, Puri, Sambalpur, Sundargarh) ; Assam, Himachal Pradesh, Punjab, Uttar Pradesh, West Bengal. Also Burma, Sri Lanka, Tibet-Circum tropical to subtropical.

46. *Tramea basilaris burmeisteri* (Kirby)

1899. *Libellula chinensis* Burmeister, *Handb. Ent.*, 2 ; 852.

1922. *Tramea burmeisteri* ; Fraser & Dover, *Rec. Indian Mus.*, 24 (3) ; 306, 307.

1936. *Tramea basilaris burmeisteri* Fraser, *Fauna Brit. India, Odonata*, III ; 432-434.

Material examined : 1 ♂, Gobindapur, Keonjhar, 21.ix.1972 (*K. Rai and Party*) ; 1 ♂, Sharkarpur, Dhenkanal, 7.x.1972 (*K. Rai and Party*) ; 1 ♂, Sarkara Village, Sundargarh, 26.x.1972 (*J. M. Julka and Party*) ; 1 ♀, Stn. No. 26, Bolangir District, 3.ii.1972 (*J. M. Julka and Party*).

Distribution : India : Orissa (Bolangir, Dhenkanal, Keonjhar, Sambalpur, Sundargarh Districts) ; Himachal Pradesh, Punjab, Rajasthan, Uttar Pradesh, West Bengal. Also Burma, Malaysia, Sri Lanka.

47. *Indothemis limbata limbata* (Selys)

1891. *Trithemis limbata* Selys, *Annali Mus. civ. Stor. nat.* (2) 10 (3) ; 463.

1936. *Indothemis limbata limbata* ; Fraser, *Fauna Brit. India, Odonata*, III ; 341, 342.

Material examined : 1 ♂, Central Rice Research Institute, Cuttack, 21.xii.1970 (*S. Khera and Party*).

Distribution : India : Orissa (Cuttack), commonly distributed in planis and submontane tracts of country. Also Burma, Malacca, Thailand. It is a new record for Orissa.

48. *Indothemis limbata sita* Champion

1923. *Indothemis limbata sita* Champion *Ann. Mag. nat. Hist.*, 11 (9) ; 28-01.

1936. *Indothemis limbata sita* ; Fraser, *Fauna Brit. India, Odonata*, III ; 342, 343.

Material examined : 1 ♂, Stn. No. 27, Bolangir District, 11.xi.1972 (*J. M. Julka and Party*).

Distribution : India : Orissa (Bolangir District), Western India. Also Sri Lanka. It is a new record for Orissa.

LIST OF ODONATES RECORDED FROM ORISSA

Order ODONATA

Suborder ZYGOPTERA

Family I. COENAGRIONIDAE

**Pseudagrion microcephalum* Rambur

Ceriagrion coromandelianum (Fabricius)

***C. rubiae* Laidlaw

***C. olivaceum* Laidlaw

***Coenagrion dyeri* Fraser

Ischnura senegalensis (Rambur)

***I. elegans* (Vander Linder)

***I. delicata* Hagen

***I. mildredae* Fraser

***Enallagma parvum* Selys

**E. insulae* Fraser

**Rodischnura nursei* Morton

***Aciagrion pallidum* Selys

***Agriocnemis lacteola* Selys

A. pygmaea (Rambur)

***Onychargia atrocyana* Selys

Family II. LESTIDAE

Lestes elata Hagen

***L. viridula* Rambur

***L. nodalis* Selys

***L. umbrina* Selys

**L. thoracica* Selys

**Ceylonolestes gracilis gracilis* (Hagen)

Family III. AGRIDAE

***Neurobasis c. chinensis* Linnaeus

Suborder ANISOPTERA

Family I. GOMPHIDAE

***Anormogomphus heteropterus* Selys

***Mesogomphus lineatus* Selys

***Ictinogomphus rapax* (Rambur)

Family II. AESHNIDAE

*****Gynacantha millardi* Fraser**

Anax guttatus (Burmeister)

Family III. MACRODIPLACTIDAE

****Macrodiplax cora* Brauer**

Urothemis s. signata (Rambur)

****Aethriamanta b. brevipennis* Rambur**

Family IV. LIBELLULIBAE

*****Cratilla lineata* (Brauer)**

Orthetrum sabina (Drury)

*****O. glaucum* (Brauer)**

O. pruinatum neglectum (Rambur)

****Lathrecista a. asiatica* (Fabricius)**

Potamarcha obscura (Rambur)

Brachydiplax sobrina (Rambur)

*****Acisoma p. panorpoides* Rambur**

*****Diplacodes nebulosa* (Fabricius)**

D. trivialis (Rambur)

Crocothemis s. servilia (Drury)

*****Bradinopyga geminata* (Rambur)**

Brachythemis contaminata (Fabricius)

*****Neurothemis fulvia* (Drury)**

*****N. i. intermedia* (Rambur)**

N. t. tullia (Drury)

*****Trithemis festiva* (Schneider)**

T. pallidinervis (Kirby)

Rhyothemis v. variegata (Linnaeus)

****Zyxomma petiolatum* Rambur**

Tholymis tillarga (Fabricius)

Pantala flavescens (Fabricius)

Tramea basilaris burmeisteri (Kirby)

****T. limbata* (Deejeans)**

*****Indothemis l. limbata* (Selys)**

*****I. l. sita* Champion**

*Species recorded earlier from Orissa, but specimens not represented in the collection studied.

**New records for Orissa.

KEY TO THE ODONATES OF ORISSA

A key to 58 species of Odonates under 37 genera and 7 families, which are known to occur in Orissa, is given below :

1. Head prominently and transversely elongated, eyes well separated-not meeting at all, Fore and Hind wings more or less similar in shape and breadth-Hindwing not distinctly broadened in its anal region ... 2
 Head not prominently transversely elongated, eyes not well separated meeting only at a point or broadly confluent, Fore wing narrower than hindwing-Hind wing distinctly broadened in its anal region. ... 24
2. Only 2 rarely 3 antenodal nervure in forewing, Postnodal in line with veins below ...
 Not less than 5 antenodal in fore wing, Postnodal not in line with veins below ... 23
3. Veins IRiii and RIV+V nearer node than arc ... 4
 Veins IRiii and RIV+V slightly nearer arc than node ... 18
4. Arc at the level of distal antenodal nervure ... 5
 Arc distal to distal antenodal nervure ... 17
5. ab arising where ac meets it ... 6
 ab arising more or less proximal to the point where ac meets it ... 8
6. Prominent ridge on frons, no postocular colour spots, head and thorax of uniform colour ... *Ceriagrion* Selys
 (Abdomen uniformly dull yellow ... *C. olivaceum* Laidlaw)
 (Abdomen bright citron yellow ... *C. coromandelianum* (Fabricius))
 (Abdomen bright reddish orange ... *C. rubia* Laidlaw)
 No ridge on frons, Postocular colour spots, present, Head and thorax of not uniform colour ... 7
7. Pterostigma in fore wing longer than hind wing ... *Aciagrion* Selys
 (Abdomen usually very long and slender, female with an apical ventral spine) ... (*A. pallidum* Selys)
 Pterostigma in fore wing of same size as that of hind wing ... *Pseudagrion* Selys
 (Diamond shaped pterostigma, 10-12 post nodal nervures) ... (*P. microcephalum* Rambur)
8. Pterostigma of fore and hind wing differ in shape, size and colour ... 9
 Pterostigms of fore and hind wing do not differ in shape, size and colour ... 14

9.	Postocular coloured spots absent, tubercles on apical border of abd. Segment widely separated ...	<i>Rhodishnura</i> (Laidlaw)	
	(Bright crimson citron yellow and black) ...	(<i>R. nursei</i> Morton)	
	Postocular coloured spots present, tubercles on apical border of abd. Segment closely placed ...	<i>Ischnura</i> (Charpentier)	10
10.	Species with the ground colour of both sexes bright orange red ...	<i>I. mildredae</i> Fraser	
	Species with ground colour of males and isochrome females blue or pale grass green ...	...	11
11.	Addomen segments 3-6 citron yellow ...	<i>I. delicata</i> Hagen	
	Abdomen segments 3-6 black on dorsum ...	...	12
12.	Segments 10 with blue spot on dorsum, pterostigma of forewing with costal side shorter ...	<i>I. forcipata</i> Morton	
	Segment 10 unmarked, costal side not shorter ...	...	13
13.	Posterior lobe of prothorax not markedly shorter-greatly prologed in middle, abd. II non-metallic ...	<i>I. elegans</i> (Vander Linden)	
	Posterior lobe of prothorax markedly shorter-not prolonged, abd. II metallic steely blue on dorsum ...	<i>I. senegalensis</i> (Rambur)	
14.	Female with a robust mid-ventral apical spine on abd. VIII, postocular coloured spot present ...	<i>Enallagma</i> Charpentier...	15
15.	Small species, abd. not more than 17 mm., Postnoal nervure in F. W. only 6-7 ...	<i>E. insulae</i> Selys	
	Large species, abd. more than 20 mm., Postnodal nervure in Forewing 10 ...	<i>E. insulae</i> Fraser	
16.	ab arising distinctly proximal to proximal antenodal nervure, tarsal claw hooks of tarsus lengthwise equal, postocular coloured spot absent ...	<i>Onychargia</i> Selys	
	(10-11 postnodal nervure in forewing and 10 in hindwing) ...	(<i>O. atrocyana</i> Selys)	
17.	ab arising distinctly distal to the proximal antenodal nervure, claw hooks of tarsus unequal, postocular spot present ...	<i>Coenagrion</i> Selys	
	(Only 8-10 postnodal in forewings, basal side of discoidal cell in forewing shorter than costal side) ...	(<i>C. dyeri</i> Fraser)	
18.	Discoidal cell of forewing and hindwing similar in shape and size ...	<i>Lestes</i> Leach...	19
	Discoidal cell of fore and hindwing dissimilar-that of hind wing longer and much narrower than of Forewing ...	<i>Ceylonolestes</i> Kennedy	
	(Antehumeral stripe partially enclosed on outer side by a row of 2-3 black spots) ...	[<i>C. gracilis</i> (Hagen)]	
19.	Thorax with green metallic antehumeral stripe ...	...	20
	Thorax without such metallic stripe ...	...	21

20. Thorax with a uniform, unexpanded, narrow, brilliant green antehumeral stripe of each side, vertex of head and dorsum of thorax pale brown ... *L. viridula* Rambur
- Thorax with narrow metallic antehumeral stripe which is expanded outwardly at upper end and vertex of head black and dorsum of thorax bright brown ... *L. elata* Hagen
21. Pterostigma unicolourous ... 22
- Pterostigma bicolourous, small black nodal points on costa ... *L. nodalis* Selys
22. Vertex of head pale brown ... *L. umbrina* Selys
- Vertex of head matt black ... *L. thoracia* Laidlaw
23. Fore wings in both sexes hyaline, pterostigma absent in female ... *Neurobasis* Selys
- (Thorax and abdomen bright metallic green so is neurulation, hindwing with basal 2/3 metallic green and apical third blackish brown) ... [*N. c. chinensis* (Linnaeus)]
24. Eyes separated or meeting only at a point ... 25
- Eyes more or less broadly confluent on vertex ... 26
25. Hindwing not excavated at base, tornus rounded in male ... *Anormogomphus* Selys
- (Anal appendage ferruginous, superior not markedly larger than the inferior but with stout basal spine ... (*A. heteropterus* Selys)
- Hindwing distinctly excavated at base, tornus angulated in male ... *Mesogomphus* Forster
- (Wing like lateral foliation on abd. Segments 8-9, anal appendage sandy yellow-superior markedly long, incurved but without basal spine) ... (*M. lineatus* Selys)
- Hind wing slightly excavated at base, tornus acutely angulated ... *Ictinogomphus* (Rambur)
- (Anal appendage black, superior anal appendage long straight, acutely pointed at distal end) ... (*I. rapax* Rambur)
26. Discoidal cell similar in shape and size in Fore and Hind wing and situated at equal distance from arc, costal and sub-costal nervure not coinciding, two robust primary antenodals present ... 27
- Discoidal cell not similar in shape and size in fore and hind wing and situated far distal to arc, costal and sub costal nervure coinciding, robust primary antenodal absent ... 28
27. Base of hind wing without a notch, tornus of hind wing rounded in both sexes, anal triangle absent ... *Anax* Leach
- (abd. Segments 4-8 with longitudinal supplementary ridge on the side, abd. Segment 3 not constricted) ... [*A. guttatus* (Burmeister)]

Base of hindwing more or less deeply notched, tornus of hindwing angulated in male, and anal triangle present	...	<i>Gynacantha</i> Rambur
(No supplementary ridge on sides of abd. Segment 4-8, segment 3 of abd. markedly constricted)	...	(<i>G. millardi</i> Fraser)
28. Sectors of arc diverging from their origin, primary antenodal present but inconspicuous, temples of head swollen	...	<i>Urothemis</i> Brauer
(Extreme base of forewing golden amber, a broader darker amber spot at hindwing)	...	(<i>U. s. signata</i> Rambur)
Sectors of arc fused at their origin and hence originate from common long stalk, primary antenodal absent, temples of head not swollen	...	... 29
29. Borders of anal loop meet posterior border of wing, loop open	...	... 30
Borders of anal loop not meeting borders of wing, loop closed	...	... 31
30. Abdomen broad at base than tapering gradually to an end, opalescent white spot in the centre of hind wing, wings not tipped with dark brown	...	<i>Tholymis</i> Hagen
(Broad smoky golden brown, fan shaped fascia in hindwing from node to base which in female is pale coloured)	..	[<i>T. tillarga</i> (Fabricius)]
Abdomen very tumid at base then abruptly narrowing remain slender till end, without opalescent spot in centre of hind wing, wings broadly tipped with dark brown.	...	<i>Zyxomma</i> Rambur
(Thorax chocolate brown, unmarked, abd. reddish brown darkening to black at end of segments)	...	(<i>Z. petiolatum</i> Rambur)
31. Distal antenodal in forewing complete	...	... 32
Distal antenodal nervure in forewing incomplete	...	... 42
32. Lobe of prothorax large and fringed with long hairs	...	... 33
Lobe of prothorax small and not fringed with long hairs	...	... 37
33. Frons metallic dorsally	...	<i>Brachydiplax</i> Brauer
(Sides of thorax dark metallic or yellow with black conspicuously projecting male genitalia)	...	[<i>B. sobrina</i> (Rambur)]
Frons non-metallic dorsally	...	... 34
34. Only 6 antenodals in forewing, abd. Segments I-VI dilated	...	<i>Acisoma</i> Rambur
(Thorax azure blue marbled with black, abd. azure blue marked with black, segment 8-10 entirely black)	...	(<i>A. p. panorpoides</i> Rambur)

More than 12 antenodal in forewing, Abd. Segments I-VI not dilated	...	<i>Orthetrum</i> Newman 35
35. Males coloured some shade of red, generally violaceous red, frons blue-black anteriorly	...	<i>O. pruinatum neglectum</i> (Rambur)
Males coloured brown or black with yellow markings	...	... 36
36. Abdomen enormously swollen at base and then abruptly narrow and laterally compressed, black marked with greenish yellow, not pruinose	...	<i>O. sabina</i> (Drury)
Abdomen long and slender but not swollen at base nor laterally compressed, thorax with narrow whitish or creamy stripes, often blue with pruinescence	...	<i>O. glaucum</i> Brauer
37. Sectors of arc in forewing from common long stalk, Frons metallic above	...	... 38
Sector of arc in forewing separated at origin, Frons non-metallic above	...	... 39
38. Only 1 cubital nervure in all wings, anal loop very long and overlapping distal end of discoidal cell	...	<i>Cratilla</i> Kirby
(Wings tipped with black, thorax steel or bronzed marked with yellow, Abdomen black marked with bright yellow)	...	(<i>C. lineata</i> Brauer)
39. Subtrigone in fore wing single celled	...	... 40
Subtrigone in forewing three celled	...	... 41
40. Hind wing with a conspicuously golden yellow basal markings, neuration black	...	<i>Aethriamanta</i> Kirby
(Thorax blackish brown, Abdomen vermilion red in male, golden olivaceous in female with black sutures, Genitalic hamule very short)	...	[<i>A. b. brevipennis</i> (Rambur)]
41. Hamules of male genitalia long and conspicuous. black dorsal markings on abd. Segments I-VIII	...	<i>Urothemis</i> Brauer
(Thorax red, abdomen deep red in male but in female olivaceous)	...	(<i>U. s. signata</i> Rambur)
Hamule of male genitalia small, black dorsal markings on abd. Segments I-X	...	<i>Macrodiplax</i> Brauer
(Thorax golden yellow/olivaceous, abd. bright ochreous tinted with blood red in male)	...	(<i>M. cora</i> Brauer)
42. Lobe of prothorax long and fringed with long hairs	...	... 43
Lobe of prothorax small, usually without hairs	...	... 45
43. Eyes meeting for a short distance, hind wing entire...		<i>Diplacodes</i> Kirby
44. Apices of wings tipped with black	...	<i>D. nebulosa</i> (Fabricius)
Apices of wings not tipped with black	...	<i>D. trivialis</i> (Rambur)

45. Sectors of arc in fore wing separated and divergent from origin ... 46
 Sectors of arc in fore wing not separated and not divergent but arising from common long stalk ... 47
46. Frons metallic above body dark metallic ... *Rhyothemis* Hagen
 (Wings marked with black spots of varying shape against amber yellow area) ... [*R. v. variegata* (Linnaeus)]
47. Borders of discoidal field converging strongly at wing ... 48
 Borders of discoidal field not converging but either parallel or divergent at wing margin ... 50
48. Discoidal cell in fore wing narrow, conspicuous supplementary nervure IRii between Rii & Riii ... *Pantala* Hagen
 (Prothorax ochreous, Meso and Metathorax olivaceous on dorsum, Abdomen bright ochreous-1-4 pale yellow, 8-10 with black mid dorsal pyriform spots) ... [*P. flavescens* (Fabricius)]
 Discoidal cell in forewing broader, No supplementary nervure between Rii & Riii ... *Trithemis* Brauer
49. Pterostigma unicolourous, thorax and abdomen violaceous black, neurulation black ... *T. festiva* (Rambur)
 Pterostigma bicolourous, thorax and abdomen yellow marked with black, neurulation bright red ... *T. pallidinerves* (Kirby)
50. Discoidal cell in forewing adjacent to discoidal cell only 2 cells wide ... *Indothemes* Ris-51
 Discoidal cell in fore wing adjacent to discoidal cell 3 or more cells wide ... 52
51. Only 10½ antenodal in forewing, apices of wing clear ... *I. limbata sita* Campion
 11½ to 12½ antenodal in forewing, apices of wing finely bordered with blackish brown ... (*I. limbata limbata* (Selys))
52. Hind wing very broad at base and tapering at apex, Pterostigma very short and unequal in length in fore and hind wing ... *Tramea* Hagen...53
 Hind wing not markedly wide at base nor tapering at apex, pterostigma longer and equal in length in fore and hind wing ... 54
53. Two large spots of dark reddish brown at base of hind wing surrounded by golden yellow areola ... *T. basilaris burmeisteri* (Kirby)
 Only a single black spot at the base of hindwing ... *T. limbata* (Desjardin)
54. Pterostigma bicolourous-black with white ends ... *Bradinopyga* Kirby
 (Thorax and abdomen dirty pale yellow with black markings) ... [*B. geminata* (Rambur)]
 Pterostigma unicolourous ... 55

55. Wings coloured amber yellow at base or more broadly dark reddish brown, more than 1 cubital nervure in all wings ... *Neurothemis* Brauer-56
- Wings usually uncoloured or basal markings in hind-wing, only 1 cubital nervure in all wings ... 58
56. Ill defined pale or golden yellow, costa yellow from base to pterostigma ... *N. i. intermedia* Rambur
- Wings with broadly black or with reddish brown markings ... 57
57. White opalescent band at outer edge of basal markings ... *N. t. tullia* (Drury)
- Clear hyaline window at apex of wings between dark reddish brown from base to pterostigma and narrow opaque brown at apex ... *N. fulvia* (Drury)
58. Red or ochreous species ... 59
- Variably coloured or darker species ... 60
59. Eyes but shortly contiguous, face and frons red, $9\frac{1}{2}$ - $10\frac{1}{2}$ antenodal in forewing ... *Crocothemis* Brauer
- (Thorax bright ferrugineous, abdomen and anal appendage blood red) ... [*C. s. servilia* (Drury)]
60. Arc situated between first and second antenodal, 2 row of cell between IRiii & Rspl ... *Potamarcha* Karsch
- (Prothorax & thorax dark brown, Abdomen pruinosed) ... (*P. obscura* (Rambur))
- Arc situated between second and third antenodal, 1 row of cell between IRiii & Rspl ... *Lathrecista* Kirby
- (Thorax dark coppery brown on dorsum bright yellow laterally, Abdomen segments 3-8 bright crimson red, 9-10 black) ... [*L. a. asiatica* (Fabricius)]

SUMMARY

The present study gives an account of 48 odonate species from Orissa, the material of which was present in our collections and studied. These represent 14 species of Coenagriidae, 4 of Lestidae, 1 Agriidae (Zygoptera), 2 of Aeshnidae, 3 of Gomphidae, 1 of Macrodiplactidae and 23 of Libellulidae (Anisoptera) and 29 species are new record for Orissa. District-wise distribution of each of the species within Orissa and elsewhere is given. A list of species so far recorded from Orissa and key for identification are provided.

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REFERENCES

- CHHOTANI, G., LAHIRI, A. R. AND MITRA, T. R. 1983. Contribution to the Odonate (Insecta) fauna of the Andaman and Nicobar Islands with description of two new species. *Res. zool. Surv. India*, **80** : 467-494.
- FRASER, F. C. 1933. *The Fauna of British India, Odonata I* : 1-423.
- FRASER, F. C. 1934. *The Fauna of British India, Odonata II* : 1-398.
- FRASER, F. C. 1936. *The Fauna of British India, Odonata III* : 1-461.
- FRASER, F. C. 1957. A reclassification of Order Odonata, based on some new interpretation of the venation of the dragonfly wing. *Royal Zoological Society*, N. S. W. Sydney : 1-133.
- FRASER, F. C. AND DOVER, C. 1922. The fauna of island in Chilka Lake—Dragonflies. *Rec. Indian Mus.*, **24** (3) ; 303-311.
- LIDLAW, E. F. 1915. Fauna of the Chilka Lake No. 2 Odonata. *Mem. Indian Mus.*, **5** : 177-188.
- RAJA RAM, SRIVASTAVA, V. D. AND PRASAD, M. 1982. Odonata (Insecta) Fauna of Calcutta and Surrounding. *Rec. zool. Surv. India*, **80** : 169-196.

INSECTA : HOMOPTERA : COCCOIDEA

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INTRODUCTION

Records of coccids from the Eastern India are sporadic : from West Bengal by Ghose (1961), from N. E. India on tea by Das & Ganguli (1962), from Tripura by Ganguli & Ghosh (1964) and from Bihar by Ali (1967, 1968). Coccids from Orissa appear to have not been listed so far, except some species reported here and there, e.g. by Ayyar (1930) and Sengupta & Behura (1957). The present study is the first consolidated account of the scale insects and mealy-bugs of Orissa. A total of 70 species in 43 genera, belonging to 10 families, are reported in this paper. Most of these are first records for the Orissa State. However, some other species which have not been collected by the authors but are recorded from Orissa in the literature, have also been included here to make the list complete.

MATERIAL AND METHOD

The materials for this study were collected by the authors from different parts of Orissa. The senior author conducted two faunistic surveys : first to Bhubaneswar, Puri, Berhampur and Chilka Lake camps in Feb.-March 1985, and second to Balasore, Baripada, Khurda and Talcher camps in July-August 1986. The junior author collected materials, for his chromosomal studies (Moharana, 1982), from many places, particularly Bhubaneswar, Cuttack, Puri and Khurda, during 1976-80. The localities of collections reported in this paper, may be arranged district-wise as follows :

Distt. Mayurbhanj	: Baripada, Takhatpur and Kuliana.
Distt. Balasore (Baleshwar)	: Balasore, Chandipur and Balramgudi.
Distt. Cuttack	: Cuttack.

- Distt. Puri : Bhubaneswar, Vani Bihar, Nandan Kanan, Baranga, Khandagiri, Dhauri, Puri, Konark (Konarak), Pipili, Jatni and Khurda.
- Distt. Ganjam : Berhampur, Tapta pani, Gopalpur-on-sea, Barkul, Rambha and Barkuda Is.
- Distt. Dhenkanal : Talcher and Anugul (Angul).

The classification given in Varshney (1985) has been followed and the genera arranged alphabetically. Photographs have been taken by the authors from self collected materials. The range of distribution for species restricts to the Indian region only and State-wise for India, and the literature recorded species are taken from a detailed check-list under preparation (Varshney, unpublished).

SYSTEMATIC ACCOUNT

Order HOMOPTERA

Superfamily COCCOIDEA

Family I. MARGARODIDAE

1. *Crypticerya* sp.

(Pl. I, fig. 2)

Material examined : From Bhubaneswar on *Rosa indica* and *Annona squamosa* in Sept. 1980 ; from Tapta pani on *Casuarina* sp. in March 1985 ; from Talcher on mango leaves and *Casuarina* ('jhau') and from Angul on undet. garden bush, in August 1986.

Remarks : Three species of *Crypticerya* are known from the Indian region, besides an undetermined species from Pakistan (Varshney, 1985). The specific determination of above materials requires further study.

2. *Icerya* sp.

(Pl. I, fig. 3)

Material examined : From Bhubaneswar on *Alangium salvifolium* in July 1980 ; from Konark on 'polang' tree, from Bhubaneswar on undet. tree ; from Tapta pani on rose (parasitised ex.), from Gopalpur-on-sea on *Nerium* sp., from Rambha on guava and *Croton* sp., all in March 1985 ; from Kuliana (Mayurbhanj) on mango, *Annona* sp. and other plants, from Baripada on guava, and from Dhauri (near Bhubaneswar) on cashewnut leaf, all in August 1986.

Remarks : Nine species of *Icerya* are known from the Indian region (Varshney, 1985). Specific determination of these materials requires further study.

3. *Icerya aegyptiaca* (Douglas)

(Pl. I, fig. 1)

1890. *Crossotoma aegyptiacum* Douglas, *Ent. mon. Mag.*, 26 : 79.

Material examined : From Bhubaneswar on *Calophyllum inophyllum*, *Acacia auriculiformis*, *Artocarpus heterophylla*, *Cajanus* sp., *Annona* sp., *Mangifera indica*, *Citrus* sp., etc., in Sept. 1978, July-Aug. 1979 and May-July 1980 ; from Khandagiri on jack fruit, from Bhubaneswar on 'bhursungha', from Tapta pani on croton twigs, from Gopalpur-on-sea on *Tectona grandis*, all in March 1985 ; from Baripada on 'ainsha', from Khurda on guava leaf (dead ex.) and *Jatropha* sp., all in August 1986.

Remarks : Known already from Orissa. Also recorded from Bihar, W. Bengal, Tripura, Tamil Nadu, Kerala, Karnataka and Maharashtra in India, and from Burma, Pakistan and Sri Lanka.

4. *Icerya formicarum* Newstead

1897. *Icerya formicarum* Newstead, *Ent. mon. Mag.*, 33 : 169.

Material examined : From Bhubaneswar on *Rosa indica*, *Codiaeum variegatum*, *Bougainvillea* sp., *Casuarina equisetifolia*, *Ficus bengalensis*, *Ocimum sanctum*, *Opuntia* sp., in Sept. 1978, July-Aug. 1979 and May-July 1980 ; and from Puri on *Croton* sp., in March 1985.

Remarks : Already known from Orissa. Also known from N. E. India, Madhya Pradesh, West Bengal, Andhra Pradesh, Maharashtra, Karnataka, Tamil Nadu and Kerala in India, and from Sri Lanka. Polyphagous.

5. *Icerya purchasi* Maskell

1878. *Icerya purchasi* Maskell, *Trans. New Zeal. Inst.*, 11 : 221.

Remarks : Recorded earlier from Orissa as a minor, but assuming sometimes as a major, pest of apple, pear, peach and plum and exotic major pest of *Citrus* sp. in Pottangi (Koraput) area. Known widely in India, particularly from Maharashtra, Karnataka, Tamil Nadu and Kerala, and from Sri Lanka. Polyphagous.

6. *Icerya seychellarum* (Westwood)

1855. *Dortheisia seychellarum* Westwood, *Gard. Chron.* : 830.

Remarks : Recorded earlier from Puri. Also known from Uttar Pradesh, Madhya Pradesh, Maharashtra, Karnataka, Tamil Nadu, N. E. India, West

Bengal and Andaman Is. in India, and also from Burma, Pakistan and Sri Lanka in Indian region. Polyphagous.

7. *Labioproctus poleii* (Green)

(Pl. I, fig. 4)

1896. *Walkeriana poleii* Green, *Indian Mus. Notes*, 4 (1) : 6.

Material examined : From Baripada on *Psidium guajava* and from Talcher on *Artocarpus integra* ('Kathal'), in August 1986.

Remarks : First record from Orissa. Earlier known from West Bengal and Karnataka in India and from Sri Lanka. Polyphagous.

Family II. TACHARDIIDAE

8. *Kerria* sp.

Material examined : From Bhubaneswar on *Annona squamosa*, in October 1980.

Remarks : 18 species and subspecies of *Kerria* are known from the Indian region (Varshney, 1977). The specific determination of this material requires further study.

9. *Kerria lacca lacca* (Kerr)

1782. *Coccus lacca* Kerr, *Philos. Trans.*, 71 : 374.

Material examined : From Bhubaneswar on *Acacia auriculiformis*, *Ficus religiosa* and *Zizyphus mauritiana*, in Aug.-September 1980.

Remarks : Earlier recorded from Orissa on *Zizyphus* sp. Already known from Bangladesh, Burma, Nepal, Pakistan and Sri Lanka and very widely from India. Polyphagous. Three subspecies are known from India, of which this material refers to *lacca lacca* (Varshney, 1977).

Family III. ERIOCOCCIDAE

10. *Pedroniopsis beelsoni* Green

1926. *Pedroniopsis beelsoni* Green, *Bull. ent. Res.*, 17 : 39.

Remarks : Green described it from Ganjam Distt. (Orissa) and Madras, collected on the bark of *Shorea robusta*. Authors have not come across it.

Family IV. DACTYLOPIIDAE

11. *Dactylopius* sp.

Material examined : From Bhubaneswar on *Opuntia dillenii* and from Barkuda Is. (Chilka Lake), in March 1985 ; and from Gopalpur-on-sea on cactus *Opuntia* sp., in March 1985.

Remarks : Four species of *Dactylopius* are recorded from the Indian region. The specific identification of present material requires further study.

12. *Dactylopius indicus* (Green)

(Pl. I, fig. 5)

1908. *Coccus indicus* Green, *Mem. Dept. Agric. India*, 2 (2) : 28.

Material examined : From Puri on *Opuntia* sp., in July 1979 ; from Khurda on *O. dillenii*, in March 1985 ; and from Balramgudi (near Chandipur) on *O. dillenii*, in August 1986.

Remarks : First record from Orissa. Earlier known from Himachal Pradesh, Bihar, West Bengal, Andhra Pradesh and Tamil Nadu in India, and from Sri Lanka. Occurs on *Opuntia* spp. only. We observed that at Balramgudi most of the infections were on the sea facing surfaces of the plants.

13. *Dactylopius tomentosus* (Lamarck)

1801. *Coccus tomentosus* Lamarck, *Syst. des Anim. sans Vertèbr.* : 298.

Remarks : This species is already recorded from Puri and Balukhand in Orissa. Authors have not come across it. Also known from Tamil Nadu, Karnataka, Maharashtra and Delhi in India, and from Sri Lanka. Recorded on *Opuntia* spp. and *Nopalea* sp.

Family V. PSEUDOCOCCIDAE

14. *Antonina graminis* (Maskell)

1897. *Sphaerococcus graminis* Maskell, *Ent. mon. Mag.*, 33 : 244.

Material examined : From Cuttack and Khurda on *Cynodon dactylon*, in Sept. 1976.

Remarks : First record from Orissa. Already known from Delhi, Bihar, West Bengal and Tamil Nadu in India, and from Pakistan and Sri Lanka in the Indian region. Recorded on *Cynodon* sp., sugarcane and other grasses.

15. *Brevennia rehi* (Lindinger)

1943. *Ripersia rehi* Lindinger, *Arb. Morph. tax. Ent.*, 10 : 152.

Remarks : A very widely distributed species and the most famous mealy-bug pest on paddy. Earlier often referred as *Ripersia oryzae*. It is already recorded from Orissa in July-September period. Also known from West Bengal, Bihar, Andhra Pradesh, Tamil Nadu, Kerala, Karnataka and Maharashtra in India, and from Bangladesh, Burma, Nepal and Pakistan in Indian region. Polyphagous.

16. Coccidohystrix insolita (Green)

1908. *Phenacoccus insolitus* Green, *Mem. Dept. Agric. India*, 2 (2) : 26.

Material examined : From Bhubaneswar on *Cajanus cajan*, *Aristolochia indica* and *Datura metel*, in Sept. 1976 ; and from Berhampur on *Solanum melongena* and *Sida cordifolia*, in Oct. 1979.

Remarks : First record from Orissa. Earlier known from Haryana, Bihar, West Bengal, Goa, Kerala and Tamil Nadu in India, and from Pakistan and Sri Lanka. A pest of brinjal and recorded on many other plants. *Centroccoccus insolitus* in Moharana (1982) refers to this species. Similarly *Centroccoccus insolitus* and *Coccidohystrix insolita* shown separately in Parida & Moharana (1982a) refer to this single species.

17. Dysmicoccus brevipes (Cockerell)

1893. *Dactylopius brevipes* Cockerell, *Entom.*, 26 : 267.

Material examined : From Baranga on *Oreodoxa regia* and *Mangifera indica*, in November 1980.

Remarks : First record from Orissa. Already known from West Bengal, Tripura, Karnataka and Kerala in India, and from Bangladesh and Sri Lanka in Indian region. A pest of pineapple, mango, mulberry and a few other plants.

18. Ferrisia sp.

Material examined : From Bhubaneswar on undet. plant (heavy infestation on both sides of leaves), from Puri on 'kathgolap', from Barkuda Is. (Chilka Lake) on wild bush, from Rambha on guava, croton and *Casuarina* sp., all in March 1985 ; from Balasore on guava, in July 1986 ; from Khurda on *Ficus bengalensis* aerial roots (mild attack), and from Talcher on *Croton* sp., all in August 1986.

Remarks : Two species, *kandyensis* and *virgata*, are known to occur in the Indian region. While the former is restricted to Sri Lanka, our material most likely belongs to the latter species. However, there are distinct infraspecific forms or races, for which studies other than morphological are called for.

19. Ferrisia virgata (Cockerell)

(Pl. II, fig. 7 & 8)

1893. *Dactylopius virgatus* Cockerell, *Entom.*, 26 : 178.

Material examined : From Cuttack, Puri, Konark and Bhubaneswar on *Croton* sp., *Mangifera indica*, *Casuarina equisetifolia*, *Ficus* sp., *Annona*

squamosa, *Solanum melongena*, *Tectona grandis*, *Citrus* sp., *Lantana camara*, *Mimosa pudica*, *Ixora coccinea*, *Psidium guajava*, *Gossypium* sp. and *Punica granatum*, in July 1976, Aug. 1977 and Sep.-November 1980 ; from Khanda-giri on wild plant, in Feb. 1985 ; from Gopalpur-on-sea on an undet. tree, guava, cashewnut bush and from Rambha on *Citrus* sp., all in March 1985 ; from Balasore on 'gaba', 'paldhus' and guava, from Khurda on *Croton* sp., *Annona squamosa*, from Jatni (Khurda Road) on crotons, *Lantana camara*, from Talcher on croton, *Tagetes indica*, *Psidium guajava* and undet. plants, and from Angul on croton (mild infestation), all in August 1986.

Remarks : A common mealy-bug pest of large number of plants, and it may be cosmopolitan in distribution. Recorded earlier from Orissa as a major pest of custard apple (*Annona* sp.). Also known from N. E. India, W. Bengal, Bihar, Uttar Pradesh, Madhya Pradesh, Maharashtra and Southern States in India, and from Bangladesh, Sri Lanka and Maldives in the Indian region. Polyphagous.

20. *Indococcus* sp.

Material examined : From Khurda, on the trunk and embedded in aerial roots of *Ficus bengalensis*, in August 1986 (mild infection).

Remarks : Only one species *pipalae* is known in this genus so far. Further study is required for the specific determination of the present material.

21. *Indococcus pipalae* Ali

1967. *Indococcus pipalae* Ali, *Orient. Ins.*, 1 : 35.

Material examined : From Bhubaneswar on *Ficus religiosa* and *F. bengalensis*, in March 1979.

Remarks : Originally it was reported from Bihar on *Ficus religiosa*. The present material is the second record of this species from India.

22. *Maconellicoccus hirsutus* (Green)

1908. *Phenacoccus hirsutus* Green, *Mem. Dept. Agric. India*, 2 (2) : 25.

Material examined : From Khurda, Pipili, Bhubaneswar, Cuttack and Balasore, on *Zizyphus mauritiana*, *Psidium guajava*, *Tectona grandis* and *Hibiscus rosa-sinensis*, in April 1976, July 1978 and July-Oct. 1980.

Remarks : First record from Orissa. Earlier known widely including Delhi, Bihar, W. Bengal and Kerala in India and from Pakistan. A common mealy-bug pest of many plants.

23. *Nipaecoccus* sp.

Material examined : From Khurda on jack fruit plant, in March 1985.

Remarks : Two species, *corymbatus* and *vastator* (= *viridis*), are known from the Indian region (Varshney, 1985). The specific identification of present material requires further study.

24. *Nipaecoccus viridis* (Newstead)

1894. *Dactylopius viridis* Newstead, *Indian Mus. Notes*, 3 (5) : 25.

Material examined : From Puri, Bhubaneswar, Mayagarh and Khurda, on *Casuarina equisetifolia*, *Holarrhena antidysenterica*, *Zizyphus* sp., *Ixora coccinea*, *Citrus* sp. and *Euphorbia hirta*, in Jan. 1976, March 1978 and Jan.-February 1979.

Remarks : A widely distributed species, it is reported from Orissa as *Pseudococcus corymbatus* on jack fruit (*Artocarpus integrifolia*) by Sengupta & Behura (1957). Already known from Himachal Pradesh, Delhi, Uttar Pradesh, Bihar, W. Bengal, N. E. India, Maharashtra, Goa and Southern States in India and from Pakistan and Sri Lanka in the Indian region. Polyphagous. The name *N. vastator* (Maskell) for this species has been suppressed in favour of *viridis*, by Williams (1985).

25. *Planococcoides robustus* Ezzat & McConnell

1956. *Planococcoides robustus* Ezzat & McConnell, *Md. Agric. Expt. Stn. Bull.*, A-84 : 59.

Material examined : From Bhubaneswar on *Ficus bengalensis* and *Artocarpus heterophylla*, in July 1979 and July 1980.

Remarks : It has been so far collected from Gujarat only (on mango) in the Indian region. Our material is the second record from India.

26. *Planococcus lilacinus* (Cockerell)

1905. *Pseudococcus lilacinus* Cockerell, *Proc. Davenport Acad. Sci.*, 10 : 128.

Remarks : Recorded earlier from Orissa as a minor pest of *Punica granatum* and *Tamarindus indica*. Also known from W. Bengal, Andhra Pradesh and Tamil Nadu in India and widely in Sri Lanka. Polyphagous.

27. *Pseudococcus* spp.

Material examined : From Khandagiri on jack fruit, from Bhubaneswar on *Phragmites karka*, from Konark on 'polang' (in the curled margin of leaves), from Puri on a garden bush, from Tapta pani on rose and croton, from Gopalpur-on-sea on undet. host, *Citrus* sp. (young-ones emerging) and guava, from Rambha on *Ficus* sp., 'chakotra', croton (heavy infestation),

all in March 1985 ; from Baripada on *Psidium guajava* (at Takhatpur Horticulture nursery), from Khurda on guava, from Talcher on *Croton* sp., *Tamarindus indica*, and from Angul on *Citrus* sp., all in August 1986.

Remarks : Eleven species of *Pseudococcus* s. str. are known from the Indian region (Varshney, 1985). Above materials are composed of at least three species, but further studies are needed for specific determination. A *Pseudococcus* sp. has been recorded earlier from Orissa as a minor pest on pineapple and bamboo.

28. *Rastrococcus ?spinosus* (Robinson)

1918. *Phenacoccus spinosus* Robinson, *Philippine J. Sci.*, 13 (4) : 145.

Material examined : From Bhubaneswar on *Calophyllum inophyllum*, *Ficus* sp. and *Psidium guajava*, in Feb. 1978, March 1979 and April 1980.

Remarks : *R. spinosus* has been recorded from Sri Lanka and Pakistan only in the Indian region. This material was determined by Dr. D.J. Williams. If it is confirmed as *spinosus* on further study, it will be first record from India.

29. *Rastrococcus iceryoides* (Green)

1908. *Phenacoccus iceryoides* Green, *Mem. Dept. Agric. India*, 2 (2) : 26.

Material examined : From Puri and Khurda, on *Mangifera indica*, *Hibiscus mutabilis*, *Capparis* sp., *Ficus* sp., *Vitex* sp., *Bignonia* sp., *Murraya koenigii* and *Cajanus* sp., in May 1976, May 1978 and July 1979.

Remarks : First record from Orissa. Widely distributed including Uttar Pradesh, Bihar, W. Bengal, Andhra Pradesh, Tamil Nadu, Kerala, Maharashtra and Gujarat in India, and from Sri Lanka, in the Indian region. Polyphagous.

30. *Rastrococcus mangiferae* (Green)

1896. *Pseudococcus mangiferae* Green, *Indian Mus. Notes*, 4 : 6.

Remarks : A minor pest, with sometimes severe infestation, on mango plants. Recorded earlier from Orissa, Andhra Pradesh, Karnataka and Tamil Nadu in India and from Sri Lanka. Occurs mostly on mango and occasionally on *Eugenia* sp. and *Echitis* sp.

31. *Saccharicoccus sacchari* (Cockerell)

1895. *Dactylopius sacchari* Cockerell, *J. Trin. Nat. Club*, 2 : 195.

Remarks : A famous pest of sugarcane, with rare occurrence on sorghum also. It is already reported from Orissa, besides Uttar Pradesh, Bihar, Andhra Pradesh, W. Bengal, Tamil Nadu, Karnataka, Madhya Pradesh and Maharashtra in India and from Pakistan and Sri Lanka in the Indian region. Authors have not got it.

32. *Xenococcus annandalei* Silvestri

1924. *Xenococcus annandalei* Silvestri, *Rec. Indian Mus.*, 26 : 212.

Remarks : This was originally described from Barkuda Is. (Chilka Lake) on the roots of *Ficus obtusa*, with the ants *Acropyga acutiventris* attending. Later on recorded from Tamil Nadu, Karnataka and Andhra Pradesh in India. Williams (1978) has redescribed it. Authors have not come across it.

Family VI. ACLERDIDAE

33. *Aclerda* sp.

Material examined : From Bhubaneswar on *Saccharum officinarum* and *Cymbopogon* sp., in August 1980 ; and from Tapta pani on *Casuarina* sp. ('jhau') in March 1985.

Remarks : Five species of *Aclerda* are reported from the Indian region. The specific determination of above material requires further study.

34. *Aclerda tokionis* (Cockerell)

1896. *Sphaerococcus* (*Pseudolecanium*) *tokionis* Cockerell, *Psyche*, 7 suppl. 1 : 19.

Remarks : Recorded earlier from Orissa, as *A. japonica* Newstead, by Sengupta & Behura (1957), as a minor pest of sugarcane, occurring on the nodes and leaf-sheaths. This species is also known from Bihar and Tamil Nadu in India, and from Pakistan in the Indian region. Occurs on sugarcane only.

Family VII. CEROCOCCIDAE

35. *Cerococcus indicus* (Maskell)

1897. *Eriococcus paradoxus* var. *indicus* Maskell, *Trans. New Zeal. Inst.*, 29 : 318.

Material examined : From Cuttack and Bhubaneswar, on *Hibiscus mutabilis*, *H. rosa-sinensis*, *Gossypium* sp. and *Solanum melongena*, in Sept. 1978, Oct. 1979 and Sept. 1980.

Remarks : First record from Orissa. Earlier known from Uttar Pradesh, Bihar, Tripura, Andhra Pradesh and Maharashtra in India, and from Burma, Pakistan and Sri Lanka in Indian region. Common on *Hibiscus*. *C. hibisci* in Moharana (1982) and Parida & Moharana (1982b) falls within this species.

Family VIII. LECANODIASPIDIDAE

36. *Anomalococcus indicus* Green

1930. *Anomalococcus indicus* Green in Ayyar, *Bull. Dept. Agric. Res. Pusa*, 197 : 52.

Material examined : From Bhubaneswar on *Streblus asper* and *Acacia* sp., in Dec. 1978 and Jan. 1979.

Remarks : Originally recorded from Karnataka (Bangalore) and Tamil Nadu (Coimbatore) on *Acacia* plants. This is the second record of this species from India.

Family IX. COCCIDAE

37. *Ceroplastodes* sp.

(Pl. II, fig. 10)

Material examined : From Khurda on *Ficus bengalensis*, in Jan. 1978 ; from Rambha on same host, in March 1985 ; from Khurda on *Ixora* sp. ('nalimandara', 'wakhari', 'raktadrum' or 'rangan'), and from Talcher on *Ixora* sp., in August 1986.

Remarks : Three species of *Ceroplastodes* are known from the Indian region. Further studies are required for specific identity of the above materials.

38. *Ceroplastodes cajani* (Maskell)

1891. *Eriochiton cajani* Maskell, *Indian Mus. Notes*, 2 (1) : 61.

Material examined : From Bhubaneswar, Khurda and Jatni, on *Ocimum sanctum* and *Mimosa pudica*, in August 1978.

Remarks : First record from Orissa. Earlier known from Bihar, West Bengal, Andhra Pradesh, Tamil Nadu, Kerala and Gujarat in India, and from Sri Lanka. A pest of 'arhar' (*Cajanus cajan*) and some other plants.

39. *Ceroplastes* sp.

(Pl. II, fig. 11)

Material examined : From Nandan Kanan on *Ficus glomerata*, from Khandagiri on undet. plant (dead ex.), from Berhampur on *Psidium guajava*, from Khurda on same host and jack fruit, all in March 1985 ; from Balasore on mango, from Khurda on *Ixora* sp. (immature ex.), from Talcher on mango leaves (some parasitised), and from Angul on mango twig, all in August 1986.

Remarks : Four species of *Ceroplastes* are recorded from the Indian region (Varshney, 1985). Above materials require further studies for specific determination. The taxonomy of *Ceroplastes* has been revised by Gimpel et al. (1974).

40. *Ceroplastes actiniformis* Green

1896. *Ceroplastes actiniformis* Green, *Indian Mus. Notes*, 4 (1) : 8.

Material examined : From Bhubaneswar and Cuttack, on *Calophyllum inophyllum*, *Mangifera indica*, *Psidium guajava* and *Canna* sp., in April-June 1976 and June 1979.

Remarks : First record from Orissa. Widely distributed in Uttar Pradesh, Bihar, West Bengal, Andhra Pradesh, Tamil Nadu, Kerala, Goa, Karnataka and Maharashtra in India, and in Pakistan and Sri Lanka, on coconut and other palms, sugarcane, mango, guava, *Ficus* spp., etc.

41. *Ceroplastes pseudoceriferus* Green

1935. *Ceroplastes pseudoceriferus* Green, *Stylops*, 4 (8) : 180.

Material examined : From Bhubaneswar, on *Croton* sp., *Ficus bengalensis*, *Mangifera indica*, *Artocarpus heterophylla*, in Oct. 1979 and Oct. 1980 ; from Baripada on *Psidium guajava*, from Jatni (Khurda Road) on *Croton* sp., and from Talcher on jack fruit ('kathal'), all in August 1986.

Remarks : First record from Orissa. Earlier known from Uttar Pradesh and Bihar in India, as well as from Sri Lanka in the Indian region. Polyphagous.

42. *Ceroplastes rubens* Maskell

1893. *Ceroplastes rubens* Maskell, *Trans. New Zeal. Inst.*, 25 : 214.

Material examined : From Khurda on *Psidium guajava* and *Calophyllum inophyllum*, in Jan. 1978 and Jan. 1979 ; and from Dhauli (near Bhubaneswar) on cashewnut leaves, in August 1986.

Remarks : Already recorded from Orissa on the jack fruit as a minor pest. Also known from Assam, Andhra Pradesh, Tamil Nadu and Kerala in India, and from Sri Lanka. Polyphagous.

43. *Cerostegia floridensis* (Comstock)

1881. *Ceroplastes floridensis* Comstock, *U. S. Dept. Agric. Rep.* 1880 : 331.

Material examined : From Jatni (Khurda Road) on *Ixora coccinea*, *Psidium guajava*, *Tamarix dioica*, *Annona squamosa* and *Mangifera indica*, in Sept. 1977, Oct. 1979 and Sept. 1980.

Remarks : Earlier recorded from the Puri Division of Orissa. Sengupta & Behura (1957) report it as a minor pest of cashew nut. Also known from Uttar Pradesh, Bihar, West Bengal, Tamil Nadu, Karnataka and Kerala in India, and from Pakistan and Sri Lanka. Polyphagous.

44. *Chloropulvinaria polygonata* (Cockerell)

1907. *Pulvinaria polygonata* Cockerell, *Proc. Davenport Acad. Sci.*, 10 : 131.

Material examined : From Khurda and Jatni, on *Mangifera indica* and *Citrus* sp., in August 1976 and Aug. 1978.

Remarks : Earlier recorded from Bhubaneswar. Also known from Uttar Pradesh, Bihar and West Bengal in India, on mango. The original year of publication of this species is 1907, and not 1905 as given in Varshney (1985).

45. *Chloropulvinaria psidii* (Maskell)

1892. *Pulvinaria psidii* Maskell, *Trans. New Zeal. Inst.*, 25 : 223.

Remarks : Recorded earlier from Orissa, specifically on guava and occasionally on mango leaves. This species is widely known in India, including Bihar, W. Bengal, Andhra Pradesh, Maharashtra, Karnataka, Tamil Nadu and Kerala, and from Sri Lanka. Polyphagous.

46. *Coccus* spp.

Material examined : From Jatni (Khurda Road) on *Cinnamomum zeylanicum*, *Codiaeum variegatum*, in Aug. 1979 ; from Bhubaneswar on *Ficus bengalensis* and *F. glomerata*, from Nandan Kanan on citrus leaf (dead ex.), from Khandagiri on jack fruit and undet. plant 'basak', from Puri on 'kathgolap', from Gopalpur-on-sea on *Nerium* sp. (heavy infestation), *Citrus* sp., guava and an undet. plant, from Barkul on croton, mango (heavy infestation), from Barkuda Is., on undet. plant (dead ex.), all in March 1985 ; from Balasore on 'pitharo' and guava leaves (immature ex.), and from Talcher on 'kathal' *Artocarpus* sp., all in August 1986.

Remarks : 25 species and infraspecies of *Coccus* s.str. are reported from the Indian region (Varshney, 1985). The above materials belong to at least 3 species, but specific determination requires further studies. *Lecanium* sp. reported by Sengupta & Behura (1957) from Orissa, on bel (*Aegle* sp.), guava, mango and plantain (*Musa sapientum*), belongs to this genus.

47. *Coccus hesperidum* Linnaeus

(Pl. II, fig. 12)

1758. *Coccus hesperidum* Linnaeus, *Syst. Nat.* (ed. X), 1 : 455.

Material examined : From Rambha on *Lochnera rosea* (= *Vinca rosea*, 'sadabahar') (heavy infestation) and *Croton* sp., in March 1985 ; and from Chandipur on *L. rosea* (heavy infestation), in August 1986.

Remarks : This may be the first record from Orissa of this very common and cosmopolitan species. Reported widely including Assam, Tripura, W. Bengal, Andhra Pradesh, Karnataka, Kerala, Goa, and Gujarat in India, and from Burma, Pakistan and Sri Lanka in the Indian region. Polyphagous.

48. Coccus longulus (Douglas)

1887. *Lecanium longulum* Douglas, *Ent. mon. Mag.*, **24** : 97.

Material examined : From Bhubaneswar on *Calophyllum inophyllum* in January 1978 ; and from Rambha on mango in March 1985.

Remarks : First record from Orissa. Earlier recorded from Assam, Andhra Pradesh and Karnataka in India, and from Sri Lanka in the Indian region. Recorded on grape vine, citrus and other plants.

49. Coccus viridis (Green)

1889. *Lecanium viridis* Green, *Ent. mon. Mag.*, **25** : 248.

Material examined : From Rambha, on petiole of mango leaves, in March 1985.

Remarks : First record from Orissa. Already recorded from Assam, Karnataka and Tamil Nadu in India, and from Pakistan and Sri Lanka in the Indian region. A pest of the coffee plant and also occurs on many other plants.

50. Pulvinaria sp.

Material examined : From Jatni (Khurda Road) on *Zizyphus mauritiana*, *Basella alba* and *Azadirachta indica*, in July 1978 and August 1979.

Remarks : Eight species and subspecies of *Pulvinaria* are recorded from the Indian region (Varshney, 1985). The specific determination of above material requires further study.

51. Pulvinaria maxima maxima Green

1904. *Pulvinaria maxima* Green, *Ent. mon. Mag.*, **40** : 206.

Remarks : Recorded from Orissa on Indian plum (*Zizyphus* sp.). Also known from Uttar Pradesh, Andhra Pradesh, Tamil Nadu and Kerala in India and from Sri Lanka. Polyphagous. Two subspecies *maxima* and *thespesiae* occur in the Indian region (Varshney, 1985).

52. Saissetia sp.

Material examined : From Bhubaneswar on *Calophyllum inophyllum*, *Erythrina* sp., *Cajanus cajan* and *Psidium guajava*, in Nov. 1978, Dec. 1979 and Nov.-Dec. 1980 ; from Khandagiri on 'basak', from Puri on undet. garden bush (mild infection), from Gopalpur-on-sea on *Nerium* sp., from Barkuda Is. on undet. plant (dry ex.), all in March 1985 ; from Balasore on wild bush (?*Cajanus* sp.) (in axil of each branch), from Chandipur on cashew nut leaf, and from Kuliana (near Baripada) on undet. weed, all in August 1986.

Remarks : Eight species of *Saissetia* are reported from the Indian region. Some of these were put in *Parasaissetia* by other workers, but have been merged in *Saissetia* in Varshney (1985). Thus, material reported by Parida & Moharana (1981) and Moharana (1982) as *Parasaissetia* sp. refers to this genus. The specific determination of above materials requires further study.

53. *Saissetia coffeae* (Walker)

1852. *Lecanium coffeae* Walker, *List of Hom. Insects in Colln. of Br. Mus.*, Pt. 4 : 1079.

Material examined : From Jatni (Khurda Road) on *Croton* sp., *Psidium guajava*, *Citrus* sp., *Ixora* sp. and *Hibiscus rosa-sinensis*, in Sept. 1978, Sept. 1979 and Sept. 1980 ; from Bhubaneswar on *Croton* sp. (heavy infestation), and from Puri on *Croton* sp. and *Ixora* sp. (mild infection), in March 1985.

Remarks : First record from Orissa. It is widely distributed including Maharashtra, Assam, W. Bengal, Bihar, Karnataka, Tamil Nadu and Andaman Is. in India, and from Sri Lanka in the Indian region. A pest of coffee and many other plants.

54. *Saissetia filicum* (Boisduval)

1867. *Chermes filicum* Boisduval, *Ent. Hort. Paris* : 335.

Remarks : Earlier recorded from Ganjam Distt. in Orissa. Also known from Karnataka and Tamil Nadu in India. Occurs on tea plant, ferns and *Randia* sp. The authors have not come across it.

55. *Vinsonia stellifera* (Westwood)

1871. *Coccus stellifera* Westwood, *Proc. ent. Soc. Lond.*, 1871 : 3.

Material examined : From Bhubaneswar on *Mangifera indica* (immature ex.), from Nandan Kanan on palm leaf, from Khandagiri on undet. plant, from Goplpur-on-sea on a shrub (?*Ixora*) and mango, from Barkul on mango, all in March 1985 ; from Khurda on *Ixora coccinea*, in August 1986.

Remarks : Immature ex. of *Ceroplastes* look like this species. First record from Orissa. Earlier known from Kerala, Tamil Nadu, Andhra Pradesh, Maharashtra and West Bengal in India, and from Pakistan and Sri Lanka, on coconut palm, etc. Polyphagous.

Family X. DIASPIDIDAE

56. *Aonidiella aurantii* (Maskell)

1879. *Aspidiotus aurantii* Maskell, *Trans. New Zeal. Inst.*, 11 : 199.

Material examined : From Bhubaneswar on *Chrysanthemum indicum*, *Citrus* sp. and *Tamarindus indica*, in Oct.-Nov. 1980 ; from Talcher on *Citrus* sp. (severe infestation on twigs and leaves), in August 1986.

Remarks : Earlier recorded from Orissa on *Citrus* spp. as a major pest. Recorded widely from N. India, Bihar, W. Bengal, Tripura, Andhra Pradesh, Tamil Nadu, Karnataka and Kerala in India, and from Burma, Nepal, Pakistan and Sri Lanka in the Indian region. A cosmopolitan pest reported on many plants.

57. *Aonidiella orientalis* (Newstead)

(Pl. I, fig. 6)

1894. *Aspidiotus orientalis* Newstead, *Indian Mus. Notes*, 3 (5) : 26.

Material examined : From Jatni (Khurda Road) on *Rosa indica*, *Caryota urens*, *Anacardium* sp., *Ficus* sp., *Eugenia* sp., all in December 1978 ; and from Angul on rose twigs (severe infestation), in August 1986.

Remarks : First record from Orissa. Earlier known from Punjab, Bihar, W. Bengal, Madhya Pradesh, Maharashtra, Karnataka, Kerala, Tamil Nadu and Andaman & Nicobar Is. in India, and from Burma, Nepal, Pakistan and Sri Lanka in the Indian region. A cosmopolitan pest. Polyphagous.

58. *Aspidiella hartii* (Cockerell)

1895. *Aspidiotus hartii* Cockerell, *Psyche*, 7 suppl. 1 : 7.

Remarks : Recorded earlier from Orissa as a major pest of turmeric (*Curcuma longa*). Also known from Maharashtra and Tamil Nadu in India. Occurs on turmeric and yam tubers. The authors have not come across it.

59. *Aspidiotus* spp.

Material examined : From Bhubaneswar on *Jatropha* sp. and mango, from Khandagiri on undet. plant, from Gopalpur-on-sea on cashewnut plant and *Citrus* sp., all in March 1985 ; from Chandipur on an undet. garden shrub and *Croton* sp. (heavy infestation), from Khurda on 'safeda' or 'chiku' (*Achras zapota*) (mild infection), and from Talcher on *Citrus* sp., all in August 1986.

Remarks : Seven species and subspecies of *Aspidiotus* s. str. have been reported from the Indian region (Varshney, 1985). Above materials contain at least two species, however, the specific determinations require further study.

60. *Aulacaspis vitis* (Green)

1896. *Chionaspis vitis* Green, *Indian Mus. Notes*, 4 : 3.

Remarks : Recorded from Orissa as a minor pest of mango : 'The whitish hard scales cover the tender leaves and suck the sap, as a result of which leaves turn yellow and fade' (Sengupta & Behura, 1957). Also known from Bihar, Tamil Nadu and Karnataka in India, and from Sri Lanka. Takagi (1985) has recently transferred this species to *Aulacaspis*.

61. Diaspis spp.

Material examined : From Bhubaneswar on a cane 'beta', from Tapta pani on undet. wild plants and 'sthala padma', from Gopalpur-on-sea on mango leaves and guava, from Rambha on mango and a wild creeper 'madhumalti', all in March 1985 ; from Chandipur on cashewnut leaves, from Baripada on guava and mango, from Khurda on 'bhursungha' (mild infection), from Talcher on mango leaves (heavy infection), and from Angul on mango, all in August 1986.

Remarks : Eight species of *Diaspis* s. str. are known from the Indian region (Varshney, 1985). Above materials consist of at least three species, however, the specific identifications require further study.

62. Diaspis echinocacti (Bouche)

1833. *Aspidiotus echinocacti* Bouche, *Shadl. Gart. Ins.* : 53.

Material examined : From Bhubaneswar on *Cereus hexagonus*, in December 1978.

Remarks : First record from Orissa. Earlier known from Maharashtra, Tamil Nadu and Karnataka in India, and from Pakistan in the Indian region. Occurs on prickly pear and *Cereus* sp.

63. Greenaspis decurvata (Green)

1903. *Chionaspis decurvata* Green, *Indian Mus. Notes*, 5 (3) : 63.

Material examined : From Cuttack on *Cymbopogon citratus* and *Phoenix* sp., in July-August 1980.

Remarks : First record from Orissa. Earlier known from West Bengal (Calcutta) and Tamil Nadu (Madras) in India, and from Pakistan (Murree Hills) in the Indian region. Occurs on paddy and other grasses.

64. Hemiberlesia lataniae (Signoret)

1869. *Aspidiotus lataniae* Signoret, *Ann. Soc. Ent. Fr.*, (4) 9 : 124.

Material examined : From Bhubaneswar on *Psidium guajava*, in October 1980.

Remarks : Recorded earlier from Orissa as a minor pest of apple, pear, etc. Also known from Karnataka and Tamil Nadu in India, and from Pakistan and Sri Lanka in the Indian region. A cosmopolitan pest. Polyphagous.

65. Lepidosaphes sp.

Material examined : From Dhauli (near Bhubaneswar) on cashewnut leaves, and from Angul on *Nerium* sp. leaves (with male tests), both in August 1986.

Remarks : Twelve species of *Lepidosaphes* s. str. are recorded from the Indian region (Varshney, 1985). The specific determination of above material requires further study.

66. *Lindingaspis ferrisi* McKenzie

1950 *Lindingaspis ferrisi* McKenzie, *Microent.*, 15 (3) : 100.

Material examined : From Cuttack on *Artocarpus heterophylla* and *Croton* sp., in November 1980.

Remarks : This species has been reported earlier from Assam (Tocklai only) on tea plants. This is its second record from India.

67. *Melanaspis* sp.

Material examined : From Jatni (Khurda Road) on *Holorrhena antidysenterica*, in August 1986.

Remarks : Two species, *glomerata* and *inopinata*, are known from the Indian region. The latter is reported from Pakistan only. The specific determination of above material requires further study.

68. *Melanaspis glomerata* (Green)

1903. *Aspidiotus (Targionia) glomeratus* Green, *Indian Mus. Notes*, 5 (3) : 93.

Material examined : From Cuttack, on sugarcane *Saccharum officinarum*, in October 1979.

Remarks : First record from Orissa. Earlier known from the sugarcane areas including Bihar, Andhra Pradesh and Tamil Nadu in India, and from Pakistan in the Indian region. A severe pest of sugarcane.

69. *Odonaspis saccharicaulis* (Zehntner)

1897. *Aspidiotus saccharicaulis* Zehntner, *Proefsta. Ost. Java, Meded.*, (n. s.) 37 : 51.

Material examined : From Bhubaneswar on *Pharagmites karka* and *Annona squamosa*, in November 1980.

Remarks : First record from Orissa. It has been earlier recorded from Tamil Nadu (Coimbatore only) as such the present material is the second record of this species from India. Occurs on sugarcane only as pest, and occasionally on other plants.

70. *Quadraspidotus perniciosus* (Comstock)

1881. *Aspidiotus perniciosus* Comstock, *Rep. U. S. Dept. Agric.*, 1881 : 304.

Remarks : The San Jose scale is a famous pest of apple, pear, peach, plum, etc. in many parts of the world. It has been recorded on some of

these plants as a minor pest from Orissa. Already known from Jammu & Kashmir, Himachal Pradesh, Punjab, Uttar Pradesh, West Bengal, Meghalaya, Karnataka and Tamil Nadu in India. Polyphagous.

ECONOMIC IMPORTANCE

The present study shows that many plants of economic importance are infested by these insects in Orissa State. These include paddy, sugarcane, teak (*Tectona grandis*), mango, guava, citrus, cashewnut and custard apple (*Annona squamosa*), a number of vegetables (e. g. *Solanum melongena*) and garden shrubs, e. g. rose, crotons, *Ixora* sp., chrysanthemums, jasmine, etc. Some coccid species, e. g. *Icerya aegyptiaca*, *Ferrisia virgata*, *Nipaeococcus viridis*, *Ceroplastes pseudoceriferus*, and *Aonidiella aurantii*, etc. are severe pests in the State, of which heavy infestations were observed by the authors. On the other hand, the beneficial lac insect, *Kerria lacca*, was not as common in this State as in the neighbouring Bihar and West Bengal States. It is suggested that lac culture be enhanced in Orissa, particularly in Mayurbhanj, Sundargarh and Sambalpur, which are adjacent to the Chota Nagpur Plateau of Bihar highly suitable for the production of lac.

Regarding the control of coccid pests, the removal and burning of infested twigs and leaves is recommended. In cases of mild attack, the insects be thoroughly scrapped out. For chemical control, sprays with insecticides like diazinon or monocrotophos and fumigation with HCN, have been suggested in the literature. Sengupta & Behura (1957) state, "Scale insects and mealy-bugs are difficult to control because of their relative resistance to contact insecticides and fumigants. The organophosphorus group of insecticides, such as parathion and malathion, offer great promise of scale and mealy-bug control. Spraying with 'Folidol' 0.05% (1 oz. in 4 gallons of water) prove effective in controlling the rice mealy-bug [*Brevinnia rehi*]. The chemicals have to be applied at the nursery stage a week before transplanting. This will help to eliminate the pest in the early stage itself. The patches that appear in the transplanted field also have to be treated as early as possible. Sprays of 0.0625% malathion completely eliminated infestations of the brinjal mealy-bug [*Coccidohystrix insolita*]. The Cottony-cushion scale (*Icerya purchasi*) may be controlled by two sprays of 0.03% parathion, in the early stages of the crop."

SUMMARY

Authors have collected coccids in Orissa from the coastal and central parts. A total of 70 species in 43 genera under 10 families are reported. Host-plants and distributional ranges are mentioned. Many species are first record for Orissa and a few species are second record for India. Some common species have been photographed.

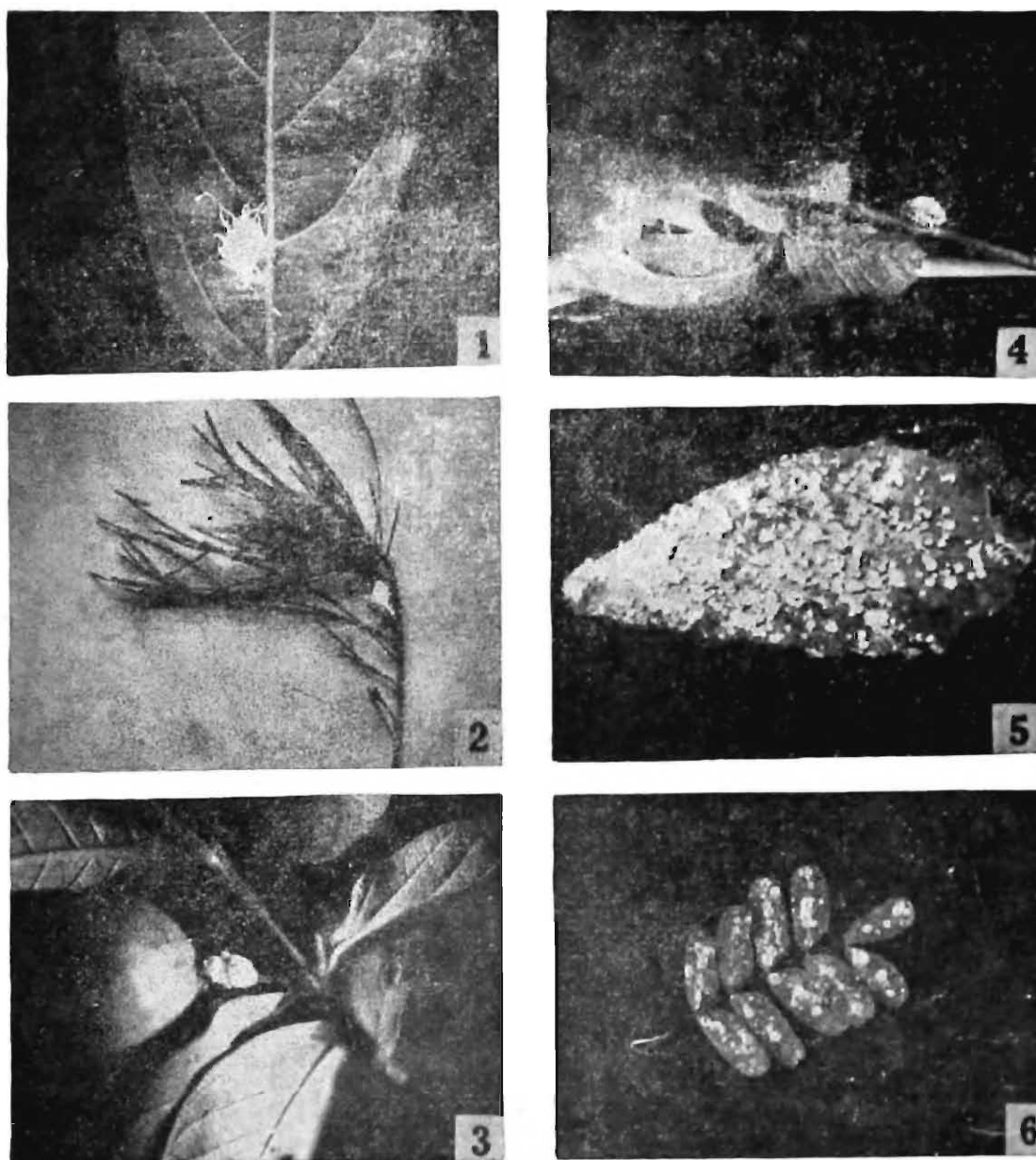
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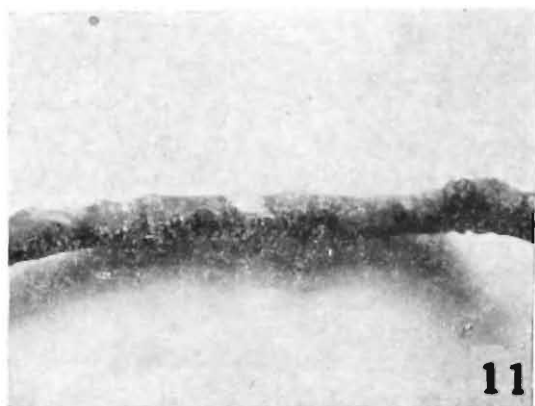
REFERENCES

- ALI, S. M. 1967. Description of a new and records of some known coccids (Homoptera) from Bihar, India. *Oriental Ins.*, **1** (1-2) : 29-43.
- ALI, S. M. 1968. Coccids (Coccoidea : Hemiptera : Insecta) affecting fruit plants in Bihar (India). *J. Bombay nat. Hist. Soc.*, **65** (1) : 120-137.
- AYYAR, T. V. R. 1930. A contribution to our knowledge of South Indian Coccidae (Scales and mealy-bugs). *Bull. agric. Res. Inst. Pusa*, **197** (1929) : 73 pp.
- DAS, G. M. AND GANGULI, R. N. 1962. Coccoids on tea in North-east India. *Indian J. Ent.*, **23** (4) (1961) : 245-256.
- GANGULI, R. N. AND GHOSH, M. R. 1964. Coccoids of Tripura. *Indian J. Ent.*, **26** (3) : 358-359.
- GHOSE, S. K. 1961. Studies on some coccids (Coccoidea : Hemiptera) of economic importance of West Bengal, India. *Indian Agric.*, **5** (1) : 57-78.
- GIMPEL, W. F. JR., MILLER, D. R. AND DAVIDSON, J. A. 1974. A systematic revision of the wax scales genus *Ceroplastes* in the United States (Homoptera : Coccoidea : Coccidae). *Misc. Publs. agric. Exp. Stn. Univ. Maryland*, **841** : 85 pp.
- MOHARANA, S. 1982. Cytological Survey of Indian Coccids. Ph. D. Thesis, Utkal University, Bhubaneswar : 504 pp.

- PARIDA, B. B. AND MOHARANA, S. 1981. Somatic chromosomes of 15 species of Indian soft and armoured scales (Coccidae and Diaspididae ; Homoptera). *Chrom. Inform. Service*, **31** : 11-13.
- PARIDA, B. B. AND MOHARANA, S. 1982a. Cytological studies on Indian scale insects. I. Somatic chromosomes in eleven species of soft mealy bugs (Pseudococcidae : Coccoidea : Homoptera). *Pranikee*, **3** : 55-69.
- PARIDA, B. B. AND MOHARANA, S. 1982b. Studies on the chromosome constitution in 42 species of scale insects (Coccoidea : Homoptera) from India. *Chrom. Inform. Service*, **32** : 18-20.
- SENGUPTA, G. C. AND BEHURA, B. K. 1957. Annotated list of crop pests in the state of Orissa. *Mem. Ent. Soc. India*, **5** : 44 pp.
- TAKAGI, S. 1985. The scale insect genus *Chionaspis* : a revised concept (Homoptera : Coccoidea : Diaspididae). *Ins. matsum.*, (n. s.) **23** : 1-77.
- VARSHNEY, R. K. 1977. Taxonomic studies on lac insects of India (Homoptera : Tachardiidae). *Oriental Ins. Suppl.*, **5** (1976) : 97 pp.
- VARSHNEY, R. K. 1985. A review of Indian coccids (Homoptera : Coccoidea). *Oriental Ins.*, **19** : 1-101.
- WILLIAMS, D. J. 1978. The anomalous ant-attended mealy bugs (Homoptera : Pseudococcidae) of South-east Asia. *Bull. Br. Mus. nat. Hist. (Ent.)*, **37** (1) : 1-72.
- WILLIAMS, D. J. 1985. Australian mealybugs. British Museum (Natural History), London : 431 pp.



Figs. 1-6. Coccids from Orissa : (1). *Icerya aegyptiaca* on 'ain-sha' leaf at Baripada ; (2). *Crypticerya* sp. on *Casuarina* branch at Talcher ; (3). *Icerya* sp. on *Psidium guajava* poduncle at Takhatpur, Baripada ; (4). *Labioproctus poleii* on *P. guajava* twig at Baripada ; (5). *Dactylopius indicus* on *Opuntia aillenii* at Khurda ; and (6). *Aonidiella orientalis* on *Tamarindus indica* leaves at Bhubaneswar.



Figs. 7-12. Coccids from Orissa : (7) & (8). *Ferrisia virgata* on croton leaf underside and on midrib of upperside at Khurda ; (9). Pseudococcid attack on a croton plant at Jatni ; (10). *Ceroplastodes* sp. heavy infestation on 'wakhari' or 'raktadrum' at Khurda ; (11). *Ceroplastes* sp. on *Mangifera indica* twig at Balasore ; and (12). *Coccus hesperidum* heavy infestation on twigs and leaves of 'Sadabahar' *Lochnera rosea* at Chandipur.



Icerya aegyptiaca (Douglas)



Ceroplastes sp.

(Photos : R. K. Varshney)

INSECTA : NEUROPTERA : PLANIPENNIA : MYRMELEONTIDAE

A CHECK-LIST

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INTRODUCTION

The taxonomic study of the family Myrmeleontidae from Orissa has received very little attention. Dover (1921) worked out a collection of these insects from Barkuda Island recording five species and Needham (1909) has reported four species from a collection of Neuroptera from the Indian Museum. Recently, the author (Ghosh, 1984), while working out a collection of this family from Eastern India, has reported fortyfive species of which twenty are from Orissa and all the species have been dealt with elaborately, giving the descriptions of new species, redescrptions and morpho-variations of others, biogeography, etc.

In this paper, a check-list of species of the family, reported so far from Orissa, has been provided with original and current references, keys to genera and species actually examined and geographical distribution of different species. Under distribution of several species, where the precise locality data were not provided by the earlier workers, the areas, as given in the original literature, have been put in the "inverted commas". This account will provide a ready reference for those interested in the neuropteran fauna of the family Myrmeleontidae from Orissa. Two species marked by asterisk (*) have been reviewed from literature due to lack of relevant material for study from the State.

SYSTEMATIC ACCOUNT

Key to genera of the family Myrmeleontidae

1. With four separate anal veins in forewing ; first anal vein in hindwing not connected directly to hind margin but to second anal by a series of crossveins ...	...	2
— With two or three anal veins in forewing ; first anal in hindwing connected directly to hind margin by crossveins. ...	...	4
2. Two or more series of costal cells near to base of forewing. ...	Stenares Hagen	
— Single series of costal cells near base excepting for a few near pterostigma of forewing. ...	...	3

3. Distance between bases of antennae not more than their basal diameter. ...	<i>Palpares</i> Rambur	
— Distance between bases of antennae more than their basal diameter. ...	<i>Tomatares</i> Hagen	
4. Spurs longer than basal joint of tarsus ; body very hairy ...	<i>Centroclisis</i> Navas	
— Spurs not longer than basal joint of tarsus ; body not so hairy. ...	...	5
5. Branches of radial sector bending to form a straight line through middle of apical part of forewing. ...	...	6
— Branches of radial sector not forming any line through the wing. ...	...	7
6. Wings rather elongate ; forewing pointed at apex : wing membrane speckled or with streaks along gradates and not heavily marked or banded. ...	<i>Cueta</i> Navas	
— Wings short and broad ; forewing rounded at apex ; wing membrane heavily marked or banded with dark brown colour. ...	<i>Nesoleon</i> Banks	
7. Forks of cubitus in forewing parallel for a distance ; first anal also parallel to these forks. ...	<i>Creoleon</i> Tillyard	
— Forks of Cubitus divergent ; first anal not parallel to upper fork of cubitus. ...	...	8
8. First anal in hindwing running parallel to cubitus for a distance but finally curving upwards. ...	<i>Echthromyrmex</i> MacLachlan	
— First anal in hindwing running directly to hind-margin. ...	...	9
9. One crossvein before radial sector in hindwing. ...	...	10
— Three or more crossveins before radial sector in hindwing. ...	<i>Myrmeleon</i> Linnaeus	
10. Spurs in hind tibia about as long as or longer than first two tarsal joints taken together. ...	...	11
— Spurs hardly longer than two basal tarsal joints taken together. ...	<i>Neuroleon</i> Navas	
11. Spurs in hind tibia about as long as two basal tarsal segments taken together. ...	<i>Macronemurus</i> Costa	
— Spurs in hind tibia always longer than two basal tarsal segments taken together. ...	<i>Distoleon</i> Banks	

Subfamily (i) PALPARINAE

Tribe Palparini

Genus 1. *Stenares* Hagen

Only one subspecies of the genus *Stenares* is known from Orissa.

1. *Stenares hyaena clara* Navas

1932. *Stenares hyaena clara* Navas, *Memorie Accad. pont. Nuovi. Lincei.*, (11) 16 : 951.

1984. *Stenares hyaena clara*, Ghosh, *Occ. Pap. Rec. zool. Surv. India*, No. 52 : 8.

Distribution : India : Orissa (Mayurbhanj and Sambalpur).

Remarks : The subspecies was recorded for the first time from Orissa by Ghosh (1984).

Genus 2. *Palpares* Rambur

Three species of the genus are known from Orissa and they may be distinguished by the following key :

Key to species of the genus Palpares Rambur

1. A large spot over Cubitus in hindwing.	...	...	2
— No such spot as above.	...	<i>contrarius</i> (Walker)	
2. With two parallel stigmal bands or spots in hindwing.	...	<i>patiens</i> (Walker)	
— With one stigmal band (either entire or broken into a series of spots) in hindwing.	...	<i>pardus</i> (Rambur)	

2. *Palpares contrarius* (Walker)

1853. *Myrmeleon contrarius* Walker, *Cat. Brit. Mus. Neur.*, 2 : 301.

1984. *Palpares contrarius*, Ghosh, *Occ. Pap. Rec. zool. Surv. India*, No. 52 : 11, Figs. 23-27.

Distribution : India (Uttar Pradesh : Mussoorie ; Maharashtra, Karnataka ; Orissa : Cuttack and Mayurbhanj) and Sri Lanka.

3. *Palpares pardus* (Rambur)

1842. *Myrmeleon pardus* Rambur, *Hist. nat. Ins. Neur.* 735.

1984. *Palpares pardus*, Ghosh, *Occ. Pap. Rec. zool. Surv. India*, No. 52 : 12, figs. 18, 28-31.

Distribution : India (Rajasthan : Maharashtra ; South India ; Madhya-Pradesh ; Orissa : Kalahandi ; Dhenkanal, West Bengal ; Bihar ; Sikkim and North-Western Himalayas).

Remarks : The species is very common and distributed almost all over India.

4. *Palpares patiens* (Walker)

1853. *Myrmeleon patiens* Walker, *Cat. Brit. Mus. Neur.*, 2 : 305.

1984. *Palpares patiens*, Ghosh, *Occ. Pap. Rec. zool. Surv. India*, No. 52 : 12.

Distribution : India (Rajasthan ; North India ; West Bengal ; Orissa : Ganjam).

Genus 3. *Tomatares* Hagen

Only one species of the genus is known from Orissa.

5. *Tomatares pardalis* (Fabricius)

1781. *Myrmeleon pardalis* Fabricius, *Spec. Ins.* : 398.

1984. *Tomatares pardalis*, Ghosh, *Occ. Pap. Rec. zool. Surv. India*, No. 52 : 14, figs. 21-25.

Distribution : India ("North India" ; Bihar ; West Bengal and Orissa : Sundargarh).

Subfamily (ii) MYRMELEONTINAE

Tribe Acanthaclisini

Genus 4. *Centroclisis* Navas

Three species of the genus are known from Orissa of which the distinguishing features of two are given in the following key and the remaining one has been reviewed from literature due to the paucity of the material at hand from the State.

Key to species of genus Centroclisis Navas

Pronotum broader than long and yellow, with a broad, median, longitudinal, dark brown stripe ; forewing 9 mm in width and without black mark at the apex of M, Cu ₁ , Cu ₂ , and before pterostigma. ...	<i>eustalacta</i> (Gerstaecker)
Pronotum longer than broad and more or less dark ; forewing 13 mm in width and with a distinct black mark before pterostigma, at the apex of M, Cu ₁ , and Cu ...	<i>horridus</i> (Walker)

6. *Centroclisis eustalacta* (Gerstaecker)

1863. *Acanthaclisis eustalacta* Gerstaecker, *Stettin. ent. ztg.*, 24 : 378.

1981. *Centroclisis eustalacta*, Ghosh, *Bull. zool. Surv. India*, 3 (3) : 269.

Distribution : India (Rajasthan, Uttar Pradesh, Orissa : Puri, Balangir, Kalahandi ; and the Lakshadweep Islands).

Remarks : Ghosh (1981) included this species under the genus *Centroclisis* and he (1984) recorded it for the first time from Orissa.

7. *Centroclisis horridus* (Walker)1853. *Myrmeleon horridus* Walker, *Cat. Brit. Mus. Neur.*, 2 : 336.1984. *Centroclisis horridus* Ghosh, *Occ. Pap. Rec. zool. Surv. India*, No. 52 : 36, figs. 53-54.*Distribution* : India (Bihar ; Assam ; West Bengal ; Orissa : Sundargarh and Tamil Nadu).*Remarks* : Ghosh (1984) included the species in the genus *Centroclisis* on the basis of a single row of costal cells in both wings.*8. *Centroclisis edax* (Walker)1853. *Myrmeleon edax* (Walker), *Cat. Brit. Mus. Neur.*, 2 : 317.1984. *Centroclisis edax* Ghosh, *Occ. Pap. Rec. zool. Surv. India*, No. 52 : 38.*Distribution* : India (Rajasthan, Orissa : Ganjam and Tamil Nadu).*Remarks* : The detailed examination of species *edax* from different parts of India excepting for eastern India, has revealed the existence of only one row of costal cells. Following Holzel (1972), *edax* has been considered under the genus *Centroclisis* Navas (Ghosh, 1984).

Tribe ISOLEONINI

Genus 5. *Cueta* Navas

Three species of this genus are known from Orissa and they may be distinguished by the following key :

Key to species of genus Cueta Navas

1. Cu, in forewing without any spot at tip ; pronotum with numerous long white bristles. ...	<i>facile</i> Banks
— Cu, in forewing with an apical spot ; pronotum with sparsely oriented, long, white bristles. ...	... 2
2. Hind femur without long black hair ; dorsal abdominal spots attached with the median stripe by short peduncles ; base of all forked veinlets beyond M with smoky brown patches. ...	<i>bolangirensis</i> Ghosh
— Hind femur with long black hairs ; dorsal abdominal spot separated from median stripe ; base of all forked veinlets beyond M without distinct smoky brown patches. ...	<i>angulensis</i> Ghosh

9. *Cueta angulensis* Ghosh1984. *Cueta angulensis* Ghosh, *Occ. Pap. Rec. zool. Surv. India*, No. 52 : 31, figs. 41-43, & pl. II, fig. 5.*Distribution* : India (Orissa : Dhenkanal).*Remarks* : The species was described new to science from Orissa by Ghosh (1984).

10. Cueta bolangirensis Ghosh

1984. *Cueta bolangirensis* Ghosh, *Occ. Pap. Rec. zool. Surv. India*, No. 52 : 30, figs. 48-49 & pl. I, fig. 4.

Distribution : India (Orissa : Bolangir).

Remarks : Ghosh (1984) described the species as new to science.

11. Cueta facile Banks

1939. *Cueta facile* Banks, *Bull. Mus. Comp. Zool. Harv.*, 85 : 455-456.

1984. *Cueta facile*, Ghosh, *Occ. Pap. Rec. zool. Surv. India*, No. 52 : 28, figs. 44-47.

Distribution : India (Bihar ; Orissa : Sundargarh and Tamil Nadu).

Remarks : The species was recorded for the first time from Orissa (Ghosh, 1984).

Genus 6. Nesoleon Banks

Only one species of this genus is known from Orissa.

12. Nesoleon perpunctatus Banks

1931. *Nesoleon perpunctatus* Banks, *Psyche*, 38 : 60.

1984. *Nesoleon perpunctatus*, Ghosh, *Occ. Pap. Rec. zool. Surv. India*, No. 52 : 32, figs. 50-52.

Distribution : India : (Madhya Pradesh ; Bihar ; Orissa : Kalahandi and Andhra Pradesh).

Remarks : The species is recorded from Orissa for the first time.

Tribe Myrmeleontini**Genus 7. Myrmeleon Linnaeus****13. Myrmeleon clothilde Banks**

1913. *Myrmeleon clothilde* Banks, *Trans. Amer. ent. Soc.*, 39 : 223.

1984. *Myrmeleon clothilde*, Ghosh, *Occ. Pap. Rec. zool. Surv. India*, No. 52 : 22.

Distribution : India (Himachal Pradesh ; Bihar and Orissa : Dhenkanal).

Remarks : Ghosh (1984) recorded the species for the first time from Orissa.

***14. Myrmeleon punctulatus Rambur**

1842. *Myrmeleon punctulatus* Rambur, *Hist. nat. Ins. Neur.*, p. 405.

1984. *Myrmeleon punctulatus*, Ghosh, *Occ. Pap. Rec. zool. Surv. India*, No. 52 : 25.

Distribution : India (West Bengal and Orissa : Ganjam).

Remarks : Needham (1909) doubtfully identified the species from Orissa.

Tribe **Distoleonini**Genus 8. **Neuroleon Navas**

Three species of this genus are known from Orissa and they may be distinguished by the following key :

Key to species of genus Neuroleon Navas

1, Pronotum without long white hairs laterally ; wing membrane without marking ; forewing over 30 mm in length ; hind femur without white bristles ; abdomen as long as hindwing. ...	<i>guptai</i> Ghosh
— Pronotum with 4-6 long, white hairs laterally ; wing membrane with markings ; forewing less than 25 mm in length ; hind femur with 3 white bristles ; abdomen shorter than hindwing. ...	... 2
2. Pterostigma with a distinct brown mark at base and cubital field with a series of brown streaks on cross-veins of forewing. ...	<i>guernii</i> Navas
— Pterostigma without any mark as mentioned above and also cubital field without brown streak ...	<i>apicalis</i> Navas

15. Neuroleon apicalis Navas

1915. *Neuroleon apicalis* Navas, *Mem. R. Acad. Cienc. Artes Barcelona*, **11** (23) : 11.

1984. *Neuroleon apicalis*, Ghosh, *Occ. Pap. Rec. zool. Surv. India*, No. **52** : 45, figs. 59-60.

Distribution : India (Pondicherry and Orissa : Keonjhar and Dhenkanal).

Remarks ; Ghosh (1984) recorded the species for the first time from Orissa.

16. Neuroleon guernii Navas

1914. *Neuroleon guernii* Navas, *Russk. ent. Obozr.*, **14** : 319.

1984. *Neuroleon guernii*, Ghosh, *Occ. pap. Rec. zool. Surv. India*, No. **52** : 44, figs. 55-56.

Distribution : India (Rajasthan ; Maharashtra ; Orissa : Keonjhar) and Sri Lanka.

Remarks : Ghosh (1984) recorded the species for the first time from Orissa.

17. Neuroleon guptai Ghosh

1984. *Neuroleon guptai* Ghosh, *Occ. Pap. Rec. zool. Surv. India*, No. **52** : 43, figs. 57-58, pl. II, fig. 6.

Distribution : India (Orissa : Dhenkanal).

Remarks : Ghosh (1984) described the species as new to science.

Genus 9. **Creoleon** Tillyard

Only one species of this genus is known from Orissa.

18. **Creoleon griseus** (Klug)

1834. *Myrmeleon griseus* Klug, *Symb. phys.*, 4, tafel, 36, fig. 8.

1984. *Creoleon griseus*, Ghosh, *Occ. Pap. Rec. zool. Surv. India*, No. 52 : 40.

Distribution : Egypt, Sudan, Israel, Iran and India (Maharashtra ; Tamil Nadu ; Orissa : Keonjhar, Mayurbhanj ; West Bengal ; Bihar ; "North India" and Madhya Pradesh).

Remarks : The species is largely exotic in distribution.

Genus 10. **Macronemurus** Costa

Only one species of this genus is known from Orissa.

19. **Macronemurus nefandus** (Walker)

1853. *Myrmeleon nefandus* Walker, *Cat. Brit. Mus. Neur.* 2 : 357.

1984. *Macronemurus nefandus*, Ghosh, *Occ. Pap. Rec. zool. Surv. India*, No. 52 : 47, figs. 61-62.

Distribution : India (North India ; Himachal Pradesh ; Uttar Pradesh ; Bihar and Orissa ; Sundargarh, Cuttack, Kalahandi and Bolangir).

Remarks : Ghosh (1984) recorded the species for the first time from Orissa.

Genus 11. **Distoleon** Banks

Three species of this genus are known from Orissa and they may be distinguished by the following key :

Key to species of genus Distoleon Banks

1. Pterostigma rosy ; pronotum with 4 irregular, pitchy stripes ; forewing 10 mm in width ; apex of both wings acute.	...	<i>verendus</i> (Walker)
— Pterostigma yellowish, with a brown mark at base ; pronotum with 3 very narrow, yellow lines ; forewing not more than 6 mm in width ; apex of both wings subacute or blunt.	...	2
2. Veins or crossveins in milk-white spaces of wings yellow ; M, Cu ₁ and Cu ₂ in forewing with a distinct, brown streak at apex ; hindwing with a lance-shaped, brown mark at apex of Cu ₁ and M ; second abdominal segment without long, white hair.	...	<i>sambalpurensis</i> Ghosh
— Veins or crossveins unicolorous throughout and no milk-white space in wings ; only Cu ₂ of forewing with an indistinct, brown mark as above ; second abdominal segment with long white hairs.	...	<i>bisoiensis</i> Ghosh

20. *Distoleon bisoiensis* Ghosh

1984. *Distoleon bisoiensis* Ghosh, *Occ. Pap. Rec. zool. Surv. India*, No. 52 : 51, figs. 63-64, pl. fig., 7.

Distribution : India (Orissa : Mayurbhanj).

Remarks : Ghosh (1984) described the species as new to science from Orissa.

21. *Distoleon sambalpurensis* Ghosh

1984. *Distoleon sambalpurensis* Ghosh, *Occ. Pap. Rec. zool. Surv. India*, No. 52 : 50, figs. 65-66, pl. II, fig. 8.

Distribution : India (Orissa : Sambalpur).

Remarks : Ghosh (1984) described this species as new to science from Orissa.

22. *Distoleon verendus* (Walker)

1853. *Myrmeleon verendus* Walker, *Cat. Brit. Mus. Neur.*, 2 : 342.

1984. *Distoleon verendus*, Ghosh, *Occ. Pap. Rec. zool. Surv. India*, No. 52 : 49, figs. 10-11.

Distribution : India (Himachal Pradesh ; "North India" ; Uttar Pradesh ; Orissa : Dhenkanal and Sundargarh).

Remarks : Ghosh (1984) combined the species *verendus* (Walker) with the genus *Distoleon* Banks.

Subfamily (iii) ECHTHROMYRMICINAE**Tribe Echthromyrmicini****Genus 12. *Echthromyrmex* MacLachlan**

Only one species of the genus is known from Orissa.

23. *Echthromyrmex orientalis* MacLachlan

1873. *Echthromyrmex orientalis* MacLachlan, *Ann. ent. Belg.*, 16 : 143.

1984. *Echthromyrmex orientalis*, Ghosh, *Occ. Pap. Rec. zool. Surv. India*, No. 52 : 16, figs. 15-17.

Distribution : India (Goa and Orissa : Sundargarh).

Remarks : The species was recorded for the first time from Orissa by Ghosh (1984).

SUMMARY

The paper incorporates a consolidated list of twentythree species belonging to twelve genera of Neuroptera under the family Myrmeleontidae from

Orissa, of which twentyone species have been examined and the other two species have been reviewed from literature due to the lack of relevant material for study. Keys to all the taxa examined, relevant references and geographical distribution of the species have been provided.

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REFERENCES

- DOVER, C. 1921. Neuropteroid insects of Barkuda Island. *Rec. Indian Mus.*, **22** : 397.
- GHOSH, S. K. 1981. New records of Neuroptera : Planipennia from the Laccadive Island, India, coupled with a short note on the taxonomic variation of *Centroclisis eustalacta* (Gerst.). *Bull. zool. Surv. India*, **3(3)** : 269-270.
- GHOSH, S. K. 1984. Contribution to the taxonomical studies of Neuroptera (Suborder Planipennia) from Eastern India. 1. Family Myrmeleontidae. *Occ. Pap. Rec. zool. Surv. India*, No. **52** : 1-vi+1-63, figs. 1-66, pl. I-II.
- HOLZEL, 1972. Die Neuropteren Vorderasiens. IV. Myrmeleonidae. *Beitr. naturk. Forsch. SüdwDtl*, **1** : 3-103.
- NEEDHAM, J. G. 1909. Notes on the Neuroptera in the collection of the Indian Musuem. *Rec. Indian Mus.*, **3** : 185-210.

INSECTA : LEPIDOPTERA : RHOPALOCERA : NYMPHALIDAE

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INTRODUCTION

The paper gives an account of butterflies belonging to the family Nymphalidae from Orissa in Eastern India. The material collected during different seasons of the year in as many as 12 districts of the state by various survey parties from the Zoological survey of India, is represented by 22 species and subspecies in 11 genera. About eight species were reported only from the Barkuda Island, Ganjam District by Annandale and Dover (1921). Majority of the species, presently dealt with, are of geographical interest in view of constituting new locality records for the State.

SYSTEMATIC ACCOUNT

Order LEPIDOPTERA

Suborder RHOPALOCERA

Family NYMPHALIDAE

1. *Charaxes polyxena imna* Butler

1870. *Charaxes imna* Butler, *Trans. ent. Soc., Lond.*, 1870 : 122, pl. 4, fig. 2.

1932. *Charaxes polyxena imna* : Evans., *Ident. Indian Butts. Ed. 2* : 141, pl. 17, fig. 2/8.

Material examined : Dist. Mayurbhanj : one ♀, Bisoi, 26.iii.1973, *at light*, S. K. Gupta & Party leg.

Wing expanse ; 76 mm.

Distribution : India : Northern, western, southern and eastern peninsular belts.

Remarks : This is one of the three Indian subspecies of *Charaxes polyxena* (Cramer) from the Indian subregion. It is widely distributed in the Indian peninsular belts. It is locally common and differs from its allies by the narrower black border of fore wing. The specimen examined is much smaller as compared to the wing expanse (90-100 mm) cited by Evans (1932) and also Wynter-Blyth (1957). The butterfly was earlier known from Orissa, though the districts were not mentioned either by Evans (*loc. cit.*) or by Wynter-Blyth (*loc. cit.*).

2. *Eriboea athamus agrarius* Swinhoe

1886. *Eriboea agrarius* Swinhoe, in Nicév., *Butt. Ind.*, 2 : 277.

1932. *Eriboea athamus agrarius* : Evans, *Ident. Indian Butts. ed. 2* : 148, pl. 17.

Material examined : Dist. Puri ; one ♂ c 8 kms north-east of Berbera, 4.i.1974., R. L. Chowdhury & Party leg.

Wing expanse : 65 mm.

Distribution : India : Southern and eastern peninsular belts including Orissa (Puri).

Remarks : This is one of the three Indian subspecies of *Eriboea athamus* (Drury) from the Indian subregion. It is locally common and differs from its allies by two subapical spots of fore wing. The subspecies constitutes new locality record for Orissa.

3. *Euthalia lepidea miyana* Fruhstorfer

1918. *Euthalia lepidea miyana* Fruhstorfer, in Seitz, *Macrolepidoptera of the World*, 9 : 656, figs. 132 a, b.

Material examined : Dist. Mayurbhanj : one ♀, Baripada, Hamilton garden, 17.iii.1973. S. K. Gupta leg ; Dist. Boudhkhandmals ; 1 ♀, 3 km south of Kotagarh, 14.x.1973. D. P. Sanyal leg.

Wing expanse : ♀ ♀ : 57-62 mm.

Distribution : India : Karnataka (N. Kanara) ; eastern peninsular belts including Orissa (Mayurbhanj and Boudhkandmals).

Remarks : This is one of the two Indian subspecies of *Euthalia lepidea* (Butler) from the Indian subregion. It is rare and differs from its allies by the small pale grey border of hind wing. Specimens examined are much smaller than those recorded by Evans (1932). The subspecies constitutes new locality record for northern and Central Orissa.

4. *Euthalia nais* (Forester)

1771. *Papilio nais* Forster, *Nov. Spec. Ins. Cent.* 1 : p. 73.

1932. *Euthalia nais* ; Evans, *Ident. Indian Butts.*, ed. 2 : 157.

Material examined : Dist. Sundargarh : one ♀, 9.i.1972, P. K. Maity & Party leg ; Dist. Sambalpur : 2 ♀ ♀, 3 kms W. of Badrama Forest, 6.vi.1972, D. P. Sanyal leg ; Dist. Mayurbhanj : 1 ♀, Kundra village, 4.vii.1972, S. K. Mitra leg ; Dist. Keonjhar : 1 ♂, Badampahar, dudhijhara stream, 8.v.1972. A. R. Bhowmik and Party leg ; 1 ♀, Kashipur, 10.x.1972. K. Rai leg ; Dist. Bolangir : 1 ♂, 1 ♀, Agriculture Farm, 2.x.1972. S. Khera leg ; 4 ♀ ♀, Bolangir, 10.xi.1972. J. M. Julka and Party leg ; Dist. Dhenkanal ; 2 ♂ ♂, Angul, 30.ix.1972, K. Rai. and Party leg ; Dist. Koraput : 1 ♂, Ca 4 km. P.W.D. Rest House, Jeypore, 24.xi.1973.

Wing expanse : ♂ ♂ : 55-58 mm. ♀ ♀ : 57-64 mm.

Distribution : India : Uttar Pradesh (Dehradun), Sikkim, Orissa (Sundargarh, Sambalpur, Mayurbhanj, Keonjhar, Bolangir, Dhenkanal Districts), South India. Sri Lanka.

Remarks : This is one of the twenty-two Indian species of the genus *Euthalia* Hübner from the Indian subregion. It is not rare. Males here are smaller as compared to the wing expanse cited by Evans (1932) and presently it constitutes new locality record for Orissa.

5. *Euthalia garuda anagama* Fruhstorfer

1913. *Euthalia garuda anagama* Fruhstorfer, in Seitz, *Macrolepidoptera of the World*, 9 : 667.

Material examined : Dist. Mayurbhanj : one ♀, Kendumundi, 18.v.1972, A. R. Bhowmik & Party leg.

Wing expanse : ♀ : 70 mm.

Distribution : India : Uttar Pradesh (Kumaon), Himachal Pradesh (Kangra), Maharashtra (Bombay), Orissa (Mayurbhanj).

Remarks : This is one of the five Indian subspecies of *Euthalia garuda* (Moore) from the Indian subregion. It is not rare and differs from its allies by the discal spots of fore wing small and dusky in males, spots in Cu_{1a} and Cu_{1b} small or absent. Evans (1932) referred to the occurrence of this species in Orissa and at present it is recorded from Mayurbhanj Dist.

6. *Pantoporia perius* (Linnaeus)

1758. *Papilio perius* Linnaeus, *Syst. Nat.* 10 : 471.

1932. *Pantoporia perius* : Evans, *Ident. Indian Butts.*, Ed. 2 : p. 164. pl. xxii.

Material examined : Dist. Kalahandi : one ♂, Nakjhari, ca 18 kms. E. of Madanpur-Rampur, 10.xii.1973, D. P. Sanyal leg.

Wing expanse : ♂ : 60 mm.

Distribution : India ; North Western Himalayas (Simla), Eastern Himalayas, Orissa (Kalahandi), Southern Peninsula. Burma.

Remarks : This is one of the thirteen species known from India of the genus *Pantoporia* Hübner from the Indian and Malayan subregion of the Oriental region. It is locally common and differs from its allies by fore wing dorsally with cell streaks divided into four portions and hind wing ventrally bright yellow with prominent row of black spots. It constitutes new locality record for Orissa.

7. *Neptis jumbah jumbah* Moore

1857. *Neptis jumbah* Moore, *Cat. Lep. East India comp.* 1 : 167.

1932. *Neptis jumbah jumbah* : Evans, *Ident. Indian Butts.*, ed. 2 : 165 pl. 22.

Material examined : Dist. Ganjam : one ♀, 1 km E. of P.W.D. Insp. Bungalow, Taptapani, 15.iii.1974, R. K. Kacker & Party leg.

Wing expanse : ♀ : 53 mm.

Distribution : India : southern to eastern peninsula including Orissa (Ganjam), Bengal, Burma.

Remarks : This is one of the three Indian subspecies of *Neptis jumbah* Moore, from the Indian subregion. It is not rare and differs from its allies with a discal spot on Rs of hind wing. The specimen examined is smaller as compared to the wing expanse cited by Wynter-Blyth (1957). It constitutes new locality record for Orissa.

8. *Neptis hylas varmona* Moore

1872. *Neptis varmona* Moore, *Proc. zool. Soc. Lond.*, 1872 : 561.

1932. *Neptis hylas varmona* : Evans, *Ident. Indian Butts.*, ed. 2 : 166, p. 22, fig. 26. 6.

Material examined : Dist. Dhenkanal : one ♀, Kuru Reserve Forest, 28.ii.1975, Dist. Cuttack : 1 ♂, Taldanda canal, Kujan, 19.i.1974. 2 ♂ ♂, Bhutmundi, E. of Kujan Camp, 18.i.1974, Dist. Puri : 1 ♂, 1 ♀, 3 kms. S. of Berbera camp, 6.i.1974 ; 2 ♀ ♀, Sonasaraipur, ca 40 km. of Berbera, 7.i.1974. 1 ♂, Champagarh, ca 35 km. S. of Berbera, 10.i.1974. 1 ♀, 6 km. N. of Berbera camp, 12.i.1974, R. L. Chowdhury and Party leg. Dist. Ganjam : 1 ♀, W. of P.W.D. Bungalow, opum, 14.iii.1974, R. K. Kacker & Party leg.

Wing expanse : ♂ ♂ : 42-48 mm, ♀ ♀ : 45-53 mm.

Distribution : India : Uttar Pradesh (Kumaon), Sikkim, Orissa (Dhenkanal, Cuttack, Puri, Ganjam, districts) ; Southern India. Sri Lanka.

Remarks : This is one of the six Indian subspecies of *Neptis hylas* (Linn.) from the Indian subregion. It is very common and the specimens examined are smaller as compared to the wing expanse cited by Evans (1932) and Wynter-Blyth (1957). It constitutes new locality record for Orissa.

9. *Neptis hordonia hordonia* (Stoll)

1791. *Papilio hordonia* Stoll, *Cramer's Papil. Exot. Suppl.* pl. 33, figs. 4, 4 D.

1932. *Neptis hordonia hordonia* : Evans, *Ident. Indian Butts.*, ed : 2 : 172, pl. 22, fig. 26. 32.

Material examined : Dist. Ganjam : one ♀, 1 km west of P.W.D. Bungalow, Taptapani, 14.iii.1974, R. K. Kacker & Party leg.

Wing expanse : ♀ : 50 mm.

Distribution : India : A very wide spread species in India, from Dehra Dun to eastern (including Orissa : dist. Ganjam) and southern peninsular belts, and also extending to Burma.

Remarks : This is one of the two Indian subspecies of *Neptis hordonia* Stoll from the Indian region constitutes new locality record for Orissa and is common in status.

10. *Cyrestis thyodamus thyodamus* Boisduval

1836. *Cyrestis thyodamus* Boisduval, *Cuv. Reg. Anim. Ans.*, 2, pl. 138 fig. 4.

1932. *Cyrestis thyodamus thyodamus* : Evans, *Ident. Indian Butts.*, ed. 2 : 173, pl. 23, fig. 27. 4.

Material examined : Dist. Mayurbhanj : one ♀, Meghasoni, 19.iii.1972., S. K. Gupta & party leg.

Wing expanse : ♀ : 48 mm.

Distribution : India : Sikkim, Orissa (Mayurbhanj), Burma.

Remarks : This is one of the four Indian subspecies of *Cyrestis thyodamus* Boisduval from the Indian sub-region. It is common and differs from its allies by apical and terminal dark areas much broader and brown. It constitutes new locality record for Orissa.

11. *Hypolimnias bolina* (Linnaeus)

1758. *Papilio bolina* Linnaeus, *Syst. Nat. ed.* 10 : 479.

1932. *Hypolimnias bolina* : Evans, *Ident. Indian Butts.*, ed. 2 : 174, pl. 23, fig. 30. 2.

Material examined : Dist. Sundargarh : one ♀, Tensa colony, 14.ix.1972 ; Dist. Sambalpur : 1 ♀, along the bank of the river Mahanadi, 28.ix.1972. S. Khera & Party leg ; Dist. Keonjhar : 1 ♂, Campus of P.W.D., Ghatgaon, 23.viii.1972. 1 ♀, Mandua, 19.ix.1972. 1 ♀, Bara-bhadrapur, Keonjhar, 20, 26.ix.1972., K. Rai & Party leg ; Dist. Mayurbhanj : 1 ♀, Bhalupahar, Bangriposhi, 14.ix.1972. 1 ♀, Manbhanj, 3 ♀ ♀, Chandanpur, 16.17.ix.1972, K. Rai & Party leg ; 2 ♀ ♀, ca 3 km N. W. of Forest Rest House, Lulang, 11.xii.1975., D. P. Sanyal and A. K. Sarkar leg ; Dist. Balasore : 1 ♀, Bhadrak, 4.x.1974., B. C. Saha and Party leg ; Dist. Dhenkanal : 1 ♀, Nisa Angul, 1 ♂, 1 ♀, Puranokote, Angul, 1 ♀, Jubileetown, 1,2,6.x.1972., K. Rai & Party leg. Dist. Puri : 1 ♀, Beside the Railway track, Tikarpara, 14.ix.1972., S. Khera & Party leg.

Wing expanse : ♂ ♂ : 76-104, ♀ ♀ : 74-104 mm.

Distribution : India : Orissa (Sundargarh, Sambalpur, Mayurbhanj, Balasore, Dhenkanal, Puri districts) Andamans, Car Nicobar, also Burma. Pakistan (Baluchistan) and Sri Lanka.

Remarks : This is one of the two Indian species of the genus *Hypolimnias* Hübner from the Indian subregion. It Constitutes new locality record for Orissa and is common in status.

12. *Hypolimnas misippus* (Linnaeus)

1764. *Papilio misippus* Linnaeus, *Mus. Ulric.*, p. 264.

1932. *Hypolimnas misippus* : Evans, *Ident. Indian Butts*, ed. 2 : 175 : pl. 23, fig. 30. 1.

Material examined : Dist. Sundargarh : one ♂, Bungalow, Jharsuguda, 17. ix.1972. S. Khera & Party leg. 1 ♀, Garden on Kalimandir, Jharsuguda, 1 ♂, In and around Brundamal Rly. stn., 19.x.1972. S. Khera & Party leg. 1 ♂, 2 km. on the way of Rourkella, 25.ix.1972. J. M. Julka & Party leg ; Dist. Mayurbhanj : 1 ♀, Bhalupahar, 14.ix.1972, K. Rai & Party leg ; Dist. Keonjhar : 1 ♂, Upardhuja, 31.iii.1973., S. K. Gupta & Party leg. Dist. Puri : 1 ♂, Bhagawanpur, 2 km E of Nandan Kanan, 24.iii.1974, R. K. Kacker & Party leg.

Wing expanse : ♂ ♂ : 63-76, ♀ ♀ : 75-79. mm.

Distribution : India : Orissa (Sundargarh, Mayurbhanj, Keonjhar, Puri districts). Andamans, Car Nicobar. Also Burma. Pakistan (Baluchistan) and Sri Lanka.

Remarks : This is one of the two Indian species of the genus *Hypolimnas* Hübner from the Indian subregion. It is rare in Andamans and Car Nicobar.

13. *Precis lemonias vaisya* Fruhstorfer

1912. *Precis lemonias vaisya* Fruhstorfer, in Seitz *Macrolepidoptera of the World*. 9 : 520.

Material examined : Dist. Sundargarh : one ♀, 5 km. SW. of Bonaigarh Court and 1 ♀, Sundargarh, 13, 15.xii.1971., P. K. Maity and Party leg. ; 1 ♀, Ranibagicha, 2.ix.1972., S. Khera & Party leg. ; Dist. Sambalpur : 3 ♂ ♂, Sambalpur and 1 ♀, Brook hill, 19 and 20.xii.1971., P. K. Maity & Party leg. ; 1 ♀, Sambalpur, 7.xi.1972. 2 ♀ ♀, Jharsuguda, 3, 31.x.1972 J. M. Julka & Party leg. 1 ♂, 1 ♀, Hirakud Dam, 25.ix.1972, S. Khera & Party leg. Dist. Keonjhar : 2 ♂ ♂, 2 ♀ ♀, Badand, 20.ix.1972. 1 ♂, 1 ♀, Mandua, 17, 19.ix.1972, 1 ♀, Bhatsai, K. Rai & Party leg. Dist. Balasore : 1 ♂, Basantapur, 9.viii.1972., S. K. Mitra & Party leg. Dist. Dhenkanal : 1 ♂, 1 ♀, Bagmunda, 1.1.1972, V. C. Agarwal leg. 1 ♀, Nisa, Angul, 1.x.1972, V. C. Agarwal and K. Rai & Party leg. Dist. Cuttack ; 1 ♀, Cuttack and environs, 25.xii.1970., S. Khera & Party leg. Dist. Puri : 1 ♂, 1 ♀, Beside Railway track, Tikarpara, 14.ix.1972., Y. Chaturvedi & Party leg. 2 ♂ ♂, 2 km. E. of camp Balugaon, 30. xii.1973. R. L. Chowdhury & Party leg. 1 ♀, Bhisari, ca 5 km. W of Bawgan, 1.1974, 1 ♂, Dhuanali ca 8 km. N. E. of Berbera, 4.1.1974. 1 ♂, 3 km. S. 1 ♂, 5 km E of Berbera camp, 6, 11.1974. 1 ♂, Raghunathpur, 3 km S. of Nandan Kanan, 25.iii.1974. 1 ♀, Botanical Garden, Nandankanan, 27.iii.1974, R. L. Chowdhury and Party leg. Dist. Ganjam : 2 ♂ ♂, Rambha, 31.xii.1973, R. L. Chowdhury & Party leg. Dist. Koraput, 1 ♂, From field of new cashewnut Garden, 5 km SE of Koraput, 20.ii.1972, K. V. S. Rao & Party leg., 1 ♂, 3 km

E of Forest Rest House, Chandili, 26.xi.1973, 1 ♂, Along Bacheli Vizianagram Railway track, ca 4 km S of Chandeli, 30.xi.1973, *D. P. Sanyal and Party leg.*

Wing expanse : ♂ ♂ : 42-52, ♀ ♀ : 43-58 mm.

Distribution : India : Madhya Pradesh, Orissa (Sundargarh, Sambalpur, Keonjhar, Dhenkanol, Cuttack, Puri, Ganjam, Koraput districts) Southern India.

Remarks : This is one of the three Indian subspecies of *Precis lemonias* (Linnaeus). It differs from its allies by small and dark colouration. The specimens examined are slightly smaller in males and larger in females compared with the expanse cited by Evans (1932) and it is common in status.

14. *Precis almana almana* (Linnaeus)

1758. *Papilio almana* Linnaeus, *Syst. Nat.*, ed. 10 : 472.

1982. *Precis almana almana* : Evans, *Ident. Indian Butts.* ed. 2 : 176, pl. 24, fig. 85. 4.

Material examined : Dist. Sundargarh : Two ♀ ♀ 13, 15.xii.1971, *P. K. Maity and Party leg* ; 1 ♂, Near Rajbari, Sundargarh town, 23.x.1972, 1 ♀, 2 km. on the way of Rourkella, 25.x.1972, *J. M. Julka and Party leg.* Dist. Sambalpur : 1 ♀, 6.xi.1972, *J. M. Julka and Party leg.* Dist. Keonjhar : 1 ♀, Badand, 2 ♂ ♂, 1 ♀, Soras, Keonjhar, 20, 26.ix.1972., *K. Rai and Party leg.* 1 ♀, Baigonpal Forest, 30.iii.1973, *S.K. Gupta and Party leg.* Dist. Mayurbhanj : 1 ♂, Bhalupahar, 1 ♀, Chandanpur, Bangriposhi, 14, 16. 30.ix.1972, *K. Rai and Party leg.* Dist. Dhenkanal : 1 ♀, Jharpara, Angul, 30.ix.1972, *K. Rai and Party leg.* Dist. Koraput : 1 ♀, Garden at Banglodoada, 2 km. N. of Jeypore, 19.iii.1972, *K.V.S. Rao and Party leg.* Dist. Puri : 1 ♀, $\frac{1}{2}$ km. W. of Balugaon, 17.iii.1974, *R. K. Kacker and Party leg.*

Wing expanse : ♂ ♂ : 44-54, ♀ ♀ : 49-56 mm.

Distribution : India : Orissa (Sundargarh, Sambalpur, Keonjhar, Mayurbhanj, Dhenkanal, Koraput, Puri). Andamans, Burma. Sri Lanka.

Remarks : This is one of the two Indian subspecies of *Precis almana* (Linnaeus) from the Indian subregion. It is common. The specimens examined are much smaller as compared to the wing expanse cited by Evans (1932) and also Wynter-Blyth (1957).

15. *Precis atlites* (Linnaeus)

1763. *Papilio atlites* Linnaeus, *Amoen. Acad.* 6 : 407.

1982. *Precis atlites* : Evans, *Ident. Indian Butts.* ed : 2 : 174, pl. 24, fig. 85. 5.

Material examined : Dist. Sundargarh : Three ♂ ♂, one ♀, 8, 13, 15.xii. 1971, 1 ♂, Sundargarh jungle; 2 km east of Bonaigarh, 15.xii.1971, *P. K.*

Maity & Party leg. 1 ♂, Subulia Khasra Forest, 4 km east of Sundargarh, 10.i.1972, 1 ♂, Near Rajbari, Sundargarh town, 23.x.1972, 2 ♂♂, Sundargarh near P. W. D. Quarter, 24.x.1972, *J. M. Julka and Party leg.* Dist. Sambalpur : 1 ♀, Village, 3 km east of Sambalpur jail, 23.xii.1971 ; 2 ♂♂, Sambalpur, 20, 22.xii.1972, *P. K. Maity and Party leg.* Dist. Bolangir ; 1 ♀, Titlagarh, 17.xi.1972., *J. M. Julka & Party leg.* Dist. Keonjhar : 1 ♂, Badand, 27.ix.1972., *P. K. Maity & Party leg.* Dist. Mayurbhanj : 1 ♂, Baripada, 17.iii.1973 ; 1 ♂, Myurbhanj, Bangriposi, (No date), *K. Rai & Party leg.* Dist. Puri : 1 ♂, Bhatpara, ca 10 km S. of Berbera, 9.i.1974 ; 1 ♂, Bhagawanpur, 2 km E. of Nandan Kanan, 24.iii.1974, 1 ♂, Raghunathpur, 3 km S. of Nandan Kanan, 25.ii.1974., *R. L. Chowdhury & Party leg.* Dist. Ganjam : 2 ♂♂, 1 ♀, Inspection Bungalow, Taptapani, 13.iii.1974., *R. K. Kacker and Party leg.*

Wing expanse : ♂♂ : 46-68, ♀♀ : 51-60 mm.

Distribution : India : Orissa (Sundargarh, Sambalpur, Bolangir, Mayurbhanj, Puri, Ganjam) and Andamans, Central Nicobars. Also Burma, Sri Lanka.

Remarks : This is one of the six Indian species of the genus *Precis* Moore from the Indian subregion. It constitutes new locality record for Orissa and is not rare.

16. *Precis hierta hierta* (Fabricius)

1798. *Papilio hierta* Fabricius, *Syst. Entom. Suppl.* p. 424.

1932. *Precis hierta hierta* : Evans, *Ident. Indian Butts.* ed : 2 : 176, pl. 24, fig. 35. 1.

Material examined : Dist. Sundargarh : Two ♂♂, 2 ♀♀, Sundargarh jungle, S W of Bonaigarh court, 6, 15.xii.1971, *P. K. Maity & Party leg.* Dist. Mayurbhanj : 1 ♂, Basantapur, Baripada, 9.viii.1972, *S. K. Mitra & Party leg.* Dist. Bolangir : 1 ♂, Teshil village, 6.x.1972, *S. K. Mitra & Party leg.*

Wing expanse : ♂♂ : 43-52, ♀♀ : 44-54 mm.

Distribution : India : Orissa (Sundargarh, Mayurbhanj, Bolangir), Pakistan : Baluchistan. Sri Lanka.

Remarks : This is one of the two Indian subspecies of *Precis hierta* (Fabricius) from the Indian subregion. It constitutes new locality record for Orissa and is very common in status.

17. *Precis orithyia swinhoe* Butler

1885. *Precis swinhoei* Butler, *Ann. Mag. nat. Hist. Soc.*, 1885 : p. 309, Seitz. 522.

1932. *Precis orithyia swinhoei* : Evans, *Ident. Indian Butts.* ed. 2 : 176.

Material examined : Dist : Sundargarh : One ♂, Panposh, 7.xii.1971. 2 ♂♂, Sundargarh, 8, 13.xii.1971. 2 ♂♂, Sundargarh jungal, 5 km. S. W. of Bolangir court, 15.xii.1971, *P. K. Maity & Party leg.* 1 ♀, River near

Sundargarh College, 27.x.1972, J. M. Julka & Party leg. Dist. Sambalpur : 1 ♂, Jharsuguda, 1.xi.1972, J. M. Julka & Party leg. Dist. Bolangir : 1 ♂, Greendial Village, 7.xii.1971 ; 1 ♀, Bolangir, 10.xi.1972, J. M. Julka and Party leg. 1 ♂, Bolangir, Teshil Village, 6.x.1972, S. Khera and Party leg.

Wing expanse : ♂ ♂ : 40-47, ♀ ♀ : 45-47 mm.

Distribution : India : Orissa (Sundargarh, Sambalpur, Bolangir), Pakistan : Baluchistan, Burma. Sri Lanka.

Remarks : This is one of the two Indian subspecies of *Precis orithyia* (Linnaeus) from the Indian subregion and it is very common. The specimens are smaller than the wing expanse cited by Evans (1932) and Wynter-Blyth (1957).

18. *Precis iphita pluviatilis* Fruhstorfer

1900. *Precis pluviatilis* Fruhstorfer, *Berl. Ent.* 45, p. 22.

1932. *Precis iphita pluviatilis* : Evans, *Ident. Indian Butts.* ed. 22 : pl. 24, fig. 35,6.

Material examined : Dist. Koraput : one ex., Garden at Banglagoada, 2 km. N of Jeypore, 19.ii.1972., K.V.S. Rao and Party leg. Dist. Puri : one ex., 2 km. E of camp Balugaon, 30.xii.1973., R. L. Chowdhury and Party leg.

Wing expanse : 60 mm.

Distribution : India : Madhya Pradesh, Orissa, (Districts, Koraput, Puri), South India also Sri Lanka and Maldives.

Remarks : This is one of the three Indian subspecies of *Precis iphita* (Cramer) from the Indian subregion. It is common and differs from its allies by small and dark facies. It constitutes new locality record for Orissa. It may be mentioned here that due to the damaged condition of the specimens examined, it was not possible to determine the sex.

19. *Phalanta phalantha phalantha* (Drury)

1770. *Papilio phalantha* Drury, *Ill. Exot. Ent.*, i, pl. 21, figs. 1, 2.

1980. *Phalanta phalantha phalantha*, Varshney, et. al., *Rec. zool. Surv. India*, Occ, paper, No. 31 : 18-19.

Material examined : Dist. Sundargarh : one ♀, Chimer village, 4 km. north of Pamposh Forest Rest House, 11.xi.1971. 1 ♀, N. W. of Bonai Court, 17.xii.1971., P. K. Maity & Party leg. 1 ♀, Forest Rest House, 23.ix.1972, S. Khera and Party leg. Dist. Mayurbhanj, 3 ♀ ♀, 1 ♂, ca 3 kms. W. of F. R. H., Lulang, 13.xii.1975., D. P. Sanyal & Party leg. Dist. Cuttack : 1 ♀, Jobra on the bank of river Mahanadi, Jobra Road, 16.i.1974., S. Biswas & Party leg. Dist. Puri : 1 ♀, Raghunathpur, 3 km S. of Nandan Kanan, 25. xii.1974., R. K. Kacker and Party leg.

Wing expanse : ♂ ♂, ♀ ♀ : 58-64 mm.

Distribution : India : Orissa Districts (Sundargarh, Mayurbhanj, Cuttack, Ganjam, Puri). Nicobars. Pakistan : Baluchistan. Burma. Sri Lanka.

Remarks : This is the only subspecies from the Indian subregion. It is common but a straggler on Central Nicobars.

20. *Cupha erymanthis* (Drury)

1770. *Papilio erymanthis* Drury, *Ill. Exot. Ent.*, 1, pl. 15, figs. 3, 4, ♀.

1932. *Cupha erymanthis* : Evans, *Indian Butts.*, ed. 2 : 187, pl. 25, fig. F 41.

Material examined : Dist. Sundargarh : one ♀, Sundargarh jungle, 5 km S W of Bolangir Court, 15.xii.1971, P. K. Maity and Party leg.

Wing expanse : ♀ : 60 mm.

Distribution : India : Mussoorie to Assam, Orissa (Sundargarh). South India also Burma and Sri Lanka.

Remarks : This is the single Indian species of the genus *Cupha* Bilberg from Indian subregion. It constitutes new locality record for Orissa and is common in status.

21. *Ergolis ariadne indica* Moore

1884. *Ergolis indica* Moore, *J. Asiat. Soc. Beng.*, 53(2) : 20.

1932. *Ergolis ariadne indica* : Evans, *Ident. Indian Butts.*, ed. 2 : 191, pl. 25, fig.

Material examined : Dist. Baudhkhondmals : one ♂, Phulbani, 14.xii.1973., D. P. Sanyal & Party leg. Dist. Puri : 2 ♀ ♀, East of Balugaon Camp, 30.xii.1973., R. L. Chowdhury and Party leg. 1 ♂, Dhundi, ca 8 km NE of Berbera, 4.i.1974, R. L. Chowdhury and Party leg ; and 1 ♀, Raghunathpur, 3 km S of Nandan Kanan, 25.iii.1974, R. K. Kacker and Party leg.

Wing expanse : ♂ : 43-44, ♀ ♀ : 40-46 mm.

Distribution : India : Bengal, Orissa (Baudhkhondmals, Puri), South India.

Remarks : This is one of the two Indian subspecies of *Ergolis ariadne* (Johanssen) from Indian subregion. The specimen examined are smaller as compared to the wing expanse cited by Evans (1932) it constitutes new locality record for Orissa and is common in status.

22. *Ergolis merione tapestrina* Moore

1884. *Ergolis tapestrina* Moore, *J. Asiat. Soc. Beng.*, 1884 : 19.

1932. *Ergolis merione tapestrina* : Evans, *Ident. Indian Butts.*, ed. 2 : 191, pl. 25.

Material examined : Dist. Dhenkanal : One ♀, Surrounding Forest Rest House, Purnakote, 1.iii.1975, R. L. Chowdhury and Party leg.

Wing expanse : ♀ : 52 mm.

Distribution : India : Kashmir, Uttar Pradesh (Kumaon). Madhya Pradesh, Orissa (Dhenkanal).

Remarks : This is one of the three Indian subspecies of *Ergolis merione* (Cramer) from the Indian subregion. It constitutes new locality record for Orissa and is common in status.

SUMMARY

Twenty-two elements of Nymphalidae, collected from different districts of Orissa by about a dozen of survey parties from Zoological Survey of India, have been enlisted in a manner as much comprehensive as possible. Of these, 14 species were hitherto unrecorded from the state.

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REFERENCES

- ANNANDALE, N. AND DOVER, C. 1921. The fauna of an Island in the Chilka lake—Butterflies. *Rec. Indian Mus.*, 22(4) : 349-375.
- EVANS, W. H. 1932. The Identification of Indian Butterflies, ed. 2 : 1-454, 32 plates, 9 text figures. Madras (Bombay Natural History Society).
- WYNTER-BLYTH, M. A. 1957. Butterflies of the Indian Region, xx+523. pp. (Bombay Natural History Society, Bombay).

**INSECTA : LEPIDOPTERA : RHOPALOCERA : PAPILIONIDAE :
PAPILIONINAE—A CHECKLIST**

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INTRODUCTION

The article incorporates a checklist of Papilioninae, one of the three present-day subfamilies of the family Papilionidae, from the state of Orissa in the eastern peninsular belt of Oriental India. It gives a skeleton classification of taxonomic categories of the faunal elements collected from the State by different survey teams of the Department.

The work is mainly based on the authors' (Mandal & Nandi, 1983) earlier studies on Papilionine collections from Orissa. The classification followed here is after Hancock (1983); in the earlier (1983) publication, however, the system was adopted after Munroe (1961) whose paper has been acclaimed by Hancock (*loc. cit.*) as "basis for all modern classifications of the family". For ready identification, a key to the taxa is also provided.

CHECKLIST OF PAPILIONINAE FROM ORISSA

Tribe I. Leptocircini

Subtribe Leptocirciti

Genus 1. *Graphium* Scopoli

Subgenus *Graphium* Scopoli

1 (a). *Graphium* (*Graphium*) *doson axion* (Felder & Felder)

1864. *Papilio axion* Felder & Felder, *Verh. zool.-bot. Ges. Wien.*, **14** : 305.

1939. *Graphium doson axion* : Talbot, *Fauna Brit. India, Butts.*, **1** : 223, fig. 61.

Distribution : India : North-west and north-east Himalayas ; eastern Himalayas ; eastern peninsular belt including only Orissa (district Sambalpur). Also Thailand, Southern China and Vietnam.

Remarks : This subspecies and the other to follow are referable to the *eurypylus*-species group being recognised by the fore wing dark bars straight and bar 5¹ broad.

1 (b). **Graphium (Graphium) doson eleius** (Fruhstorfer)

1908. *Papilio doson eleius* Fruhstorfer, *Ent. Zeit.* 21 (34) : 209.

1939. *Graphium doson eleius* : Talbot, *Fauna Brit. India, Butts.*, 1 : 223, pl. I, figs. 20-21.

Distribution : India : Eastern and southern peninsular belts, the former including Orissa (districts Mayurbhanj and Ganjam).

Subgenus **Pathysa** Reakirt

2. **Graphium (Pathysa) antiphates naira** (Moore)

1903. *Pathysa naira* Moore, *Lep. Indica*, 6 : 22, pl. 475, figs. 1, 1a.

1939. *Graphium antiphates naira* : Talbot, *Fauna Brit. India Butts.*, 1 : 213, fig. 58 ; pl. I, figs. 24-25.

Distribution : India : Western, southern and eastern peninsular belts, the last including only Orissa (district Mayurbhanj).

Remarks : The specimens examined belong to the dry-season form with wing bars narrow, short and hind wing pale.

3. **Graphium (Pathysa) nomius nomius** (Esper)

1785-98. *Papilio nomius* Esper, *Ausland. Schmett.*, p. 210, pl. 52, fig. 3.

1939. *Graphium nomius nomius* : Talbot, *Fauna Brit. India, Butts.*, 1 : 207, figs. 55a-b ; pl. I, figs. 22-23.

Distribution : India : North-east Himalayas ; almost throughout the peninsular area including Orissa (districts Mayurbhanj, Keonjhar, Dhenkanal and Ganjam). Also Sri Lanka.

Remarks : This subspecies and the next belong to the *antiphates*-species group, being recognised by the fore wing bars 6 and 7 fused and veins not dark-scaled dorsally.

Tribe II. **Troidini**

Subtribe **Troiditi**

Genus 2. **Atrophaneura** Reakirt

Subgenus **Atrophaneura** Reakirt

4. **Atrophaneura (Atrophaneura) aristolochiae aristolochiae** (Fabr.)

1775. *Papilio aristolochiae* Fabricius, *Syst. Ent.*, p. 443.

1939. *Polydorus aristolochiae aristolochiae* : Talbot, *Fauna Brit. India, Butts.*, 1 : 86, figs. 15-16 a-c ; pl. I, figs. 3-4. [gen. replaced by *Atrophaneura* Reakirt in Talbot, 1947, *F. B. I.*, 2 : 490].

Distribution : India : North-west and north-east Himalayas ; almost throughout the peninsular area including Orissa (districts Mayurbhanj,

Keonjhar, Dhenkanal, Cuttack, Puri and Ganjam). Also Sri Lanka, Java and Sulawesi.

Remarks : The forms, "*aristolochiae*" and "*diphilus*" are not mentioned here for the reasons cited earlier by Mandal & Nandi (1983).

5. *Atrophaneura* (*Atrophaneura*) *hector* (Linn.)

1758. *Papilio hector* Linnaeus, *Syst. Nat.*, 10 : 459.

1989. *Atrophaneura* (*Atrophaneura*) *hector* : Hancock, *Smithersia*, 2 : 47.

Distribution : India : Western, southern and eastern peninsular belts, the last including Orissa (districts Puri and Ganjam); the Andaman Islands. Also Sri Lanka.

Remarks : This species and the next are the representatives of the *polydorus*-species group, being recognised by the scent-fold in male vestigial and presence of tail.

Genus 3. *Troides* Hübner

Subgenus *Troides* Hübner

6. *Troides* (*Troides*) *helena cerberus* (Felder & Felder)

1864. *Papilio cerberus* Felder & Felder, *Verh. zool.-bot. Ges. Wien.*, 14 : 291.

1939. *Troides helena cerberus* : Talbot, *Fauna Brit. India*, Butts., 1 : 66.

Distribution : India : North-east Himalayas ; eastern and southern peninsular belts, the former including Orissa (district Sambalpur). Also Bangladesh, Burma, Malay Peninsula, Vietnam and Nepal.

Remarks : The subspecies is referable to *helena*-species group, being recognised by the fore wing without iridescent sheen.

Tribe III. *Papilionini*

Genus 4. *Chilasa* Moore

Subgenus *Chilasa* Moore

7. *Chilasa* (*Chilasa*) *clytia clytia* (Linn.)

1758. *Papilio clytia* Linnaeus, *Syst. Nat.*, 10 : 479.

1939. *Chilasa clytia clytia* : Talbot, *Fauna Brit. India*, Butts., 1 : 116, figs., 28-29 ; pl. I, figs. 5-6.

Distribution : India : North-west and north-east Himalayas ; western, northern, southern and eastern peninsular belts, the last including only Orissa (districts Sundargarh, Sambalpur, Mayurbhanj, Keonjhar and Dhenkanal). Also Burma.

Remarks : The subspecies is referred to the *clytia*-species group, being recognised by the blue-spotted hind wing. Amongst several forms mentioned

by Talbot (1939), *f. clytia* (Linn.) is represented by specimens of both sexes being mimetic of *Euploea core* with hind wing cell not white and *f. dissimilis* (Linn.), by a couple of females mimicking *Danaus limniace* with white hind wing cell ; the former form is from all the foregone districts but Dhenkanol and the latter, from Keonjhar and Dhenkanal only.

Genus 5. **Princeps** Hübner

Subgenus **Menelaides** Hübner

8. **Princeps (Menelaides) nephelus nephelus** (Boisduval)

1836. *Papilio nephelus* Boisduval, *Spe'c. Ge'n. Lep.*, 1 : 210.

1927. *Papilio nephelus nephelus* : Jordan, in Seitz, *Macrolep. World, Indo-Australian Rhopal.*, 9 : 52, pl. 22b.

Distribution : India : North-east Himalayas ; eastern peninsular belt including only Orissa (districts Mayurbhanj and Sambalpur). Also Nepal, Burma and Malaya.

Remarks : Talbot (1939) considered the subspecies as *Papilio chaon chaon* Westwood. Later, Hancock (1983) revised the nomenclature as *nephelus* and included it in the *nephelus*-species group, being recognised by wings in both sexes with cream band or patch and their bases ventrally not red.

9. **Princeps (Menelaides) polymnestor polymnestor** (Cramer)

1775. *Papilio polymnestor* Cramer, *Pap. Exot.*, 1 : 83, pl. 53, figs. A, B.

1939. *Papilio polymnestor polymnestor* : Talbot, *Fauna Brit. India, Butts.*, 1 : 126, figs. 30 a, b ; pl. I, figs. 10-11.

Distribution : India : North-east Himalayas ; almost throughout the peninsular area including Orissa (district Mayurbhanj).

Remarks : This subspecies is referred to the *memnon*-species group, being recognised by male hind wing dorsally with dispersed blue scales and both sexes with wing-bases ventrally red.

10. **Princeps (Menelaides) polytes romulus** (Cramer)

1775. *Papilio romulus* Cramer, *Pap. Exot.*, 1 : 67, pl. 43, fig. A.

1939. *Papilio polytes romulus* : Talbot, *Fauna Brit. India, Butts.*, 1 : 178, figs. 46-48 ; pl. I, figs, 18a-b, 19.

Distribution : India : North-west and north-east Himalayas ; eastern and southern peninsular belts, the former including Orissa (districts Bolangir, Sundargarh, Sambalpur, Mayurbhanj, Keonjhar, Dhenkanol, Puri and Ganjam). Also Burma, Sri Lanka, Malaya and Vietnam.

Remarks : The subspecies belongs to the *polytes*-species group, being recognised by the male hind wing with distinct discal white band and female always mimetic. Talbot (1939) mentioned several well-marked female forms, of which ♀ *f. romulus* (Cramer) is represented by specimens from southern, and ♀ *f. stichius* Hübner, by those from the northern districts of Orissa. The former is readily distinguished from the latter by the fore wing being crossed obliquely from the mid-cell to the tornus by a broad white band and hind wing with all the markings red. The models which these forms mimic are also different, being *Atrophaneura hector* and *A. aristolochiae* respectively.

Subgenus *Princeps* Hübner

11. *Princeps (Princeps) demoleus demoleus* (Linn.)

1758. *Papilio demoleus* Linnaeus, *Syst. Nat.*, 10 : 464.

1939. *Papilio demoleus demoleus* : Talbot, *Fauna Brit. India, Butts.*, 1 : 189, fig. 50.

Distribution : India : North-west and north-east Himalayas ; throughout the peninsular area, including Orissa (districts Bolangir, Sundargarh, Sambalpur, Mayurbhanj, Keonjhar, Dhenkanal, Cuttack and Ganjam). Also North Burma, Sri Lanka and East Palaearctic.

Remarks : The subspecies is referred to the *demoleus*-species group which is recognised by pattern black and yellow with bands and spots, fore wing base streaked yellow, hind wing red and blue-spotted and without tail. All the females examined from the above-mentioned districts of Orissa fit well in the *f. demoleinus* (Oberthür) with their hind wing red anal spot separated from blue lunules by black.

12. *Princeps (Princeps) paris decorosa* (Fruhstorfer)

1909. *Papilio paris, f. decorosa* Fruhstorfer, *Ent. Zeit. Stutt.*, 22 (41) : 171.

1947. *Papilio paris decorosa* : Talbot, *Fauna Brit. India, Butts.*, 2 : 491 [nec *p. paris* Linn., in Talbot, 1939, *F. B. I., Butts.*, 1 : 150].

Distribution : India : North-west and north-east Himalayas ; western, southern and eastern peninsular belts, the last including Orissa (district Sambalpur). Also Burma and Thailand.

Remarks : This subspecies is included in the *paris*-species group which can be recognised by pattern green and blue with dispersed metallic scales, fore- and hind wings without yellow scales, the latter being tailed.

KEY TO TAXA OF PAPILIONINAE FROM ORISSA

1. Tibiae and tarsi scaled. ... Leptocircini
 [Fore wing middle discocellular down-curved]. ... Leptocirciti
 [Antennae less than half length of fore wing ; R_2 free from R_4 ; R_1 fused with Sc]. ... *Graphium*-2
 Tibiae and tarsi unscaled. ... 5
2. Pattern primitive-banded ; tail long, sword-like. ... Subgen. *Pathysa*-3
 Pattern specialised ; tail absent. ... Subgen. *Graphium*-4
3. Fore wing bars 6 and 7 fused throughout their length up to the posterior angle ; hind wing terminal band traversed by a series of white lunules. ... *nomius nomius*
 Fore wing bars 6 and 7 fused at Cula before reaching the posterior angle ; hind wing terminal band with markings obsolete. ... *antiphates naira*
4. Fore wing apical spots yellowish green and subbasal line prominently green. ... *doson eleius*
 Fore wing with all the spots and markings pale white. ... *doson axion*
5. Tibiae and tarsi with rows of spines not differentiated dorso-ventrally ; hind wing precosta forked. ... *Troidini*
 [Antennae with sense-pits ; ♂ scent-organ never as shiny streak but sparse black hairs on anal fold of hind wing]. ... *Troiditi*-6
 Tibiae and tarsi with rows of spines differentiated dorso-ventrally by an impressed spineless space ; hind wing precosta simple, curved distad. ... *Papilionini*-8
6. Fore wing with R_2 arising opposite Cu_{1a} ; wings without white marginal spots ; antennae black, club curved. ... *Atrophaneura*
 [Hind wing without golden transparent scales]. ... Subgen. *Atrophaneura*-7
 Fore wing with R_2 arising opposite Cu_{1b} ; wings and antennae as above, but hind wing with golden transparent scales. ... *Troides*
 [Tail absent ; ♂ scent-fold prominent]. ... Subgen. *Troides*
 [Hind wing marginal spots in both sexes from areas M_3 to Cu_{1a} proximally not suffused black and in ♀ with postdiscal series of large oval black spots and inner margin broadly black]. ... *helena cerberus*
7. Sexes dissimilar ; fore wing white bands prominent ; hind wing with discal and submarginal rows of red spots ; ♀ fore wing with markings pale and abdomen black up to the anal end. ... *hector*
 Sexes similar ; fore wing with discal series of white spots ; hind wing without cell-spot. ... *aristolochiae aristolochiae*

8.	Mimetic of Danaids.	...	<i>Chilasa</i>
	[Tail absent; frons with lateral cream stripes ; thorax and abdomen pale-spotted].	...	Subgen. <i>Chilasa</i>
	[Fore wing with submarginal white spots irregular].	..	<i>clytia clytia</i>
	Non-mimetic of Danaids ; tail often spatulate ; frons and thorax with lateral lines.	...	<i>Princeps</i> -9
9.	Bands or patches on wings never of metallic colour ; pattern black and yellow ; often mimetic of Troidini.	...	Subgen. <i>Menelaides</i> -10
	Bands or patches on wings usually of metallic colour ; pattern green and blue, or if black and yellow, then with submarginal pale spots enlarged ; non-mimetic of Troidini.	...	Subgen. <i>Princeps</i> -12
10.	Female not always mimetic.	...	... 11
	Female always mimetic.		
	[Fore wing with prominent marginal white spots ; ♀ with red or white discal spots on hind wing ; ♂ hindwing with white discal band of even width].	...	<i>polytes romulus</i>
11.	Hind wing tailless.		
	[♀ fore wing with pale internervular streaks extending into the cell].	...	<i>polymnestor polymnestor</i>
	Hind wing tailed.		
	[♀ paler, with markings larger].	...	<i>nephelus nephelus</i>
12.	Sexes similar.		
	[Fore wing with basal half of cell sprinkled yellow and a narrow discal band of spots].	...	<i>demoleus demoleus</i>
	Sexes dissimilar.		
	[♀ with red submarginal lunule in area R, more prominent than in ♂ ; hind wing with discal patch curved inward and sharply green-edged ; shiny blue at the base of area of M ₂ and outer areas of M ₁ and M ₂]	...	<i>paris decorosa</i>

SUMMARY

A checklist of Papilioninae from Orissa is presented in the light of modern taxonomy. Twelve species and subspecies in five genera and seven subgenera under three tribes and concerned subtribes are recognised. A key is provided for easy identification of different taxa taken into consideration.

RÉSUMÉ

Une liste révisée des Papilioninae de l'Orissa est soumise sous la lumière de la taxonomie à la page. Douze espèces et leurs sous-espèces en cinq genres et sept sous-genres des trois tribus et subtribus pertinents sont reconnues. Une clé des taxa inclus dans la liste est pourvue pour faire leur identification à l'aise.

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REFERENCES

- HANCOCK, D. L. 1983. Classification of the Papilionidae (Lepidoptera) : A phylogenetic approach. *Smithersia*, **2** : 1-48.
- MANDAL, D. K. & NANDI, D. N. 1983. On collections of Papilionidae from Orissa, India. *Rec. Zool. Surv. India*, **81** : 355-368, one table, 1 map.
- MUNROE, E. 1961. The classification of the Papilionidae (Lepidoptera). *Canad. Ent. Suppl.*, **17** : 1-51.
- TALBOT, G. 1939. *Fauna Brit. India, Butterflies*, **1** : xxix+600 pp. London (Francis Taylor).

INSECTA : COLEOPTERA : CHRYSOMELIDAE

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INTRODUCTION

Jacoby (1908), Maulik (1919, 1926, 1936) and Scherer (1969) dealt this family extensively from Indian subregion wherein they included 19 species from Orissa state. Subsequently Kimoto (1972) and Takizawa (1983) also recorded 8 species from this state. The present work is based on the collection of Chrysomelidae, made by various survey parties from Zoological Survey of India, from Orissa mainly during the seventies and other older collections present in the National Zoological Collections. Besides, the species reported by the earlier workers have also been included here to give an upto date account of the Orissa fauna of Chrysomelidae.

The collection studied comprises about 900 examples spreading over 66 species under 9 subfamilies namely Criocerinae, Clytrinae, Cryptocephalinae, Eumolpinae, Galerucinae, Chrysomelinae, Alticinae, Hispinae and Cassidinae. The classification and arrangement of species in this paper are as followed in Fauna of British India. Of the species dealt with here, one species is new to science and 31 are new records from Orissa State. New records are marked with asterisks. The specimens dealt with in this paper are deposited in the collection of Zoological Survey of India, Calcutta.

TAXONOMIC ACCOUNT

Key to the Chrysomelidae of Orissa

[largely after Kimoto and Gressitt (1966), taxa marked with asterisks in the key are not included in the text.]

1.	Head normal, vertex not projecting, mouth directed forward.	...	...	2
	Head with vertex projecting strongly forward, mouth directed posteriorly and often partly hidden by prosternum.	...	...	58
2 (1)	Antennae rarely closely inserted on front of head, separated by frons or vertex ; elytron generally somewhat rigid.	...	...	3
	Antennae closely inserted ; elytron not very rigid.	...	...	29
3 (2)	Antennal insertions not separated by entire frons, relatively close.	...	Donacinae*	
	Antennal insertions separated by entire frons.	...	...	4

4 (3)	Prothorax not completely margined laterally ; head narrowed behind prominent eyes. ...	...	5
	Prothorax completely margined laterally ; head not conspicuously narrowed behind eyes ; eyes not particularly prominent. ...	...	15
5 (4)	Tarsal claws toothed internally ; prothorax tuberculate at side anterior to constricted base. ...	Zugophorinae*	
	Tarsal claws simple, not toothed ; prothorax not tuberculate laterally (Criocerinae). ...	...	6
6 (5)	Tarsal claws free, not fused at base ; head as broad as long. ...	...	7
	Tarsal claws fused for basal $\frac{1}{4}$ to basal $\frac{1}{2}$	...	8
7 (6)	Head with transverse depression across top at constriction behind eyes, and with deep grooves on sides of constriction of neck containing upward and forward as grooves setting off central portion of occiput ; prothorax strongly constricted near middle ; dark brown with the ventral surface black ; elytra red brown with finely punctate-striate. ...	<i>Lilioceris malabarica</i> (Jacoby)	
8 (6)	Occiput abbreviated, wider than long, with sides forming a front angle of more than 90° ; prothorax with two transverse sulci ; elytra with a black sutural band terminated before the apex. ...	<i>Aulema downesi</i> (Baly)	
	Occiput not abbreviated, not wider than long, with sides forming a front angle of less than 90° (<i>Lema</i>)....	...	9
9 (8)	Elytra unicoloured. ...	...	10
	Elytra more than one colour. ...	...	13
10 (9)	Elytra metallic blue ; prothorax redbrown ; clypeus, mandibles black. ...	...	11
	Elytra red-brown or dark brown. ...	...	12
11 (10)	Anterior portion of clypeus only black ; ventral side red-brown with the apical portion of tibia and tarsi darker, antennae black except the basal segment ; prothorax with single basal transverse depression. ...	<i>Lema obscuritarsis</i> Jacoby	
	Clypeus with the anterior portion of head black ; ventral side black ; antennae completely black with one or two basal segments shining ; prothorax with anterior and posterior basal depression. ...	<i>Lema coromandelina</i> (F.)	
12 (10)	Body completely red-brown or yellow-brown ; prothorax with single transverse basal depression. ...	<i>Lema rufotestacea</i> Clark	
	Dorsal side completely dark brown with labrum and apical border of clypeus black ; ventral side brown with the breast and last two pairs of legs black ; prothorax with single transverse basal depression. ...	<i>Lema lacertosa</i> Lacord.	

- 13 (9) Elytra red-brown with longitudinal metallic blue bands ; prothorax with single basal transverse sulcus. ... *Lema constrictofasciata* Jacoby
- Elytra red-brown with an apical blue or black spot ; prothorax with anterior and basal transverse sulci. ... 14
- 14 (13) Legs black. ... *Lema terminata* Lacord.
- Legs red-brown. ... *Lema praeusta* (F.)
- 15 (4) Middle 3 abdominal sternites constricted, body subcylindrical. ... 16
- Middle 3 abdominal sternites not constricted, body more or less ovate or rounded, often strongly convex and constricted anteriorly. ... 23
- 16 (15) Antenna relatively short and serrate. ... 17
- Antenna fairly long and slender, not serrate (*Cryptocephalinae*) ; scutellum large ; antenna long, filiform ; prothorax closely fitted to base of elytra ; base of prothorax not margined ; pale-brown with a broad longitudinal black band on elytra. ... *Cryptocephalus sehestedti* F.
- 17 (16) Prothoracic pleuron without antennal grooves ; body surface smooth (*Clytrinae*). ... 18
- Prothoracic pleuron with grooves for reception of antenna ; body surface rough or tuberculate. ... *Clamisiae**
- 18 (17) Posterior angles of prothorax not raised in ♂. ... 19
- Posterior angles of prothorax more or less raised in ♂. ... *Labidostomis**
- 19 (18) Elytral epipleurae strongly lobed at base ; pygidium exposed. ... 20
- Elytral epipleurae not or very slightly convex ; pygidium not exposed. ... 21
- 20 (19) Body fairly parallel-sided ; epipleural lobe of elytra distinct, but not conspicuously large ; posterior angles of pronotum strongly angulate ; hind margin of pronotum strongly produced in middle (*Diapromorpha*) ; pronotum with two black spots (sometimes united) ; elytra with three black transverse bands. ... *Diapromorpha turcica* (F.)
- 21 (19) Antenna normal, very strongly widened or serrate ; elytron dilated in ♂. ... 22
- 22 (21) Fore legs not larger and more slender than others ; posterior angles of pronotum strongly angulate. ... *Smaragdina**
- Fore legs considerably more elongate than others ; posterior angles of pronotum rounded ; pronotum shining black ; elytron with two black spots. ... *Merilia lunulata* (F.)

23 (15)	Clypeus not divided into 2 parts.	...	...	24
	Clypeus divided into 2 parts (Chrysomelinae).	...	...	42
24 (23)	Prothorax as broad as base of elytron ; its side grooved for reception of antenna ; abdomen grooved for reception of hind leg.	...	Lamprosomatinae*	
	Prothorax generally narrower than base of elytron, its sides not grooved for reception of antenna ; abdomen not grooved for reception of hind leg (Eumolpinae).	...	...	25
25 (24)	Anterior margin of thoracic episterna straight or concave.	...	...	26
	Anterior margin of thoracic episterna convex.	...	...	28
26 (25)	Head with deep sulcus above eyes ; prothorax short, subglobular and much narrower than elytra, bronze-coloured : labrum, mandibles and terminal joints of antennae black, elytra with three smooth purple spots.	...	Scelodonta indica Duv.	
	Head without sulcus above eyes ; prothorax not narrower than elytra.	...	...	27
27 (25)	Greenish-cupreous ; antenna, legs and abdomen brownish.	...	Colasposoma rufipes Jac.	
	Bronzy, sometimes metallic blue or green ; antennae, legs and abdomen bronzy.	...	Colasposoma metallicum Clark	
28 (25)	Dorsum clothed with whitish scales ; intermediate and posterior tibiae emarginate at apex ; prosternum deeply grooved for reception of antennae ; dark brownish with greenish tinge ; antennae and legs dark red.	...	Pachnephorus brettehamsi Baly	
	Dorsum glabrous ; head with deep sulcus above eyes ; tibiae simple, longitudinally sulcate ; metallic blue, prothorax and elytron strongly punctured ; tarsal claws bifid.	...	Platycorynus peregrinus Hbst.	
29 (2)	Posterior femora not strongly dilated (Galerucinae)....	...	...	30
	Posterior femora strongly dilated (Alticinae).	...	...	46
30 (29)	Tarsal claws bifid.	...	...	31
	Tarsal claws not bifid, appendiculate.	...	...	39
31 (30)	Anterior coxal cavities closed behind ; elytron glabrous ; anterior and posterior borders of pronotum not margined or hairy (Meristata) ; metallic violet blue-black including suture ; apical brown area on each elytron without a dark spot.	...	Meristata sexmaculata K. & R.	
	Anterior coxal cavities open behind.	...	...	32
32 (31)	Pronotum without transverse depression.	...	...	33
	Pronotum with transverse depression.	...	...	35

- 33 (32) Body broadly ovate ; elytral epipleuron wide, inferior, recurved basally (*Oides*). ... 34
- 34 (33) Each elytron with one spot ; large size (10 to 14.5 mm) ; front margin of pronotum deeply curved ; elytral spot varying from a small oval spot to a large patch. ... *Oides andrewisi* Jacoby
- Elytra without any spot ; smaller size (7.5-10.5 mm) ; front margin of pronotum very slightly concave ; uniformly yellow-brown. ... *Oides flava* Oliv.
- 35 (32) Body narrower, not parallel-sided ; tibiae with distinct apical spine ; elytral epipleuron abbreviated behind middle (*Aulacophora*). ... 36
- Body narrower, parallel-sided, tibiae not distinctly spined apically ; elytral epipleuron narrow but distinct almost to apex (*Hoplasoma*) ; prothorax with side slightly sinuate and with basal and apical angles prominent ; pronotal disc with transverse depression barely reaching forward of middle ; elytron subtriangularly punctured and without carinae on disc ; length 7-8.5 mm. ... *Hoplasoma unicolor* (Ill.)
- 36 (35) Elytra brown ; eyes, metasternum and first four abdominal sternites black ; in ♂ humerus covered with hairs. ... *Aulacophora foveicollis* (Lucas)
- Elytra blue-black, black or with greenish tinge. ... 37
- 37 (36) Species large, not less than 7.5 mm in length, generally 8-10 mm ; broad excavation on pronotum ; elytra fine steel blue, not shining. ... *Aulacophora excavata* Baly
- Species smaller than 7.5 mm ; pronotum with the usual transverse depressions ; elytron shining and not steel-blue. ... 38
- 38 (37) Elytra with greenish tint. ... *Aulacophora viridis* Maulik
- Elytra without greenish tint, in ♂ the vertical area of head without structures. ... *Aulacophora lewisi* Baly
- 39 (30) Elytral punctures regularly striated, the rows equidistant ; pronotum without distinct depression (*Strobiderus*). ... 40
- Elytral punctures confused. ... 41
- 40 (39) Large size (5.50 mm) ; antennal segment 3 three times longer than segment 2, segment 4 more than one and half times as long as segment 3, segment 5 as long as segment 6. ... *Strobiderus orissaensis* n. sp.
- Small size (3.80 mm.) ; antennal segment 3 two and half times as long as segment 2, segment 4 one and one fifth ($1\frac{1}{5}$) times as long as segment 3, segment 5 and 6 subequal. ... *Strobiderus fulvus* Kimoto*

- 41 (39) First segment of posterior tarsus longer than the remainder combined ; pronotum without depression ; elytra pale brown with a black pattern as the margins all round narrowly, a stripe along suture, humerus completely covered, a median transverse band extended in a longitudinal direction and an apical black patch, all the markings completely united with one another ; size 3.50 mm. ... *Monolepta signata* (Oliv.)
- First segment of posterior tarsus not so long ; occiput smooth ; antenna slightly longer than half as long as body, segments 6-8 modified in ♂. ... *Taumcera*
- First segment of posterior tarsus as long as or longer than remainder combined ; post antennal swellings triangular ; yellowish brown, elytron with a narrow incomplete black stripe. ... *Medythia nigrobilineata* (Mots.)
- 42 (23) Anterior coxal cavities open behind ; tarsal claws simple. ... 43
- 43 (42) Anterior border of elytral epipleuron not silicate. ... 45
- Anterior border of elytral epipleuron silicate (*Chrysolina*). ... 44
- 44 (43) Species large, length 10-11 mm ; black with aeneous sheen on the upper side, under side blue ; scutellum blue. ... *Chrysolina coerulipes* Harold
- Species not so large, length 7-8 mm ; bright cupreous or dark bronze, some times blue, antennae black ; pronotum almost flat in the middle and no longitudinal impression on either side. ... *Chrysolina inconstans* Wied.
- 45 (43) Elytra confusedly punctate or with irregular rows ; tibial apices not armed with tooth like processes ; elytral epipleuron concave ; reddish brown, elytron with bronzy reflections. ... *Plagiodera rufescens* Gyll.
- 46 (29) Anterior coxal cavities closed behind. ... 47
- Anterior coxal cavities open behind. ... 53
- 47 (46) Mid and hind tibiae deeply excavate apically. ... 48
- Mid and hind tibiae not deeply excavate apically. ... 52
- 48 (47) Interantennal space flat and strongly punctured ; postantennal space distinctly and regularly punctured [*Chaetocnema* (*Chaetocnema*)]. ... 49
- 49 (48) Elytral puncture closely arranged in 15 rows ; length 2.0 mm. ... *Chaetocnema* (*Chaetocnema*) *concinnipennis* Baly
- Elytral puncture arranged in 11 rows, ... 50

- 50 (49) Scuteller row of punctures of elytra consisted of three irregular rows ; body above cupreous or blackish blue or violaceous blue. ... 51
- 51 (50) Antennae reddish brown with apical four or five segments black ; length 1.8-2.0 mm. ... *Chaetocnema (C.) concinnicollis* (Baly)
- Antennae blackish with five or six basal segments brown ; length 2-2.50 mm. ... *Chaetocnema (C.) cognata* Baly
- 22 (47) Pronotum with short longitudinal impression on each side of middle on anterior and basal margin ; elytra confusedly punctate or in narrow more or less correct rows ; elytra blue or blue green, with the punctuation more or less arranged in double rows. ... *Nisotra gemalla* (Erichson)
- Pronotum without any longitudinal impression on front margin or basal margin ; elytra punctate-striate and the whole dorsal surface finely granulate ; red-brown with black patches. ... *Clitea picta* Baly
- 53 (47) Pronotum without ante-basal transverse impression.... ... 54
- Pronotum with ante-basal transverse impression limited on sides by a short longitudinal impression ; clypeal carina narrow ; antennal calli large and distinctly limited ; longitudinal depression on sides of antebasal depression on pronotum not sharply impressed ; entirely shining brown ; antennae except four basal segment, dark brown. ... *Phygasia silacea* (Ill.)
- Pronotum with ante-basal transverse impression extends to sides ; clypeus with distinct vertical and horizontal carina, form behind T-shaped ; antennal calli large more or less rounded ; antennal segment 3 nearly twice as long as 2 ; elytral puncture distinct ; blackish blue to violaceous blue ; length 4.8-5.5 mm.... *Altica cyanea* (Weber)
- 54 (53) Hind tarsus with segment 1 equal to or extending $\frac{1}{2}$ length of tibia and inserted always a small callosity at apex of tibia ; antennal calli absent ; frons impunctate ; elytra distinctly but not very deeply confusedly punctured ; length 2.50 mm. ... *Longitarsus belgaumensis* Jac.
- Hind tarsus with segment 1 shorter and never inserted a callosity at apex of tibia. ... 55
- 55 (54) Elytron with sparse, fine pubescence on apical edge ; prosternum narrow ; antennae with segment 2 and 3 small, nearly equal in length ; head not black ; antennae and hind femora pitch coloured ; length 3.1-3.5 mm. ... *Luperomorpha vittata* Duv.
- Elytron not pubescent apically. ... 56

- 56 (55) Antennal calli obsolete ; hind tibia with apical spine inserted medially ; dark metallic green ; antennal calli fused ; shining ; head without any puncture ; length 2.0 mm. ... *Phyllotreta chotanica* Duv.
- Antennal calli prominent, subovate, with no process to interantennal space ; its hind margin enclose a right angle or obtuse angle in middle ; preocular lines distinct and sharp ; some species with a very shallow ante-basal depression on pronotum ; hind tibia with apical spine inserted laterally on apex (*Aphthona*). ... 57
- 57 (56) Larger than 2.5 mm ; the whole hind femora black ; scutellum black ; elytra almost impunctate, suture more or less darker ; labrum black ; tarsus darker ; length 3.00-3.6 mm. ... *Aphthona nigrilabris* Duv.
- Smaller than 2.5 mm ; hind femora often darker ; scutellum not black ; elytra confusedly punctate, suture not darker ; under side more or less black ; length 1.8-2.5 mm. ... *Aphthona kanaraensis* Jac.
- 58 (1) Pronotum and elytra often with long spines, lacking broad marginal expansions ; head never covered (Hispinae). ... 59
- Pronotum and elytra with broad marginal expansions ; head covered (Cassidinae). ... 64
- 59 (58) Body armed with distinct spines ; tarsal claws double, as usual ; antennae 11 segmented. ... 60
- 60 (59) Antennae without any dorsal spine. ... 62
- Antennal segment 1-6 with dorsal spines (*Hispa*). ... 61
- 61 (60) Antennal segment 1 with five dorsal spines. ... *Hispa brachycera* Gestro
- Antennal segment 1 with three dorsal spines, segment 2 with one. ... *Hispa ramosa* Gyll.
- Antennal segment 1 with two dorsal spines, segment 2 with two, one very minute. ... *Hispa andrewesi* (Weise)
- 62 (60) The front border of prothorax with spines (*Dactylispa*). ... 63
- The front border of prothorax without spines ; antennae 11-segmented ; body narrow, subparallel ; elytral margin not produced (*Dicladispa*) ; each side of prothorax with five spines, the anterior four on a common base and straight, the fifth being small and separate. ... *Dicladispa armigera* (Oliv.)
- 63 (62) The front border of prothorax with a pair of spines on each side of the middle line ; each side of prothorax with three spines ; pronotum without any smooth discal areas. ... *Dactylispa dilaticornis* Duv.

- 64 (58) Head not visible from above, covered by the explanate margin of pronotum. ... 65
- 65 (64) Tarsal claws bearing a comb-like structure at base. ... 66
- Tarsal claws without comb-like structure at base. ... 70
- 66 (65) Body depressed and rounded (*Aspidomorpha*). ... 67
- Body strongly convex, sub-pentagonal ; elytron with declivous expansion which is largely subopaque ; length 7.5-9.0 mm. ... *Laccoptera quadrimaculata* Thun.
- 67 (66) The dorsal surface not raised into a conical hump behind scutellum ; the explanate margins of elytra at their widest almost as broad as the disc. .. *Aspidomorpha familiaris* (F.)
- The dorsal surface raised into a conical hump behind scutellum. ... 68
- 68 (67) Anterior and posterior angles of elytral explanate margins marked with dark patches. ... 69
- Only anterior angles of elytral explanate margins marked with dark patches ; suture not dark brown at the extreme apex ; length 6.5-7.5 mm. ... *Aspidomorpha furcata* (Thumb.)
- 69 (68) Size smaller than 8.0×7.0 mm ; pointed conical hump very low ; elytral disc more or less regular with one or two depressions. ... *Aspidomorpha indica* Boh.
- Size larger than 8.0×7.0 mm : pointed conical hump very high ; elytral disc irregular. ... *Aspidomorpha sanctaescrucis* (F.)
- 70 (65) Prosternum without a groove on side for reception of antenna ; apical margin of elytron without a row of fine hairs on underside ; a broad black stripe along the middle on each elytron, meeting posteriorly at suture, and a short stripe along suture which may extends to the pronotum. ... *Cassida circumdata* Hbst.
- Pronotum with a groove on side for reception of antenna. ... 71
- 71 (70) Only the basal segments of antennae lie in the groove ; last two antennal segments passing beyond the posterior margin of pronotum ; antenna slender ; the suture with a narrow red stripe lacking black bordering. ... *Chiridopsis septemnotata* (Boh.)
- The whole antenna lies in the groove ; antennae short and stout, not reaching the posterior edge of pronotum (*Oocassida*) ... 72
- 72 (71) Elytral interstices not raised into sharp ridges. ... 73
- 73 (72) Elytra with three faint longitudinal red stripes, one along the suture and one on each disc. ... *Oocassida cruenta* (F.)
- Elytra with a faint longitudinal red stripe along the suture. ... *Oocassida pudibunda* (Boh.)

Subfamily (i) CRIOCERINAE

* 1. *Lema obscuritarsis* Jacoby

1892. *Lema obscuritarsis* Jacoby, *Ann. Mus. civ. Stor. nat. Genova*, 32 : 872.

1908. *Lema obscuritarsis* : Jacoby, *Fauna Brit. India, Col., Chry.*, 1 : 19.

Material examined : 1 ex., Titlagarh (Balangir Dist.), 15.xi.1972, J. M. Julka coll.

Distribution : India : Orissa (Titlagarh) and Assam. *Elsewhere* : Burma.

2. *Lema coromandelina* (Fabricius)

1798. *Leptura coromandelina* Fabricius, *Ent. Syst. Suppl.* : 154.

1801. *Lema coromandelina* : Fabricius, *Syst. Eleuth.* 1 : 475.

1908. *Lema coromandelina* : Jacoby, *Fauna Brit. India, Chry.* 1 : 25-26.

Distribution : India : Orissa (Cuttack), West Bengal, Sikkim, Karnataka and Tamil Nadu. *Elsewhere* : Sri Lanka, Thailand, Laos, Cambodia, Vietnam, S. China, Taiwan, Philippines.

Remarks : This species is not available from the present collection but it was reported by Takizawa (1983) from Cuttack (Orissa).

* 3. *Lema lacertosa* Lacordaire

1845. *Lema lacertosa* Lacordaire, *Mon. Phytoph.* 1 : 339.

1908. *Lema lacertosa* : Jacoby, *Fauna Brit. India, Col., Chry.* 1 : 35-36.

Material examined : 1 ex., Cuttack, 24.xi.1955, T. G. Vazirani coll. ; 1 ex., Anandapur (Keonjhar Dist.), 3.iv.1973. S. K. Gupta coll.

Distribution : India : Orissa (Cuttack, Anandapur) and West Bengal. *Elsewhere* : Burma, Malay Peninsula, China.

* 4. *Lema rufotestacea* Clark

1866. *Lema rufotestacea* Clark, *App. Cat. Phytoph.* : 29.

1908. *Lema rufotestacea* : Jacoby, *Fauna Brit. India, Col., Chry.* 1 : 36.

Material examined : 1 ex., Tensa Colony (Sundargarh Dist.), 14.ix.1972, S. Khera coll.

Distribution : India : Orissa (Sundargarh), Assam, Mahe and States of South India (Deccan), *Elsewhere* :- Burma, South China, Hainan and Taiwan.

5. *Lema* sp.

Material examined : 1 ex., Dhutra (Sambalpur Dist.) 18.ix.1972, S. Khera coll.

Remarks : The single specimen available could not be identified up to the species, it is however close to *L. lycon* Jacoby.

6. *Lema constrictofasciata* Jacoby

1908. *Lema constrictofasciata* Jacoby, *Fauna Brit. India, Col., Chry.*, 1 : 46-47.

1988. *Lema constrictofasciata* : Takizawa, *Ent. Rev. Japan*, 38 (1) : 66.

Material examined : 1 ex., Gosanipal, Bangriposi (Mayurbhanj Dist.), 15.ix.1972, K. Rai coll.

Distribution : India : Orissa (Bangriposi, Cuttack), and West Bengal.

7. *Lema praeusta* (Fabricius)

1792. *Crioceris praeusta* Fabricius, *Ent. Syst.*, 1 (2) : 8

1908. *Lema praeusta* : Jacoby, *Fauna Brit. India, Col., Chry.*, 1 : 58.

Material examined : 9 exs., Sundargarh, 2.x.1972, S. Khera coll. ; 2 exs., Govt. Seed Farm, Sundargarh, 20.ix.1972, S. K. Gupta coll. ; 16 exs., Gosanipal, Bangriposi (Mayurbhanj Dist.), 15.ix.1972, K. Rai coll. 1 ex., Amlapara (Dhenkanal Dist.), 5.x.1972, K. Rai coll.

Distribution : India : Orissa (Sundargarh, Bangriposi, Amlapara), Andhra Pradesh/Tamil Nadu (Coromandal).

*** 8. *Lema terminata* Lacordaire**

1845. *Lema terminata* Lacordaire, *Mon. Phytoph.*, 1 : 341.

1908. *Lema terminata* : Jacoby, *Fauna Brit. India, Col., Chry.*, 1 : 59.

Material examined : 1 ex., Sundargarh, 2.x.1972, S. Khera coll. ; 2 exs., Tensa Colony, Sundargarh, 14.ix.1972, S. Khera coll.

Distribution : India : Orissa (Sundargarh), Andhra Pradesh/Tamil Nadu (Coromandal).

*** 9. *Aulema downesi* (Baly)**

1865. *Lema downesi* Baly, *Ann. Mag. nat. Hist. London*, (3) 16 : 156.

1908. *Lema downesi* : Jacoby, *Fauna Brit. India, Col. Chry.*, 1 : 43.

1983. *Aulema downesi* : Takizawa, *Ent. Rev. Japan*, 38 (1) : 66.

Material examined : 1 ex., Gosanipal, Bangriposi (Mayurbhanj Dist.), 15.ix.1972, K. Rai coll.

Distribution : India : Orissa (Bangriposi), Maharashtra, New Delhi, Kerala/Tamil Nadu (Malabar coast).

10. *Lilioceris malabarica* (Jacoby) Comb. nov.

1904. *Crioceris malabarica* Jacoby, *Annls Soc. ent. Belg.*, 48 : 391.

1908. *Crioceris malabarica* : Jacoby, *Fauna Brit. India. Col., Chy.*, 1 : 72.

Material examined : 1 ex., Angul (Dhenkanal Dist.) 2.x.1972, K. Rai coll. ; 1 ex., Silwan, Keonjhar (Keonjhar Dist.) 25.ix.1972, K. Rai coll.

Distribution : India : Orissa (Angul, Silwan in Keonjhar Dist.), Kerala/Tamil Nadu (Malabar coast)

Subfamily (ii) CLYTRINAE

* 11. *Merilia lunulata* (Fabricius)

1781. *Cryptocephalus lunulata* Fabricius, *Spec. Ins.*, 1 : 138.

1848. *Merilia lunulata* : Lacordaire, *Men. Phytoph.*, 2 : 127.

1908. *Merilia lunulata* : Jacoby, *Fauna Brit. India, Col., Chry.*, 1 : 98-99.

Material examined : 1 ex., Sundargarh, 2.x.1972, S. K. Gupta, coll. ; 1 ex., Tensa Colony, Sundargarh, 14.ix.1972. S. Khera coll.

Distribution : India : Orissa (Sundargarh) and Tamil Nadu. *Elsewhere* : Africa.

12. *Smaragdina* sp.

Material examined : 1 ex., Barsuan (Sundargarh Dist.), 13.ix.1972, S. Khera coll. ; 1 ex., Puri, 17.iii.1974, R. K. Kacker coll.

Remarks : The specific identification could not be possible, however, one example is close to *S. longicornis* Jac. and another to *S. nilgiriensis* Jac.

* 13 *Diapromorpha turcica* (Fabricius)

1801. *Clythra turcica* Fabricius, *Syst. Eleuth.*, 2 : 37.

1908. *Diapromorpha turcica* : Jacoby, *Fauna Brit. India, Col., Chry.*, 1 : 169-170.

Material examined : 1 ex., Angul (Dhenkanal Dist.). 1.x.1972., K. Rai coll.

Distribution ; India : Orissa (Angul) and Tamil Nadu *Elsewhere* : Sri Lanka,

Subfamily (iii) CRYPTOCEPHALINAE

* 14 *Cryptocephalus sehestedti* Fabricius

1798. *Cryptocephalus sehestedti* Fabricius, *Ent. Syst. Suppl.* : 107.

1908. *Cryptocephalus sehestedti* : Jacoby, *Fauna Brit. India, Col., Chry.*, 1 : 228.

Material examined : 1 ex., Salapali (Balangir Dist.). 7.i.1972, P. K. Maiti coll.

Distribution : India : Orissa (Balangir Dist.), West Bengal, Maharashtra, Madhya Pradesh, Karnataka and Tamil Nadu. *Elsewhere* : Sri Lanka.

15. *Cryptocephalus* sp.

Material examined : 1 ex., Upardhaja (Keonjhar Dist.), 31.iii.1973, S. K. Gupta coll.

Remarks : The single specimen could not be identified upto species, it is however, close to *C. vahli* F.

Subfamily (iv) EUMOLPINAE

***16. *Scelodonta indica* Duvivier**

1891. *Scelodonta indica* Duvivier, *Bull. Soc. ent. Belg.*, **35** : 39.

1908. *Scelodonta indica* : Jacoby, *Fauna Brit. India, Col., Chry.*, **1** : 383-384.

Material examined : 1 ex., Baripada (Mayurbhanj Dist.). 10.iii.1973. S. K. Gupta coll.

Distribution : India : Orissa (Baripada) and Bihar.

***17. *Pachnephorus bretinghami* Baly**

1878. *Pachnephorus bretinghami* Baly, *J. Linn. Soc. zool. London*, **14** : 256.

1908. *Pachnephorus bretinghami* : Jacoby, *Fauna Brit. India, Col., Chry.*, **1** : 460.

Material examined : 1 ex., Baripada (Mayurbhanj Dist.). 5.xii.1973, S. K. Gupta coll.

Distribution : India : Orissa (Baripada), West Bengal and Bihar. *Elsewhere* : Burma, Pakistan and Indonesia.

***18. *Platycorynus peregrinus* (Herbst)**

1783. *Cryptocephalus peregrinus* Herbst, in Fuesly, *Archiv. Ins.*, **5** : 63.

1908. *Corynodes peregrinus* : Jacoby, *Fauna Brit. India, Col., Chry.*, **1** : 493-494.

1963. *Platycorynus peregrinus* : Gressitt & Kimoto, *Pac. Ins. Monogr.*, **1A** : 294.

Material examined : 1 ex., Puri, 15.ix.1972, Y. Chaturvedi Coll. ; 1 ex., Gopalpur (Berhampur Dist.), 7.x.1972, Y. Chaturvedi coll.

Distribution : India : Orissa (Puri, Gopalpur), Sikkim. *Elsewhere* : Sri Lanka, Nepal, Burma, Malaya, Laos, Vietnam, Thailand and S. China.

Remarks : In earlier records no specific locality is mentioned except the word 'India'.

***19. *Colasposoma rufipes* Jacoby**

1900. *Colasposoma rufipes* Jacoby, *Mem. Soc. ent. Belg.*, **7** : 114.

1908. *Colasposoma rufipes* : Jacoby, *Fauna Brit. India, Col., Chry.*, **1** : 442-443.

Material examined : 1 ex., Biswanathpur (Koraput Dist.), 5.vii.1974, A. K. Mandal coll.

Distribution : India : Orissa (Biswanathpur in Koraput Dist.).

Remarks : No specific locality is mentioned by Jacoby (1908) except 'INDIA'.

***20. Colasposoma metallicum Clark**

1865. *Colasposoma metallicum* Clark, *Ann. Mag. nat. Hist.* (3) 15 : 142.

1908. *Colasposoma metallicum* : Jacoby, *Fauna Brit. India, Col., Chry.*, 1 : 446.

Material examined : 2 exs., Biswanathpur (Koraput Dist.) 8.vii.1974, A. K. Mandal coll.

Distribution : India : Orissa (Biswanathpur in Koraput Dist.), Maharashtra and Andaman Is. *Elsewhere* : Burma.

Subfamily (v) GALERUCINAE

***21. Oides andrewesi Jacoby**

1781. *Chrysomela bipunctata* Fabricius (nec. Linnaeus 1758), *Spec. Ins.*, 1 : 127.

1900. *Oides andrewesi* : Jacoby, *Mem. Soc. r. ent. Belg.* 7 : 127.

1936. *Oides bipuncta* var. *andrewesi* : Maulik, *Fauna Brit. India, Col., Chry.*, (Gal.) : 109.

1963. *Oides andrewesi* : Gressitt & Kimoto, *Pac. Ins. Monogr.*, IB : 475-475.

Material examined : 2 exs., Cuttack, 26.viii.1972, S. K. Mitra coll.

Distribution : India : Orissa (Cuttack), West Bengal, Assam, Meghalaya, Bihar and Maharashtra. *Elsewhere* : Burma.

22. Oides flava (Olivier)

1807. *Adorium flavum* Olivier, *Entomologie*, 5 : 611.

1936. *Oides flava* : Maulik, *Fauna Brit. India, Col., Chry.* (Gal.) : 118.

Material examined : 2 exs., Cuttack, 5.xii.1965, A. P. Kapur and G. S. Arora coll.

Distribution : India : Orissa (Cuttack), West Bengal, Assam, Meghalaya, Bihar, Madhya Pradesh, Karnataka and Tamil Nadu. *Elsewhere* : Bangladesh, Nepal, Burma, Malay Peninsula, Indonesia, Philippines, Vietnam, Hainan (China).

23. Meristata sexmaculata (Kollar & Redtenbacher)

1848. *Galleruca sexmaculata* Kollar & Redt., *In Hugel Kaschmir und das Reich der Siek*, 4 : 555.

1936. *Merista sexmaculata* : Maulik, *Fauna Brit. India, Col., Chry.* (Gal.) : 145-146.

1983. *Meristata sexmaculata* : Takizawa, *Ent. Rev. Japan*, 38 (1) : 71.

Distribution : India : Orissa (Chandipore), West Bengal, Sikkim, Arunachal Pradesh, Uttar Pradesh and Jammu & Kashmir. *Elsewhere* : Nepal, Bhutan.

Remarks : This species is not available from the present collection but it was reported by Maulik (1936) from Chandipore (Orissa).

24. *Hoplasoma unicolor* (Illiger)

1800. *Galleruca unicolor* Illiger, *In Weidemann, Archiv. fur Zool. u. Zoot.*, 1 (2) : 135.

1888. *Haplosoma unicolor* : Allard, *Ann. Soc. ent. France*, (6) 8 : 327.

1936. *Hoplasoma unicolor* : Maulik, *Fauna Brit. India, Col., Chry. (Gal.)* : 161-167.

Distribution : India : Orissa (Balasore and Balighai near Puri), West Bengal, Assam, Meghalaya, Tripura, Sikkim, Bihar, Karnataka, Kerala, Tamil Nadu and Andaman Is. *Elsewhere* : Nepal, Bhutan, Bangladesh, S. China, Hainan, Malay Peninsula, Burma.

Remarks : This species was not available in the present collection but Maulik (1930) reported from Balasore and Belighai (Orissa).

25. *Aulacophora foveicollis* (Lucas)

1849. *Galeruca foveicollis* Lucas, *Explor. Alger. Ent.* : 542.

1879. *Aulacophora foveicollis* : Baly, *Cist. Ent.*, 2 : 445.

1936. *Aulacophora foveicollis* : Maulik, *Fauna Brit. India, Col., Chry. (Gal.)* : 173-176.

Material examined : 1 ex., Sambalpur, 14.ix.1972 ; 4 exs., Charbati (Sambalpur Dist.), 27.ix.1972 ; 8 exs., Sundargarh, 20.ix.1972 ; 2 exs., Ranibagicha (Sundargarh Dist.), 21.ix.1972 ; 1 ex., Bank of Mahanadi, Sambalpur, 28.ix.1972 ; 3 exs., Dhutra (Sambalpur Dist.), 18.ix.1972 ; all *S. Khera* coll. 1 ex., Sambalpur, 6.xi.1972 ; 1 ex., Balangir, 3.xi.1972 ; coll. *J. M. Julka* coll. 1 ex., Banta Kumari Hill. (Cuttack Dist.), 6.ii.1974. *S. Biswas* coll. ; 1 ex., Jharsaguda (Sambalpur Dist.), 30.x.1972, *J. M. Julka* coll. 3 exs., Angul (Dhenkanal Dist.), 1.x.1972, 14 exs., Bangriposi (Mayurbhanj Dist.), 14-16.ix.1972 ; 13 exs., Baripada (Mayurbhanj Dist.), 17.ix.1972 ; 7 exs., Barabhadrapur (Keonjhar Dist.), 26.ix.1972 ; 23 exs., Dhenkanal, 6.x.1972 ; 4 exs., Bedend (Dhenkanal Dist.), 20.ix.1972 ; all *K. Rai* coll. 2 exs., Astia, Baripada (Mayurbhanj Dist.), 23.iii.1973, *S. K. Gupta* coll. ; 2 exs., Cuttack, 27.iii.1972, 5 exs., Athgarh (Cuttack Dist.), 26.viii.1972, *S. K. Mitra* coll. ; 9 exs., Taptapani (Ganjam Dist.), 14.ii.1974, *R. K. Kacker* coll. ; 3 exs., Sonapali (Sambalpur Dist.), 23.xii.1971, *P. K. Maiti* coll. ; 3 exs., Cuttack, 23-26.xii.1970, *S. Khera* coll.

Distribution : India ; Orissa (Sambalpur, Sundargarh, Balangir, Banta Kumari Hills, Angul, Baripada, Barabhadrapur in Keonjhar Dist., Dhenkanal, Cuttack, Taptapani in Ganjam Dist.), West Bengal, Meghalaya, Arunachal Pradesh, Tripura, Bihar, Uttar Pradesh, Punjab, Maharashtra, Gujarat, Kerala, Tamil Nadu and Andaman Is. *Elsewhere* : Bangladesh, Sri Lanka, Burma, Nepal and also in Europe.

***26. *Aulacophora excavata* Baly**

1886. *Aulacophora excavata* Baly, *J. Linn. Soc. London*, **20** : 3, 5, 18.

1936. *Aulacophora excavata* : Maulik, *Fauna Brit. India, Col., Chry. (Gal.)* : 177-180.

Material examined : 1 ex., Baripada (Mayurbhanj Dist.), 10.iii.1973. *S. K. Gupta* coll.

Distribution : India : Orissa (Baripada), Bihar and Uttar Pradesh.

***27. *Aulacophora lewisi* Baly**

1886. *Aulacophora lewisi* Baly, *J. Linn. Soc. Lond.*, **20** : 5, 24.

1892. *Aulacophora intermedia*, Jacoby, *Ann. Mus. Civ. Stor. nat. Genova*, **32** : 942.

1936. *Aulacophora intermedia* : Maulik, *Fauna Brit. India, Col., Chry. (Gal.)* : 181-182.

1982. *Aulacophora lewisi* : Kimoto, *Ent. Rev. Japan*, **37** (1) : 10.

Material examined : 2 exs., Titlagarh (Balangir Dist.), 5.x.1972, 2 exs., Charbati (Sambalpur Dist.), 27.ix.1972, 1 ex., Sundargarh, 2.x.1972., 12 exs., Jharsaguda (Sambalpur Dist.), 17.ix-13.x.1972, 1 ex., Balasore, 12.ix.1972, 3 exs., Dhenkanal, 22.xii.1972, all *S. Khera* coll ; 1 ex., Chandra Bhaga Beach, 17.iii.1973, *V. K. Premkumar* coll. ; 2 exs., Purankote, Angul (Dhenkanal Dist.), 9.iv.1973, *S. K. Gupta* coll. ; 4 exs., Bangriposi (Mayurbhanj Dist.), 10-14.ix.1972, 3 exs., Baripada (Mayurbhanj Dist.), 17.ix.1972, 1 ex., Jubilee Town (Dhenkanal Dist.), 6.x.1972, 3 exs., Bedant, Keonjhar, 20. ix.1972, all *K. Rai* coll. ; 1 ex., Cuttack, CRRI, 5.xii.1965, *A. P. Kapur* and *G. S. Arora* coll.

Distribution : India : Orissa (Titlagarh, Sambalpur, Balasore, Dhenkanal, Bangriposi, Baripada, Keonjhar, Cuttack), West Bengal, Bihar, Assam, Meghalaya, Sikkim, Uttar Pradesh, Punjab, Madhya Pradesh, Gujarat, Karnataka and Tamil Nadu. *Elsewhere* : Sri Lanka, Bhutan, Burma, China, Japan.

28. *Aulacophora viridis* Maulik

1936. *Aulacophora viridis* Maulik, *Fauna Brit. India, Col., Chry. (Gal.)* : 180-181.

Distribution : India : Orissa (Chilka Lake, Barkuda Island, Ganjam Dist.).

Remarks : This species is not available from the present collection, it is however reported by Maulik (1936) from Orissa.

29. *Aulacophora indica* (Gmelin)

1790. *Oriocerus indicus* Gmelin, *Linn. Syst. Nat.* **1** (4) : 1720.

1936. *Oriocerus indicus* Maulik, *Fauna Brit. India, Col., Chry. (Gal.)* : 197.

1983. *Aulacophora indica* : Takizawa, *Ent. Rev. Japan*, **38** (1) : 71.

Distribution : India : Orissa (Cuttack), Uttar Pradesh, Haryana, Jammu & Kashmir, Madhya Pradesh, Maharashtra and Karnataka, *Elsewhere* : Nepal, Bhutan.

Remarks : This species is reported by Takizawa (1983) from Orissa (Cuttack).

30. *Strobiderus orissaensis* sp. nov.

(Fig. 1)

Oblong, slender, almost parallel-sided. Entirely pale brown to brown except eyes and mandibles black.

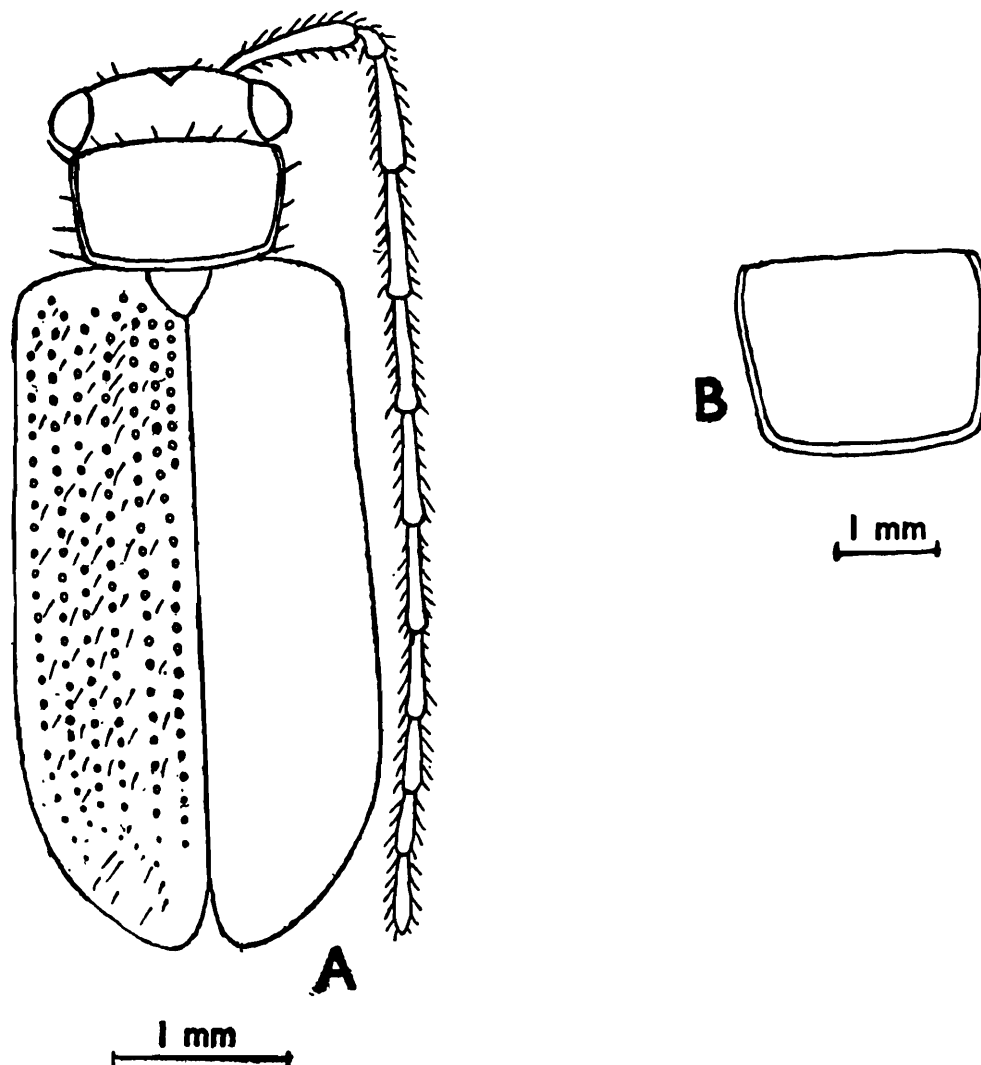


Fig. 1. *Strobiderus orissaensis* sp. nov., A. Dorsal view (♂), B. Prothorax.

Head with vertex smooth and impunctate, frontal tubercles distinctly raised, large and separated from behind by a transverse impression, clypeus impunctate, antennae slender, in male longer than the body, segment 1 long and apically thickened, segment 2 small, segment 3 three times as long as segment 2, segment 4 longest and more than one and half times as long as segment 2, segment 5 slightly shorter than segment 4 and as long as segment 6, the following segments gradually shorter and in female shorter than the body. Prothorax (Fig. 2) one and half times as broad as long, widest

before the middle and narrowed posteriorly, front margin nearly straight, basal margin arched, sides slightly rounded, all margins with corners having usual erect hairs, surface convex and under high magnification minutely and densely punctate. *Scutellum* smooth and impunctate. Elytra slightly widened behind, punctate-striate, humerus prominent, each elytron with eleven regular rows of punctures including a short scutellar row, interstices flat and with a row of erect hairs.

Measurements (in mm.) : *Holotype* ♂ : Total length 5.50, width of head across eyes 1.25, length of antennae 5.80, width of prothorax across middle 1.20, length of elytra 4.10, and width of elytra across middle 2.10 ; *Paratype* ♀ . Length 5.00, width 1.90.

Holotype ♂, INDIA : ORISSA, Jharsaguda, 31.x.1972, *J. M. Julka* coll., *paratype* ♀, INDIA : ORISSA, Balangir Dist., Titlagarh, 15.xi.1972, *J. M. Julka* coll.

This species is near *S. fulvus* Kimoto but can be easily separated by the following characters : Body length much longer (5-5.50 mm) as against 3.80mm in *fulvus*, antennal segment 3 three times longer than segment 2, (nearly $2\frac{1}{2}$ times as long as segment 2 in *fulvus*), segment 4 more than one and half times as long as segment 3 ($1\frac{1}{2}$ times as long as segment 3 in *fulvus*), segment 5 as long as segment 6 (segment 5 and 6 subequal in *fulvus*).

*31. *Medythia nigrobilineata* (Motschulsky)

1860. *Cnecodes nigrobilineatus* Motschulsky, *Etud. Ent.*, 9 : 26.

1936. *Monolepta nigrobilineata* : Maulik, *Fauna Brit. India, Col., Chry. (Gal.)* : 396-397.

1973. *Medythia suturalis nigrobilineata* : Wilcox, In Junk, *Col. Cat. Suppl.*, 78 (3) : 434.

1981. *Medythia nigrobilineata* : Kimoto, *Ent. Rev. Japan*, 35 (1 & 2) : 9-10.

Material examined : 1 ex., Baigunpal Forest (Keonjhar Dist.), 30.iii.1973, *S. K. Gupta* coll. ; 1 ex., Bank of Mahanadi, Cuttack, 16.i.1974, *R. L. Chowdhury* coll.

Distribution : India : Orissa (Baigunpal Forest in Keonjhar Dist., Cuttack), West Bengal, Bihar, Uttar Pradesh, Kerala, Maharashtra and Tamil Nadu. *Elsewhere* : China, Japan, Siberia (U. S. S. R.).

32. *Medythia suturalis* (Motschulsky)

1858. *Cnecodes suturalis* Motschulsky, *Etud. Ent.*, 7 : 100.

1973. *Medythia suturalis* : Wilcox, In Junk, *Col. Cat. Suppl.*, 78 (3) : 433.

Distribution : India : Orissa (Bhubaneswar) and Uttar Pradesh. *Elsewhere* : Burma, Thailand, Cambodia, Vietnam, S. China, Taiwan, Malaya, Philippines, Sumatra, Java, Celebes.

Remarks : This species is not available in the present collection but it is reported by Takizawa (1983) from Bhubaneswar (Orissa).

33. *Monolepta signata* (Olivier)

1808. *Galeruca signata* Olivier, *Entomologie*, 6 : 665.

1889. *Monolepta signata* : Jacoby, *Ann. Mus. Civ. Stor. nat. Genova*, 27 : 229.

1936. *Monolepta signata* : Maulik, *Fauna Brit. India, Col., Chry. (Gal.)* : 410-411.

Material examined : 5 exs., Titlagarh (Balangir Dist.), 15-16.xi.1972, J. M. Julka coll. ; 4 exs., Daspalla (Puri Dist.) 10.ii.1974, S. Biswas coll. ; 1 ex., Dhamupati (Sambalpur Dist.), 22.xii.1971, P. K. Maiti coll. ; 1 ex., Meghasai (Mayurbhanj Dist.), 19.iii.1973, S. K. Gupta coll. ; 1 ex., Angul Horti. Forest (Dhenkanal Dist.), 7.iv.1973, S. K. Gupta coll. ; 1 ex., Taptapani (Ganjam Dist.), 14.iii.1974, R. K. Kacker coll. ; 4 exs., Cuttack, CRRI, 3-7.xii.1965 ; 1 ex., Bhubaneswar, 6.xii.1965, A. P. Kapur & G. S. Arora coll. ; 1 ex., Tarasingi (Ganjam Dist.) 29.xii.1971, V. C. Agrawal coll.

Distribution : India ; Orissa (Titlagarh, Daspalla in Puri Dist., Dhamupati in Sambalpur Dist., Meghasai in Mayurbhanj Dist, Angul, Taptapani in Ganjam Dist, Cuttack, Puri and Bhubaneswar), West Bengal, Assam, Meghalaya, Tripura, Sikkim, Uttar Pradesh, Gujarat, Maharashtra, Hariyana, Karnataka and Tamil Nadu. *Elsewhere* : Sri Lanka, Nepal, Bhutan, Burma, Tibet, China, Vietnam and Thailand.

34. *Taumacera* (Cerophysa) sp.

Material examined : 1 ex., Taptapani (Ganjam Dist.), 13.iii.1974, R. K. Kacker coll. ; 5 exs., Salapali (Balangir Dist.) 7.1.1972, P.K. Maiti coll. ; 5 exs., Angul (Dhenkanal Dist.), 12.ix.1973, S. K. Gupta coll.

Remarks : The above specimens of *Taumacera* appear to be new species, it is however close to *T. fulvicollis* Jacoby and require much time to confirm.

Subfamily (vi) CHRYSOMELINAE*** 35. *Chrysolina inconstans* (Wiedeman)**

1823. *Chrysomela inconstans* Wiedeman, *Zool. Mag.*, 2 (1) : 74.

1926. *Chrysolina inconstans* : Maulik, *Fauna Brit. India, Col., Chry. (Chry. & Hali.)* : 35-36.

Material examined : 1 ex., Puri, 17.iii.1974, R. K. Kacker coll.

Distribution : India : Orissa (Puri), Uttar Pradesh and Punjab. *Elsewhere* : Sri Lanka, Nepal, Bangladesh.

36. *Chrysolina coerulipes* (Gemminger & Harold)

1874. *Chrysomela coerulipes* Gemminger & Harold, *Col. Cat.*, 11 : 3417.

1919. *Chrysolina coerulipes* : Maulik, *Fauna Brit. India, Col., Chry. (Chry. & Hali.)* : 34-35.

Distribution : India : Orissa (Cuttack), West Bengal, Bihar and Madhya Pradesh,

Remarks : The present collection is not representing this species but it is reported by Maulik (1926) from Cuttack (Orissa).

*** 37. *Plagiodera rufescens* (Gyllenhal)**

1808. *Chrysomela rufescens* Gyllenhal, In Schönh., *Syn. Ins.*, 1 (2) : 267.

1926. *Plagiodera rufescens* : Maulik, *Fauna Brit. India, Col., Chry. (Chry. & Halti.)* : 64-66.

Material examined : 5 exs., Anandapur (Keonjhar Dist.). 2.iv.1973, S. K. Gupta coll., 1 ex., Baripada (Mayurbhanj Dist.), 10.viii.1908, H. M. L. coll.

Distribution : India : Orissa (Anandapur, Baripada), Uttar Pradesh, Himachal Pradesh, Punjab and Sikkim. *Elsewhere* : Sri Lanka, Burma.

Subfamily (vii) ALTICINAE

38. *Chaetocnema (Chaetocnema) concinnipennis* Baly

1877. *Chaetocnema concinnipennis* Baly, *Trans. ent. Soc. Lond.* : 170.

1926. *Chaetocnema concinnipennis* : Maulik, *Fauna Brit. India, Col., Chry. (Chry. & Halti.)* : 207.

1969. *Chaetocnema (Chaetocnema) concinnipennis* : Scherer, *Pac. Ins. Monogr.*, 22 : 161.

Material examined : 2 exs., Cuttack, CRRI, 7.xii.1965, A. P. Kapur & G. S. Arora coll.

Distribution : India : Orissa (Cuttack), West Bengal, Assam, Tripura, Bihar and Tamil Nadu. *Elsewhere* : Sri Lanka, Bangladesh, Vietnam and Hainan (China).

39. *Chaetocnema (Chaetocnema)* sp.

Material examined : 1 ex., Angul Horti. Forest (Dhenkanal Dist.), 7.i.v.1973, S. K. Gupta coll.

Remarks : The single specimen could not be identified upto species, it is however close to *C. nepalensis* Scherer.

40. *Chaetocnema (Chaetocnema) cognata* Boly

1877. *Chaetocnema cognata* Baly, *Trans. ent. Soc. London* : 168.

1926. *Chaetocnema cognata* : Maulik, *Fauna Brit. India, Col., Chry. (Chry. & Halti.)* : 216-217.

1969. *Chaetocnema (Chaetocnema) cognata* : Scherer, *Pac. Ins. Monogr.*, 22 : 160.

Distribution : India : Orissa (Rambha in Ganjam Dist.), West Bengal, Tripura, Bihar, Uttar Pradesh, Karnataka and Tamil Nadu. *Elsewhere* : Sri Lanka.

Remarks : This species is reported by Maulik (1926) from Rambha (Orissa). It is not represented in the present collection.

41. *Chaetocnema* (*Chaetocnema*) *concinnicollis* (Baly)

1874. *Plectroscelis concinnicollis* Baly, *Trans. ent. Soc. Lond.* : 208.

1934. *Chaetocnema concinnicollis* : Chen, *Sinensia*, 5 : 248.

1969. *Chaetocnema* (*Chaetocnema*) *concinnicollis* : Scherer, *Pac. Ins. Monogr.*, 22 : 157.

Distribution : India : Orissa (Cuttack) and Gujarat. *Elsewhere* : Nepal, Vietnam, China, Taiwan, Japan.

Remarks : This species is reported by Takizawa (1983) from Cuttack (Orissa) and no material is available in the present collection.

42. *Clitea picta* Baly

1877. *Clitea picta* Baly, *Trans. ent. Soc. Lond.* : 287.

1926. *Clitea picta* : Maulik, *Fauna Brit. India, Col., Chry. (Chry. & Halti)* : 252-254.

1969. *Clitea picta* : Scherer, *Pac. Ins. Monogr.*, 22 : 200.

Distribution : India : Orissa (Surada), West Bengal, Karnataka. *Elsewhere* : Burma.

Remarks : This species was not available in the present collection but Scherer (1969) reported it from Surada (Orissa).

43. *Nisotra gemella* (Erichson)

1834. *Haltica gemella* Erichson, *Nov. Acad. Leop. Carol*, 16 : 275.

1885. *Nisotra gemella* : Jacoby, *Ann. Mus. Civ. Stor. nat. Genova* (2), 2 (22) : 34.

1969. *Nisotra gemella* : Scherer, *Pac. Ins. Monogr.*, 22 : 148-149.

Distribution : India : Orissa (Jeypore), West Bengal, Assam, Sikkim, Andaman Is., Nicobar Is. and Tamil Nadu. *Elsewhere* : Burma, Thailand, Malaya, Vietnam, S. China, Sumatra and Philippines.

Remarks : This species is reported by Scherer (1969) from Jeypore (Orissa) although it is not available in the present collection.

44. *Nisotra* sp.

Material examined : 1 ex., Barsuan (Keonjhar Dist.). 13.ix.1972. S. Khera coll.

Remarks : The single specimen could not be identified upto species, it is however close to *N. gemella* Erichson.

45. *Longitarsus belgaumensis* Jacoby

1896. *Longitarsus belgaumensis* Jacoby, *Annl. Soc. ent. Belg.*, 40 : 260.

1926. *Longitarsus belgaumensis* : Maulik, *Fauna Brit. India, Col., Chry. (Chry. & Halti)* : 348-349.

Distribution : India : Orissa (Bhubaneswar), Assam, Sikkim, Manipur, Tripura, Bihar, Uttar Pradesh, Maharashtra, Karnataka and Tamil Nadu. *Elsewhere* : Nepal, Sri Lanka, Vietnam.

Remarks : This species is not represented in the present collection, it is reported by Kimoto (1972) from Bhubaneswar (Orissa).

***46. *Luperomorpha vittata* Duvivier**

1892. *Luperomorpha vittata* Duvivier, *Annls. Soc. ent. Belg.*, **36** : 427.

1926. *Luperomorpha vittata* : Maulik, *Fauna Brit. India, Col., Chry. (Chry. & Halti)* : 365.

Distribution : India : Orissa (Tarasingi in Ganjam Dist.), West Bengal, Tripura and Bihar.

***47. *Aphthona kanaraensis* Jacoby**

1896. *Aphthona kanaraensis* Jacoby, *Annls. Soc. ent. Belg.*, **40** : 255.

1926. *Aphthona kanaraensis* : Maulik, *Fauna, Brit. India, Col., Chry. (Chry. & Halli)* : 368-369.

Material examined : 1 ex., Purankote, Angul (Dhenkanal Dist.), 9.iv.1973, S. K. Gupta coll. ; 2 exs., Angul Horti. Forest (Dhenkanal Dist.), 7.iv.1973, S. K. Gupta coll.

Distribution : India : Orissa (Angul in Dhenkanal Dist.) West Bengal, Assam, Bihar, Uttar Pradesh, Himachal Pradesh, Gujarat, Maharashtra, Madhya Pradesh, Karnataka, Andhra Pradesh and Tamil Nadu.

***48. *Aphthona nigrilabris* Duvivier**

1892. *Aphthona nigrilabris* Duvivier, *Annls. Soc. ent. Belg.*, **36** : 426.

1926. *Aphthona nigrilabris* : Maulik, *Fauna Brit. India, Col., Chry. (Chry. & Halti)* : 370-371.

Material examined : 6 exs., Meghasai (Mayurbhanj Dist.), 19.iii.1973, 31 exs., Purankote, Angul (Dhenkanal Dist.), 9.iv.1973, 4 exs., Angul Horti. Forest, 7.iv.1973, 3 exs., Angul, Panygarh, 8.iv.1973, all S. K. Gupta coll. ; 8 exs., Taptapani (Ganjam Dist.) 13.iii.1974, R. K. Kacker coll.

Distribution : India : Orissa (Meghasai in Mayurbhanj Dist., Angul, Taptapani), West Bengal, Assam, Bihar, New Delhi, Uttar Pradesh, Maharashtra, Karnataka and Tamil Nadu. *Elsewhere* : Sri Lanka, Nepal, Laos, Vietnam, Sumatra.

***49. *Phyllotreta chotanica* Duvivier**

1892. *Phyllotreta chotanica* Duvivier, *Annls. Soc. ent. Belg.*, **36** : 426.

1926. *Phyllotreta chotanica* : Maulik, *Fauna Brit. India, Col., Chry. (Chry. & Halti)* : 379-380,

Material examined : 1 ex., Meghasai (Mayurbhanj Dist.), 19.iii.1973, 2 exs., Angul Horti. Forest (Dhenkanal Dist.), 7.iv.1973, 1 ex., Baripada (Mayurbhanj Dist.), 23.iii.1973, 5 exs., Panygarh, Angul, 8.iv.1973, all *S. K. Gupta* coll.

Distribution : India : Orissa (Meghasai in Mayurbhanj Dist., Angul in Dhenkanal Dist., Baripada), West Bengal, Tripura, Uttar Pradesh, New Delhi, Himachal Pradesh, Madhya Pradesh, Gujarat and Maharashtra.

* 50. **Phygasia silacea** (Illiger)

1807. *Haltica silacea* Illiger, *Mag. Insektenkunde*, 6 : 121.

1969. *Phygasia silacea* : Scherer, *Pac. Ins. Monogr.* 22 : 113.

Material examined : 1 ex., Pernagar, Angul (Dhenkanal Dist.), 29.ix.1972, 2 exs., Silwan, (Keonjhar Dist.), 25.ix.1972. 1 ex., Purnakoti, Angul, 2.x.1972, 10 exs., Keonjhar (Keonjhar Dist.), 25.ix.1972, all *K. Rai* coll. : 2 exs., Jharsaguda (Sambalpur Dist.), 17.ix.1972, *S. Khera* coll. : 2 exs., Bolangir, 18.ii.1972, *K. V. S. Rao* coll.

Distribution : India : Orissa (Angul, Silwan in Keonjhar Dist., Jharsaguda, Bolangir), West Bengal, Karnataka and Tamil Nadu. *Elsewhere* : Sri Lanka.

51. **Altica cyanea** (Weber)

1801. *Galleruca cyana* Weber, *Observ. ent.*, 1 : 67.

1889. *Haltica cyanea* : Jacoby, *Ann. Mus. Civ. Stor. nat. Genova*, 7 : 191.

1960. *Altica cyanea* : Ohno, *Toyo Univ. Bull. Dept. Lib. Arts.*, 1 : 90.

Distribution : India : Orissa (Cuttack), West Bengal, Punjab, New Delhi, Uttar Pradesh, Maharashtra, Karnataka and Andhra Pradesh. *Elsewhere* : Sri Lanka, Nepal, Burma, Afghanistan, Malaya, Indo-China, Taiwan, Japan.

Remarks : This species is reported by Takizawa (1983) from Cuttack (Orissa), it is not represented by the present collection.

Subfamily (viii) HISPINAE

52. **Hispa brachycera** (Gestro)

1897. *Hispella brachycera* Gestro, *Ann. Mus. Civ. Stor. nat. Genova* : 123.

1919. *Hispella brachycera* : Maulik, *Fauna Brit. India, Col., Chry. (Hisp. & Cassi.)* : 157-158.

1957. *Hispa brachycera* : Uhmman, In Junk, *Col. Cat. Suppl.* (35) : 271.

Material examined : 2 exs., Rambha (Ganjam dist.), 20.ix.1913, *N. Anandale* coll.

Distribution : India : Orissa (Rambha in Ganjam Dist.), Maharashtra and Himachal Pradesh.

*** 53. *Hispa ramosa* (Gyllenhal)**

1817. *Hispella ramosa* Gyllenhal, In Schonherr, *Syn. Ins.*, 1 (9) : 6.

1919. *Hispella ramosa* : Maulik, *Fauna Brit. Ind. Col., Chry.* (*Hisp. & Cassi.*) : 160.

1957. *Hispa ramosa* : Uhmman, In Junk, *Col. Cat. Suppl.* (35) : 271-272.

Material examined : 1 ex., Nandan Kanan (Puri Dist.), 26.iii.1974, R. K. Kacker coll., 1 ex., Anantapur (Keonjhar Dist.), 8.iv.1973, S. K. Gupta coll.

Distribution : India : Orissa (Puri, Anantapur in Keonjhar Dist.), Bihar, Uttar Pradesh, Karnataka and Tamil Nadu. *Elsewhere* : Sri Lanka.

54. *Hispa andrewesi* (Weise)

1897. *Hispella andrewesi* Weise, *Dt. ent. Z.* : 126.

1919. *Hispella andrewesi* : Maulik, *Fauna Brit. India, Col., Chry.* (*Hisp. & Cassi.*) : 161.

1958. *Hispa andrewesi* : Uhmman, In Junk, *Col. Cat. Suppl.* 35 (2) : 269.

Distribution : India : Orissa (Cuttack), Karnataka and Tamil Nadu. *Elsewhere* : Sri Lanka, Burma, Java, Vietnam, South China.

Remarks : This species is reported by Kimoto (1972) from Cuttack (Orissa), it is not represented by the present collection.

*** 55. *Dactylispa dilaticornis* (Duvivier)**

1891. *Hispa dilaticornis* Duvivier, *Annls. Soc. ent. Belg.* : 48.

1919. *Dactylispa dilaticornis* : Maulik, *Fauna Brit. India, Col., Chrys.* (*Hisp. & Cassi.*) : 178.

Material examined : 1 ex., Angul, Purnakote (Dhenkanal Dist.) 9.iv.1973, 1 ex., Bisoi (Mayurbhanj Dist.), 26.iii.1973, all S. K. Gupta coll.

Distribution : India : Orissa (Angul, Bisoi in Mayurbhanj Dist.), West Bengal, Bihar, Uttar Pradesh, Pondichery, Kerala and Tamil Nadu. *Elsewhere* : Sri Lanka.

56. *Dicladispa armigera* (Olivier)

1808. *Hispa armigera* Olivier, *Ent.* 6 : 763.

1919. *Hispa armigera* : Maulik, *Fauna Brit. India, Col., Chryso.* (*Hisp. & Cassi.*) : 249.

1952. *Dicladispa armigera* : Uhmman, *Treubia*, 21 : 236.

Material examined : 1 ex., Cuttack CRRI, 4.xii.1965, A. P. Kapur & G. S. Arora coll. ; 2 exs., Balighai (Puri Dist.), 16-20.viii.1911, N. Anandale & F. H. Gravely coll.

Distribution : India : Orissa (Balighai in Puri Dist., Cuttack), West Bengal, Assam, Tripura, and Tamil Nadu. *Elsewhere* : Bangladesh, Nepal, Burma, Indochina, Hainan, (China).

Subfamily (ix) CASSIDINAE

* 57. *Aspidomorpha sanctaecrucis* (Fabricius)

1792. *Cassida sanctaecrucis* Fabricius, *Ent. Syst.*, 4 : 446.

1854. *Aspidomorpha sanctaecrucis* : Boheman, *Mon. Cassid.*, 2 : 287.

1919. *Aspidomorpha sanctaecrucis* : Maulik, *Fauna Brit. India, Col., Chry. (Hisp. & Cassi.)* : 329-330.

Material examined : 6 exs., Jharsaguda (Sambalpur Dist.), 30-31.x.1972, 3 exs., Sambalpur, 4.xi.1972, 1 ex., Sundargarh, 21-28.x.1972, 2 exs., Balangir, 3-12.xi.1972, all J. M. Julka coll. ; 1 ex., Jubilee Town (Dhenkanal Dist.) 6.x.1972, K. Rai coll.

Distribution : India : Orissa (Jharsaguda in Sambalpur Dist., Sundargarh, Balangir, Sambalpur, Jubilee Town in Dhenkanal Dist.), West Bengal, Sikkim, Assam, Meghalaya, Arunachal Pradesh, Karnataka, Kerala and Tamil Nadu. *Elsewhere* : Sri Lanka, Burma, Nepal, Bhutan, Indo-China, Thailand, Malaya, S. China.

58. *Aspidomorpha furcata* (Thunberg)

1789. *Cassida furcata* Thunberg, *Ins. Spec.*, 5 : 87.

1897. *Aspidomorpha furcata* : Weise, *Dt. ent. Z.* : 104.

1919. *Aspidomorpha furcata* : Maulik, *Fauna Brit. India, Col., Chry. (Hisp. & Cassi.)* : 333.

Distribution : India : Orissa (Chilka Lake), West Bengal, Assam, Karnataka and Tamil Nadu. *Elsewhere* : Burma, Sumatra, Sri Lanka, S. China, Taiwan, Vietnam, Thailand, Malaya.

Remarks : This species is not available in the present collection but it was reported by Maulik (1919) from Chilka Lake (Orissa).

* 59. *Aspidomorpha indica* Boheman

1854. *Aspidomorpha indica* Boheman, *Mon. Cassid.*, 2 : 318.

1919. *Aspidomorpha indica* : Maulik, *Fauna Brit. India, Col., Chrys. (Hisp. & Cassi.)* : 327.

Material examined : 1 ex., Bolangir, 3.xi.1972, J. M. Julka coll. ; 1 ex., Balijuri (Sundargarh Dist.), 11.i.1972, P. K. Maiti coll.

Distribution : India : Orissa (Bolangir, Baliguri in Sundargarh Dist.), West Bengal, Assam, Sikkim and Tamil Nadu. *Elsewhere* : Nepal, Pakistan, W. China, Vietnam, Taiwan, Korea, U. S. S. R.

60. *Aspidomorpha miliaris* (Fabricius)

1775. *Cassida miliaris* Fabricius, *Syst. Ent.* : 91.

1854. *Aspidomorpha miliaris* : Boheman, *Mon. Cassid.*, 2 : 261.

1919. *Aspidomorpha miliaris* : Maulik, *Fauna Brit. India, Col., Chryso. (Hisp. & Cassid.)* : 334-336.

Material examined : 52 exs., Nandan Kanan (Puri Dist.), 31.1.1974, *S. Biswas* coll ; 14 exs., Balangir, 3-12.xi.1972, 7 exs., Sambalpur, 6.xi.1972, 15 exs., Titlagarh (Balangir Dist.), 15-16.xi.1972, 1 ex., Sambalpur, 4.xi.1972, 11 exs., Sundargarh, 28.x.1972., all *J. M. Julka* coll. ; 100 exs., Gobindapur, Keonjhar (Keonjhar Dist.), 20.ix.1972, 50 exs., Barsosan, Keonjhar, 27.ix.1972, 54 exs., Barabhadrapur, Keonjhar, 26.x.1972, 27 exs., Bhetrai, Keonjhar, 20.xi.1972, 49 exs., Silwan, Keonjhar, 25.ix.1972, 15 exs., Kshipur, Keonjhar, 19.ix.1972, 12 exs., Mandua, Keonjhar, 19.ix.1972, 20 exs., Bedand, Keonjhar, 20.ix.1972, 12 exs., Barahal, Keonjhar, 25 ix.1972, 1 ex., Jubilee town (Dhenkanal Dist.), 6.x.1972, all *K. Rai* coll. ; 3 exs., Banta Kumari Hills (Cuttack Dist.), 6.ii.1974, *S. Biswas* coll. ; 8 ex., Chandanpur, Bangriposi (Mayurbhanj Dist.) 14.xi.1972.

Distribution : India : Orissa (Nandan Kanan, Balangir, Titlagarh, Sambalpur, Keonjhar, Bangriposi, Jubilee Town in Dhenkanal Dist., Banta Kumari Hills in Cuttack Dist.), West Bengal, Assam, Meghalaya, Bihar, Karnataka, Tamil Nadu and Andaman Is. *Elsewhere* : Burma, South China, Sri Lanka, Vietnam, Indo-China.

* 61. *Laccoptera quadrimaculata* (Thunberg)

1789. *Cassida quadrimaculata* Thunberg, *Nov. Ins. Spec.*, 5 : 86.

1919. *Laccoptera quadrimaculata* : Maulik, *Fauna Brit. India, Col., Chrys. (Hisp. & Cassid.)* : 347-350.

Material examined : 2 exs., River Kurodhi, Barsuan, (Sundargarh Dist.), 13-15.ix.1972. *S. Khera* coll.

Distribution : India : Orissa (Barsuan in Sundargarh Dist.), West Bengal, Assam, Arunachal Pradesh, Sikkim, Meghalaya, Bihar, Uttar Pradesh, Karnataka, Kerala, Tamil Nadu and Andaman Islands. *Elsewhere* : Nepal, Burma, Taiwan, Indo-China, South China, Bhutan.

* 62. *Oocassida cruenta* (Fabricius)

1792. *Cassida cruenta* Fabricius, *Ent. Syst.* 1 : 293.

1919. *Oocassida cruenta* : Maulik : *Fauna Brit. India, Col., Chryso. (Hisp. & Cassid.)* : 356-357.

Material examined : 1 ex., Bhubaneswar, —.i.1983.

Distribution : India : Orissa (Bhubaneswar), West Bengal, Tamil Nadu.

63. *Oocassida pudibunda* Boheman

1856. *Cassida pudibunda* Boheman, *Cat. Col. Brit. Mus.*, 9 : 133.

1897. *Oocassida pudibunda* : Weise, *Dt. ent. Z.* : 110.

1919. *Oocassida pudibunda* : Maulik ; *Fauna Brit. India, Col., Chryso. (Hisp. & Cassid.)* : 358-359.

Material examined : 1 ex., Bank of Mahanadi (Sambalpur Dist.), 28.ix.1972, S. Khera coll. ; 1 ex., Bhubaneswar, —.i.1983.

Distribution : India : Orissa (Bhubaneswar, Sambalpur), Bihar, Uttar Pradesh and Maharashtra.

64. *Cassida* sp.

Material examined : 2 exs., Amlapara (Dhenkanal Dist.), 5.x.1972, K. Rai coll.

Remarks : The specific identification could not be confirmed, however one example is close to *C. subtilis* Weise and another *C. enervis* Boheman,

65. *Cassida circumdata* Herbst

1790. *Cassida circumdata* Herbst, *Natursyst. Kaf.*, 8 : 268.

1919. *Cassida circumdata* : Maulik, *Fauna Brit. India, Col., Chry. (Hisp. & Cassi.)* : 404-405.

Distribution : India : Orissa (Balighai near Puri), West Bengal, Kerala and Tamil Nadu. *Elsewhere* : Sri Lanka, South China, Taiwan, Indo-China.

Remarks : This species was not available in the present collection but Maulik (1919) reported it from Balighai (Orissa).

*66. *Chiridopsis septemnotata* (Boheman)

1855. *Coptocycla septemnotata* Boheman, *Mon. Cassid.*, 3 : 133.

1913. *Chirida septemnotata* : Maulik, *Rec. Ind. Mus.* : 133.

1981. *Chiridopsis septemnotata* : Kimoto, *Ent. Rev. Japan*, 36 (1) : 61.

Material examined : 1 ex., Charbati (Sambalpur Disr.), 27.ix.1972, S. Khera coll. : 4 exs., Sambalpur, 4-6.xi.1972, 3 exs., Titlagarh (Balangir Dist.), 16.xi.1972, 9 exs., Balangir, 3.xi.1972, J. M. Julka coll.

Distribution : India : Orissa (Charbati in Sambalpur Dist., Titlagarh, Balangir), West Bengal, Assam and Sikkim *Elsewhere* : Bhutan, Malaya.

SUMMARY

Sixtysix species belonging to thirtyseven genera distributed in nine subfamilies are reported in this paper. One new species *Strobiderus orissaeensis* is described. Thirtyone species are new records from the State (Orissa) and one species forms new combination. A running key for a Orissa Chrysomelidae has also been provided.

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REFERENCES

- JACOBY, M. 1908. The Fauna of British India, including Ceylon and Burma, Coleoptera—Chrysomelidae. Vol. 1 : 534 pp.
- KIMOTO, S. AND GRESSITT, J. L. 1966. The Chrysomelidae of the Ryukyu Archipelago. *Pac. Ins.*, 8 (2) : 467-577.
- KIMOTO, S. 1972. A list of the Chrysomelid beetles collected by Prof. K. Yasumatsu in India and Pakistan in 1963 (Col. : Chrysomelidae). *Ent. Rev. Japan*, 24 (1/2) : 43-48.
- MAULIK, S. 1919. The Fauna of British India, including Ceylon and Burma. Coleoptera—Chrysomelidae (Hispidinae & Cassidinae). xii+440 pp.
- MAULIK, S. 1926. The Fauna of British India, including Ceylon and Burma. Coleoptera—Chrysomelidae (Chrysomelinae & Halticinae) : xiii+442pp.
- MAULIK, S. 1936. The Fauna of British India, including Ceylon and Burma. Coleoptera—Chrysomelidae (Galerucinae) : xiv+648 pp.
- SCHERER, G. 1969. Die Alticinae Des Indischen Subkontinentes (Coleoptera—Chrysomelidae), *Pac. Ins. Monogr.*, 22 : 1-251.
- TAKIZAWA, H. 1983. Chrysomelid-beetles of India in the collection of the National Institute of Agricultural Sciences, Tsukuba. (Coleoptera). *Ent. Rev. Japan*, 38 (1) : 65-79.

INSECTA : DIPTERA

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INTRODUCTION

The state of Orissa physiographically includes parts of the Deccan plateau and plains alongside the coast of the Bay of Bengal. The climate is typically tropical, mainly favouring luxuriant growth of monsoonal, deciduous forests. Naturally, it is expected to harbour dual faunal representation admixed with transitional elements qualified by the true Oriental biogeographic entity.

Since very little is known of the Diptera fauna of Orissa, a recent collection made by one of us (P. Parui) is reported here so as to have a preliminary idea on the faunal characteristics. This comprises the following families : Stratiomyidae, Tabanidae, Bombyliidae, Syrphidae, Tephritidae, Otitidae, Sepsidae, Chloropidae, Ephydriidae, Muscidae, Calliphoridae and Sarcophagidae. The family Asilidae has, however, been reported elsewhere (Joseph & Parui, *in press*). For the only earlier works on the above groups, the reader is referred to Dover (1921) for the general dipterous insects, Senior-White (1930) for the Calliphoridae and Nandi (1977) for the Sarcophagidae.

SYSTEMATIC ACCOUNT

Family I. STRATIOMYIDAE

1. *Microchrysa calopa* Brunetti

1912. *Microchrysa calopa* Brunetti, *Rec. Indian Mus.*, 7 : 453.

1920. *Microchrysa calopa* : Brunetti, *Fauna Brit. India, Diptera* 2 : 88.

1975. *Microchrysa calopa* : James, *Cat. Diptera Oriental Region* 2 : 18.

Material examined : 2♂♂, 2♀♀, Hirakud, Sambalpur District, 22.viii.1983.

Remarks ; The species originally described from Assam and Bihar in India, is recorded for the first time from Orissa.

2. *Sargus metallinus* Fabricius

1805. *Sargus metallinus* Fabricius, *Syst. Antliat.* : 258.

1920. *Sargus metallinus* : Brunetti, *Fauna Brit. India, Diptera* 2 : 82.

1975. *Sargus metallinus* : James, *Cat. Diptera Oriental Region* 2 : 21.

Material examined : 1♂, 1♀, Sundargarh, Sundargarh District, 16.viii.1983 ; 1♀, Panderipani, Sundargarh District, 17.viii.1983.

Remarks : This is a widespread Oriental species (James, 1975). The species originally described from "Bengal" has so far been reported from Arunachal Pradesh in India (Datta & Chakraborti, 1985), and Indonesia (Aru islands, Borneo, Celebes, Java, Moluccas), Burma (Rangoon), Singapore, China (Shanghai) and Sri Lanka (Brunetti, 1920 ; James, 1975). This is, however, recorded for the first time from Orissa.

3. *Odontomyia kashmirensis* Brunetti

1920. *Odontomyia kashmirensis* Brunetti, *Fauna Brit. India, Diptera* 2 : 67.

1975. *Odontomyia kashmirensis* : James, *Cat. Diptera Oriental Region* 2 : 23.

Material examined : 1 ♂, Sundargarh, Sundargarh District, 16.viii.1983.

Remarks : The species has originally been described from Kashmir in India (Brunetti, 1920). This is recorded from Orissa for the first time.

4. *Oplodontha minuta* (Fabricius)

1794. *Stratiomys minuta* Fabricius, *Ent. Syst.* 4 : 268.

1920. *Odontomyia minuta* : Brunetti, *Fauna Brit. India, Diptera* 2 : 65.

1975. *Oplodontha minuta* : James, *Cat. Diptera Oriental Region* 2 : 24.

Material examined : 1 ♀, Sundargarh, Sundargarh District, 16.viii.1983.

Remarks : The species originally described from Tamil Nadu, has subsequently been recorded from Bihar, Orissa, Uttar Pradesh and West Bengal in India, and Sri Lanka (Brunetti, 1920 ; James, 1975).

5. *Tinda javana* (Macquart)

1838. *Beris javana* Macquart, *Mem. Soc. Sci. Agric. Lille*, 1838 : 192.

1920. *Tinda javana* : Brunetti, *Fauna Brit. India, Diptera* 2 : 30.

1975. *Tinda javana* : James, *Cat. Diptera Oriental Region* 2 : 42.

Material examined : 1 ♂, Nimidha, Dhenkanal District, 26.viii.1983.

Remarks : The species originally described from Java, has subsequently been reported to occur in Celebes, Lombok, Sumatra and Sumba in Indonesia and India (Andaman island, Assam, Bihar, Meghalaya and West Bengal) and Philippines (Brunetti, 1920 ; James, 1975). This is recorded here for the first time from Orissa.

Family II. TABANIDAE

6. *Chrysops pellucidus* Fabricius

1805. *Chrysops pellucida* Fabricius, *Syst. Antliat.* : 113.

1911. *Chrysops pellucida* : Ricardo, *Rec. Indian Mus.* 4 : 386.

1975. *Chrysops pellucidus* : Stone, *Cat. Diptera Oriental Region* 2 : 45.

Material examined : 1 ♂, Baripada, Balidiya, Mayurbhanj District, 9.viii.1983.

Remarks : The species has been reported from Tamil Nadu in India (Ricardo, 1911b ; James, 1975) and recorded here for the first time from Orissa.

7. *Tabanus (Tabanus) rubidus* Wiedemann

1821. *Tabanus rubidus* Wiedemann, *Dipt. exot.* 1 : 69.

1911. *Tabanus rubidus* : Ricardo, *Rec. Indian Mus.* 4 : 155.

1975. *Tabanus (Tabanus) rubidus* : Stone, *Cat. Diptera Oriental Region* 2 : 68.

Material examined : 2 ♀ ♀, Kapilas Deer Park, Dhenkanal District, 28.viii.1983.

Remarks : This is a widespread Oriental species originally described from "Bengal" (Ricardo 1911a ; Basu, Menon & Sen Gupta, 1952 ; Stone 1975 ; Datta & Biswas, 1977).

8. *Tabanus (Tabanus) triceps* Thunberg

1827. *Tabanus triceps* Thunberg, *Nova Acta Upsala* 9 : 59.

1981. *Tabanus triceps* : Burger & Thompson, *Proc. ent. Soc. Wash.*, 83 : 350.

Material examined : 1 ♀, Kapilas Deer Park, Dhenkanal District, 28.viii.1983.

Remarks : The species has been described from the Indian subcontinent and reported to occur in "Bengal", Karnataka, Kerala, Maharashtra, Orissa, Pondicherry and Tamil Nadu in India, and also in Pakistan and Sri Lanka (Burger & Thompson, 1981).

Family III. BOMBYLIIDAE

9. *Bombylius maculatus* Fabricius

1775. *Bombylius maculatus* Fabricius, *Syst. Ent.* : 803.

1920. *Bombylius maculatus* : Brunetti, *Fauna Brit. India, Diptera* 2 : 267.

1975. *Bombylius maculatus* : Bowden, *Cat. Diptera Oriental Region* 2 : 171.

Material examined : 2 ♂ ♂, Ashanput, Keonjhar District, 11. viii. 1983 ; 1 ♀, Sundargarh, Sundargarh District, 16.viii.1983 ; 1 ♂, Kapilas Deer Park, Dhenkanal District, 28.viii.1983.

Remarks : The species originally described from Tamil Nadu, has subsequently been recorded from Orissa (Brunetti, 1920 ; Bowden, 1975).

Family IV. SYRPHIDAE

10. *Episyrphus balteatus* (De Geer)

1776. *Musca balteata* De Geer, *Mem. pour. serv. Hist. Ins.* 6 : 116.
 1923. *Syrphus balteatus* : Brunetti, *Fauna Brit. India, Diptera* 3 : 82.
 1975. *Episyrphus balteatus* : Knutson, Thompson & Vockeroth, *Cat. Diptera Oriental Region* 2 : 314.

Material examined : 1 ♀, Sundargarh, Sundargarh District, 16.viii.1983.

Remarks : The species has been reported to occur in the entire Oriental Region and has also been recorded from Australia, Bonin island and the Palaearctic region (Knutson *et al.*, 1975). This is, however, recorded from Orissa in India for the first time. For other records in India, the reader is referred to the works by Datta & Chakraborti (1983 and 1986).

11. *Ischiodon scutellaris* (Fabricius)

1805. *Scaeva scutellaris* Fabricius, *Syst. Antliat.* : 252.
 1923. *Ischiodon scutellaris* : Brunetti, *Fauna Brit. India, Diptera* 3 : 97.
 1975. *Ischiodon scutellaris* : Knutson, Thompson & Vockeroth, *Cat. Diptera Oriental Region* 3 : 315.

Material examined : 1 ♂, Ashanput, Keonjhar District, 11.viii.1983 ; 1 ♂, Hirakud, Sambalpur District, 22.viii.1983.

Remarks : The species originally described from Tamil Nadu in India, has been reported to have wide distribution from south-east Asia to Japan and has also been recorded from Australia, Hawaii and Micronesia (Knutson *et al.*, 1975). This is recorded for the first time from Orissa. For other Indian records, the reader is referred to the works by Datta and Chakraborti (1983 and 1986).

12. *Paragus (Paragus) serratus* (Fabricius)

1805. *Mulio serratus* Fabricius, *Syst. Antliat.* : 186.
 1923. *Paragus serratus* : Brunetti, *Fauna Brit. India, Diptera* 3 : 31.
 1975. *Paragus (Paragus) serratus* : Knutson, Thompson & Vockeroth, *Cat. Diptera Oriental Region* 3 : 327.

Material examined : 3 ♀ ♀, Hirakud, Sambalpur District, 22.viii.1983.

Remarks : The species originally described from Tamil Nadu, occurs almost everywhere in India and has also been recorded from Borneo, Java, Nepal, Pakistan, Papua and Africa (Brunetti, 1923 ; Knutson *et al.*, 1975 ; Datta & Chakraborti, 1986).

13. *Ceriana ornatifrons* (Brunetti)

1915. *Ceria ornatifrons* Brunetti, *Rec, Indian Mus.*, **11** : 252.
 1923. *Ceria ornatifrons* : Brunetti, *Fauna Brit. India, Diptera* **3** : 331.
 1975. *Ceriana ornatifrons* : Knutson, Thompson & Vockeroth, *Cat. Diptera Oriental Region* **2** : 344.

Material examined : 1 ♀, Rengli, Sambalpur District, 21.viii.1983.

Remarks : The species originally described from Nepal, has subsequently been recorded from West Bengal in India and Sri Lanka (Brunetti, 1923 ; Knutson *et al.*, 1975). This is recorded from Orissa for the first time.

14. *Eristalinus (Eristalinus) arvorum* (Fabricius)

1787. *Syrphus arvorum* Fabricius, *Mantissa Insect.* **2** : 335.
 1923. *Eristalis arvorum* : Brunetti, *Fauna Brit. India, Diptera* **3** : 181.
 1975. *Eristalinus (Eristalinus) arvorum* : Knutson, Thompson & Vockeroth, *Cat. Diptera Oriental Region* **2** : 347.

Material examined : 2 ♂ ♂, 1 ♀, Rengli, Sambalpur District, 21.viii.1983.

Remarks : The species originally described from China, has been reported to occur throughout south-east Asia and has also been reported from Australia, Hawaii, Japan and Micronesia (Knutson *et al.*, 1975). This is, however, recorded for the first time from Orissa.

15. *Eristalinus (Eristalinus) obscuritarsis* (de Meijere)

1908. *Eristalis obscuritarsis* de Meijere, *Tijdschr. Ent.* **51** : 250.
 1923. *Eristalis obscuritarsis* : Brunetti, *Fauna Brit. India, Diptera* **3** : 190.
 1975. *Eristalinus (Eristalinus) obscuritarsis* : Knutson, Thompson & Vockeroth, *Cat. Diptera Oriental Region* **2** : 348 (As synonym of *E. laetus* (Wiedemann)).

Material examined : 1 ♀, Rengli, Sambalpur District, 21.viii.1983.

Remarks : The species has been reported to occur from Kashmir to Bangalore in India, and in Bangladesh, Java and Malaya (Brunetti, 1923 ; Knutson *et al.*, 1975). It was originally described from Singapore and Bombay. The species is valid ; for comments, see Datta & Chakraborti (1986).

16. *Eristalis polychromata* Brunetti

1923. *Eristalis polychromatus* Brunetti, *Fauna Brit. India, Diptera* **3** : 180.
 1975. *Eristalis polychromata* : Knutson, Thompson & Vockeroth, *Cat. Diptera Oriental Region* **2** : 353 (As unplaced species of *Eristalis* Latreille).

Material examined : 2 ♂ ♂, Sundargarh, Sundargarh District, 16.viii.1983.

Remarks : The species originally described from West Bengal, has so far been recorded only from Kerala in India (Brunetti, 1923 ; Knutson *et al.*, 1975 ; Datta & Chakraborti, 1986). This is recorded for the first time from Orissa.

17. *Phytomia (Phytomia) errans* (Fabricius)

1787. *Syrphus errans* Fabricius, *Mantissa Insect.* 2 : 337.

1923. *Megaspis errans* : Brunetti, *Fauna Brit. India, Diptera* 3 : 199.

1975. *Phytomia (Phytomia) errans* : Knutson, Thompson & Vockesoth, *Cat. Diptera Oriental Region 2* : 357.

Material examined : 1 ♂, Baripada, Mayurbhanj District, 7.viii.1983.

Remarks : The species originally described from China, has been reported to occur throughout south-east Asia and Japan (Brunetti, 1923 ; Knutson *et al.*, 1975). This is recorded for the first time from Orissa.

Family V. TEPHRITIDAE

18. *Gastrozona montana* Bezzi

1913. *Gastrozona montana* Bezzi, *Mem. Indian Mus.* 3 : 106.

1977. *Gastrozona montana* ; Hardy, *Cat. Diptera Oriental Region 3* : 94.

Material examined : 1 ♀, Bogchora, Dhenkanal District, 27.viii.1983.

Remarks : The species originally described from West Bengal, has subsequently been recorded from Meghalaya in India (Munro, 1938 ; Hardy, 1977). This is recorded for the first time from Orissa.

Family VI. OTITIDAE

19. *Physiophora aenea* (Fabricius)

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

1977. *Physiophora aenea* : Steyskal, *Cat. Diptera Oriental Region 3* : 167.

Material examined : 11 ♂♂, 19 ♀♀, Nimidha, Dhenkanal District, 26.viii.1983.

Remarks : The species originally described from India, has been reported to occur from Seychelles to Samoa, Hawaii to Australia, and North and South America (Steyskal, 1977). This has so far been reported to occur in India from West Bengal and most probably Assam. This is recorded for the first time from Orissa.

Family VII. SEPSIDAE

20. *Australosepsis niveipennis* (Becker)

1903. *Sepsis niveipennis* Becker, *Mitt. zool. Mus. Berl.* 2 (3) : 143.

1977. *Australosepsis niveipennis* : Zuska, *Cat. Diptera Oriental Region 3* : 175.

Material examined : 2 ♂♂, 2 ♀♀, Hirakud, Sambalpur District, 22.viii.1983.

Remarks : The species has wide distribution in the Oriental, Ethiopian and Australian regions (Zuska, 1977).

21. *Meroplius fasciculatus* (Brunetti)

1909. *Sepsis fasciculata* Brunetti, *Rec. Indian Mus.* 3 : 365.

1977. *Meroplius fasciculatus* : Züska, *Cat. Diptera Oriental Region* 3 : 177.

Material examined : 1 ♂, Lahamani Village, Sambalpur District, 24.viii.1983.

Remarks : The species originally described from Sri Lanka, has subsequently been recorded from Borneo, China, India (West Bengal), Java, Philippines, Taiwan, Thailand and New Guinea (Züska, 1977). It is recorded from Orissa for the first time.

22. *Sepsis indica* Wiedemann

1824. *Sepsis indica* Wiedemann, *Analecta Ent.* : 57.

1909. *Sepsis indica* : Brunetti, *Rec. Indian Mus.*, 3 : 357.

1977. *Sepsis indica* : Züska, *Cat. Diptera Oriental Region* 3 : 178.

Material examined : 1 ♂, Baripada, Balidiya, Mayurbhanj District, 9.viii.1983 ; 1 ♂, Nimidha, Dhenkanal District, 26.viii.1983.

Remarks : The species originally described from India, has subsequently been recorded from Bangladesh, Borneo, Burma, Celebes, China, Java, Lesser Sunda islands, Malaya, Nepal, Philippines, Sumatra, Sri Lanka, Taiwan and Vietnam and from Australasian region (Brunetti, 1909 ; Züska, 1977). In India, this has so far been recorded from Arunachal Pradesh, Assam, Kerala, Maharashtra, Sikkim and West Bengal, and hence this is a new record for Orissa.

23. *Sepsis nitens* Wiedemann

1824. *Sepsis nitens* Wiedemann, *Analecta Ent.* : 57.

1977. *Sepsis nitens* : Züska, *Cat. Diptera Oriental Region* 3 : 179.

Material examined : 1 ♂, Gondbari, Keonjhar District, 11.viii.1983 ; 3 ♂♂, Timadihi, Sundargarh District, 19.viii.1983 ; 1 ♂, Lahamani Village, Sambalpur District, 24.viii.1983.

Remarks : The species originally described from India, has subsequently been recorded from Java, Lesser Sunda islands, Philippines, Sri Lanka and Taiwan, and also from the Australasian region (Züska, 1977). In India, this has been reported to occur in Andhra Pradesh, Assam, Bihar, Madhya Pradesh, Tamil Nadu, Uttar Pradesh and West Bengal, and hence this is a new record for Orissa.

Family VIII. CHLOROPIDAE**24. *Pachylophus rufescens* (de Meijere)**

1904. *Myrmomorpha rufescens* de Meijere, *Bijdr. Dierk.* 17-18 : 113.

1977. *Pachylophus rufescens* : Sabrosky, *Cat. Diptera Oriental Region* 3 : 314.

Material examined : 1 ♀, Sagbahal, Sundargarh District, 18.viii.1983.

Remarks : The species originally described from Java, has subsequently been recorded from Burma, Bangladesh, Cambodia, China, India (including Orissa), Nepal, Philippines, Sri Lanka, Sumatra, Taiwan, Thailand, Vietnam and also Australia (Sabrosky, 1977).

Family IX. EPHYDRIDAE

25. *Paralimna hirticornis* de Meijere

1913. *Paralimna hirticornis* de Meijere, *Bijdr. Dierk.* 19 : 65.

1977. *Paralimna hirticornis* : Cogan & Wirth, *Cat. Diptera Oriental Region* 3 : 334.

Material examined : 1 ♂, Kapilas Deer Park, Dhenkanal District, 28.viii.1983.

Remarks : The species originally described from Saonel, New Guinea, has subsequently been recorded from Burma, India (Tamil Nadu), Nepal, Pakistan, Philippines, Sri Lanka and Taiwan, and from West Iran (Cogan & Wirth, 1977) and hence this is recorded here for the first time from Orissa.

26. *Paralimna lineata* de Meijere

1908. *Paralimna lineata* de Meijere, *Tijdschr. Ent.* 51 : 165.

1977. *Paralimna lineata* : Cogan & Wirth, *Cat. Diptera Oriental Region* 3 : 334.

Material examined : 1 ♂, Sagbahal, Sundargarh District, 18.viii.1983.

Remarks : The species originally described from Java, has subsequently been recorded from India (Tamil Nadu, Uttar Pradesh), Sri Lanka, Taiwan and Vietnam and Micronesia, Samoa and Seychelles islands (Cogan & Wirth, 1977). This is recorded for the first time from Orissa.

Family X. MUSCIDAE

27. *Orthelia coerulea* (Wiedemann)

1819. *Musca coerulea* Wiedemann, *Zool. Mag.* 3 : 23.

1965. *Orthelia coerulea* : Emden, *Fauna India, Diptera* 7 : 124.

Material examined : 3 ♂♂, 2 ♀♀, Baripada, Balidiya, Mayurbhanj District, 9.viii.1983.

Remarks : The species originally described from Java, has been reported to occur in Arunachal Pradesh, Assam, Bihar, Sikkim, southern India, and Uttar Pradesh in India and also from Burma, China, Indonesia to Australia, Japan, Malaya, Nepal, Siam, Solomon islands, Sri Lanka and Taiwan (Emden, 1965 ; Joseph & Parui, 1977 ; Datta & Chakraborti, 1985). This is recorded for the first time from Orissa.

28. *Atherigona (Atherigona) pulla* (Wiedemann)

1830. *Coenosia pulla* Wiedemann, *Aussereurop. zweifl. Insekt.* 2 : 441.

1977. *Atherigona (Atherigona) pulla* : Pont, *Cat. Diptera Oriental Region*, 3 : 494.

Material examined : 7 ♂♂, 8 ♀♀, Timadehi, Sundargarh District, 19.viii.1983 ; 1 ♂, Lahamani Village, Sambalpur District, 24.viii.1983.

Remarks : The species originally described from Tamil Nadu, has subsequently been recorded from Bihar and Karnataka in India and also from China and Sri Lanka (Pont, 1977). This is recorded for the first time from Orissa.

Family XI. CALLIPHORIDAE**29. *Bengalia bezzii* Senior-White**

1923. *Bengalia bezzii* Senior-White, *Spolia zeylan.* 12 : 306.

1940. *Bengalia bezzii* : Senior-White, Aubertin & Smart, *Fauna Brit. India, Diptera* 6 : 99.

1977. *Bengalia bezzii* : James, *Cat. Diptera Oriental Region* 3 : 528.

Material examined : 1 ♂, Asanput, Keonjhar District, 11.viii.1983.

Remarks : The species originally described from Sri Lanka, has subsequently been reported to occur in India, Java, Malaya, Pakistan and Singapore (Senior-White *et al.*, 1940 ; James, 1977). This is, however, recorded for the first time from Orissa.

30. *Hemipyrellia pulchra* (Wiedemann)

1830. *Musca pulchra* Wiedemann, *Aussereurop. zweifl. Insekt.* 2 : 406.

1940. *Hemipyrellia pulchra* : Senior-white, Aubertin & Smart, *Fauna Brit. India, Diptera* 6 : 44.

1977. *Hemipyrellia pulchra* : James, *Cat. Diptera Oriental Region* 3 : 533.

Material examined : 1 ♂, Baripada, Balidiya, Mayurbhanj District, 9.viii.1983 ; 1 ♀, Kapilas Deer Park, Dhenkanal District, 28.viii.1983.

Remarks : The species has been reported to occur in India (Bihar, Pondicherry, Punjab, Tamil Nadu, Uttar Pradesh and West Bengal), and probably in Java (Senior-White *et al.*, 1940 ; James, 1977). This is recorded for the first time from Orissa. The type-locality of the species is not definitely known.

31. *Chrysomya megacephala* (Fabricius)

1794. *Musca megacephala* Fabricius, *Syst. Ent.* 4 : 317.

1940. *Chrysomyia megacephala* : Senior-White, Aubertin & Smart, *Fauna Brit. India, Diptera* 6 : 138.

1977. *Chrysomya megacephala* : James, *Cat. Diptera Oriental Region* 3 : 542.

Material examined : 1 ♀, Hirakud, Sambalpur District, 22.viii.1983.

Remarks : The species has been reported to occur widely in the Oriental and Australasian regions, and also in China and Japan of the Palearctic region and in the Malagasy subregion of the Ethiopian region (Zumpt, 1975). The type-locality of the species is not definitely known.

32. *Idiella euidielloides* Senior-White

1923. *Idiella euidielloides* Senior-White, *Mem. Dep. Agric. India* (ent. ser.) 7 : 166.

1940. *Stomorphina euidielloides* : Senior-White, Aubertin & Smart, *Fauna Brit. India, Diptera* 6 : 196.

1977. *Idiella euidielloides* : James, *Cat. Diptera Oriental Region* 3 : 545.

Material examined : 1 ♂, Ashanput, Keonjhar District, 11.viii.1983.

Remarks : The species originally described from Meghalaya, has subsequently been recorded from Kerala, Sikkim and West Bengal in India and has also been reported to occur in Java, Malaya, Philippines, Sri Lanka, Taiwan, Thailand and Timor (Senior-White *et al.*, 1940 ; Joseph & Parui, 1977, and *in press* ; and James, 1977). This is, however, recorded for the first time from Orissa.

33. *Idiella mandarina* (Wiedemann)

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

1940. *Stomorphina mandarina* : Senior-White, Aubertin & Smart, *Fauna Brit India, Diptera* 6 : 199.

1977. *Idiella mandarina* : James, *Cat. Diptera Oriental Region* 3 : 546.

Material examined : 1 ♂, Sundargarh, Sundargarh District, 16.viii.1983.

Remarks : The species originally described from China, has subsequently been recorded from Borneo, Burma, India, Sri Lanka, Sumatra, Taiwan, Thailand, Timor and the Key islands (Senior-White *et al.*, 1940 ; James, 1977). This is known in India from Assam, Bihar, Gujarat, Haryana, Kerala, Madhya Pradesh, Maharashtra, Uttar Pradesh and West Bengal and hence it is a new record for Orissa.

34. *Metallea notata* van der Wulp

1880. *Metallea notata* van der Wulp, *Tijdschr. Ent.* 23 : 175.

1940. *Metallea notata* : Senior-white, Aubertin & Smart, *Fauna Brit. India, Diptera* 6 : 180.

1977. *Metallea notata* : James, *Cat. Diptera Oriental Region* 3 : 552.

Material examined : 1 ♂, 1 ♀, Sundargarh, Sundargarh District, 16.viii.1983 ; 1 ♂, 1 ♀, Lahamani Village, Sambalpur District, 24.viii.1983.

Remarks : The species originally described from Java, has subsequently been recorded from China, India (Andaman islands, Meghalaya, Orissa, Uttar Pradesh), Malaya and Sri Lanka and from Africa (Senior-White *et al.*, 1940 ; James, 1977).

Family XII. SARCOPHAGIDAE

35. *Parasarcophaga (Parasarcophaga) albiceps* (Meigen)

1826. *Sarcophaga albiceps* Meigen, *Syst. Besch. europ. zweifl. Insekt.* 5 : 22.
1940. *Sarcophaga albiceps* : Senior-White, Aubertin & Smart, *Fauna Brit. India, Diptera* 6 : 242.
1977. *Parasarcophaga (Parasarcophaga) albiceps* : Lopes, Kano, Shinonaga & Kurahashi, *Cat. Diptera Oriental Region* 3 : 570.

Material examined : 1 ♂, Baripada, Mayurbhanj District, 7.viii.1983 ; 4 ♂ ♂, Ashanput, Keonjhar District, 11.viii.1983 ; 3 ♂ ♂, 6 ♀ ♀, Rankie, Keonjhar District, 12.viii.1983 ; 6 ♂ ♂, Sundargarh, Sundargarh District, 16.viii.1983 ; 1 ♂, Sundargarh, Sundargarh District, 17.viii.1983 ; 1 ♂, 2 ♀ ♀, Nimidha, Dhenkanal District, 26.viii.1983 ; 1 ♂, 5 ♀ ♀, Bogchora, Dhenkanal District, 27.viii.1983 ; 1 ♂, 1 ♀, Kapilas Deer Park, Dhenkanal District, 28.viii.1983.

Remarks : The species has been reported to occur throughout the Oriental Region and has also been recorded from Bismarck Archipelago, Europe, Hawaii, Japan, Korea, New Britain, New Guinea and Solomon islands (Senior-White *et al.*, 1940 ; Lopes *et al.*, 1977 ; Nandi, 1977). The type-locality of the species is Europe.

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

1868. *Sarcophaga dux* Thomson, *Dipt. Eugen. Reise* : 540.
1940. *Sarcophaga dux* : Senior-White, Aubertin & Smart, *Fauna Brit. India, Diptera* 6 : 266.
1977. *Parasarcophaga (Liosarcophaga) dux* : Nandi, *Rec. zool. Surv. India*, 73 : 214.

Material examined : 1 ♂, 1 ♀, Bogchora, Dhenkanal District, 27.viii.1983.

Remarks : The species originally described from Hawaii, has subsequently been reported to occur in Europe, Mesopotamia, India (Arunachal Pradesh, Bihar, Maharashtra, Orissa, Punjab, Tamil Nadu, Uttar Pradesh, West Bengal), Bangladesh, Sri Lanka, Java, Bali, Philippines, Taiwan and also in the Australian, Nearctic and Ethiopian regions (Senior-White *et al.*, 1940 ; Nandi, 1977).

37. *Iranihindia futilis* (Senior-White)

1924. *Sarcophaga futilis* Senior-White, *Rec. Indian Mus.* 26 (3) : 246.
1940. *Sarcophaga futilis* : Senior-White, Aubertin & Smart, *Fauna Brit. India, Diptera* 6 : 257.
1977. *Iranihindia futilis* : Lopes, Kano, Shinonaga & Kurahashi, *Cat. Diptera Oriental Region* 3 : 580.

Material examined : 1 ♂, Sagbahal, Sundargarh District, 18.viii.1983, 1 ♂, Lahamani Village, Sambalpur District, 24.viii.1983.

Remarks : The species originally described from Sri Lanka, has subsequently been recorded from Burma and India (Assam, Bihar, Maharashtra, Orissa, Uttar Pradesh and West Bengal) (Senior-White *et al.*, 1940 ; Lopes *et al.*, 1977 ; Nandi, 1977).

38. *Iranihindia martellata* (Senior-White)

1924. *Sarcophaga martellata* Senior-White, *Rec. Indian Mus.* 26 (3) : 247.

1940. *Sarcophaga martellata* : Senior-White, Aubertin & Smart, *Fauna Brit. India, Diptera* 6 : 258.

1977. *Iranihindia martellata* : Lopes, Kano, Shinonaga & Kurahashi, *Cat. Diptera Oriental Region 3* : 580.

Material examined : 1♂, Ashanput, Keonjhar District, 11.viii.1983 ; 1♂, Hirakud, Sambalpur District, 22.viii.1983.

Remarks : The species originally described from Sri Lanka, has subsequently been reported to occur in Bihar, Karnataka, Kerala, Maharashtra, Orissa, Tamil Nadu and West Bengal in India (Senior-White *et al.*, 1940 ; Lopes *et al.*, 1977 ; Nandi 1977).

39. *Iranihindia martellatoides* (Baranov)

1931. *Sarcophaga martellatoides* Baranov, *Konowia* 10 : 114.

1940. *Sarcophaga martellatoides* : Senior-White, Aubertin & Smart, *Fauna Brit. India, Diptera* 6 : 259.

1977. *Iranihindia martellatoides* : Lopes, Kano, Shinonaga & Kurahashi, *Cat. Diptera Oriental Region 3* : 580.

Material examined : 1♂, Sundargarh, Sundargarh District, 16.viii.1983.

Remarks : The species originally described from Sri Lanka, has subsequently been recorded from Orissa and West Bengal in India (Senior-White *et al.*, 1940 ; Lopes *et al.*, 1977 ; Nandi, 1977).

GENERAL REMARKS ON DISTRIBUTION

The foregoing account clearly indicates that the Diptera fauna of Orissa was very little known, and it may need still a thorough and intensive exploration for a fuller knowledge on the diversity of Diptera of the state. With the present knowledge, it would not be proper to make any zoogeographical interpretation. Of 39 species reported here, 19 are known to occur in other zoogeographical regions also ; 14 are confined to the Oriental region only and 6 do not extend beyond the Indian territory. There appears no probability of endemism of any species in Orissa.

SUMMARY

The paper deals with 39 species under 31 genera belonging to 12 families (Brachycera and Cyclorrhapha), of which 25 species are recorded for the first time from Orissa.

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REFERENCES

- BASU, B. C., MENON, B. M. AND SENGUPTA, C. M. 1952. Regional distribution of *Tabanus* flies in India and its relationship to the incidence of surra. *Indian J. Vet. Anim. Husb.*, **22** : 273-292.
- BOWDEN, J. 1975. Family Bombyliidae. In M. D. Delfinado and D. E. Hardy (eds.) : *A Catalog of Diptera of the Oriental Region*, **2** : 165-184. Univ. Hawaii press, Honolulu.
- BRUNETTI, E. 1909. New Oriental Sepsinae. *Rec. Indian Mus.*, **3** : 343-372.
- BRUNETTI, E. 1912. New Oriental Diptera. *Rec. Indian Mus.*, **7** : 445-513.
- BRUNETTI, E. 1920. *The Fauna of British India including Ceylon and Burma*, Diptera, Brachycera, **1** : ix+401 pp., pls. I-IV. Taylor and Francis, London.
- BRUNETTI, E. 1923. *The Fauna of British India including Ceylon and Burma*, Diptera, **3** : xi+424 pp., pls. I-VI. Taylor and Francis, London.
- BURGER, J. F. AND THOMPSON, F. C. 1981. The *Tabanus striatus* complex (Diptera : Tabanidae) : A revision of some Oriental horse fly vectors of surra. *Proc. ent. Soc. Wash.*, **83** : 339-358.
- COGAN, B. H. AND WIRTH, W. W. 1977. Family Ephydriidae. In M. D. Delfinado and D. E. Hardy (eds.) : *A Catalog of Diptera of the Oriental Region*, **3** : 321-339. Univ. Hawaii Press, Honolulu.
- DATTA, M. AND BISWAS, S. 1977. A preliminary study of the insect fauna of Meghalaya, India. *12. Proc. Indian Acad. Sci.*, (B) **86** : 127-133.
- DATTA, M. AND (Miss) CHAKRABORTI, M. 1983. On a collection of flower flies (Diptera : Syrphidae) with new records from Jammu and Kashmir. *Rec. zool. Surv. India*, **81** : 237-253.

- DATTA, M. AND (Miss) CHAKRABORTI, M. 1985. Insecta : Diptera. In Fauna of Namdapha : Arunachal Pradesh. *Rec. zool. Surv. India*, **82** : 231-252.
- DATTA, M. AND CHAKRABORTI (MUKHERJEE), M. 1986. On collections of flower flies (Diptera : Syrphidae) from south India. *Rec. zool. Surv. India*, **83** : 53-67.
- DOVER, C. 1921. The fauna of an island in Chilka Lake : The Dipterous insects of Barkuda island. *Rec. Indian Mus.*, **22** : 393-396.
- EMDEN, F. I. V. 1965. *The Fauna of India and the adjacent countries*, Diptera, Muscidae, 7 (I) : xiv+642 pp. Manager of Publications, Government of India, Delhi.
- HARDY, D. E. 1977. Family Tephritidae. In M. D. Delfinado and D. E. Hardy (eds.) : *A Catalog of Diptera of the Oriental Region*, **3** : 44-134. Univ. Hawaii Press, Honolulu.
- JAMES, M. T. 1975. Family Stratiomyidae. In M. D. Delfinado and D. E. Hardy (eds.) : *A Catalog of Diptera of the Oriental Region*, **2** : 14-42. Univ. Hawaii Press, Honolulu.
- JAMES, M. T. 1977. Family Calliphoridae. In M. D. Delfinado and D. E. Hardy (eds.) : *A Catalog of Diptera of the Oriental Region*, **3** : 526-556. Univ. Hawaii Press, Honolulu.
- JOSEPH, A. N. T. AND PARUI, P. 1977. On a small collection of Diptera from Chota Nagpur, Bihar. *Rec. zool. Surv. India*, **72** : 227-238.
- JOSEPH, A. N. T. AND PARUI, P. Diptera from Silent Valley. *Rec. zool. Surv. India (in press)*.
- JOSEPH, A. N. T. AND PARUI, P. On a collection of Asilidae (Diptera) from Orissa, India. *Bull. zool. Surv. India, (in press)*.
- KNUTSON, L. V., THOMPSON, F. C. AND VOCKEROTH, J. R. 1975. Family Syrphidae. In M. D. Delfinado and D. E. Hardy (eds.) : *A Catalog of Diptera of the Oriental Region*, **2** : 307-374. Univ. Hawaii Press, Honolulu.
- LOPES, H. D., KANO, R., SHINONAGA, S. AND KURAHASHI, H. 1977. Family Sarcophagidae. In M. D. Delfinado and D. E. Hardy (eds.) : *A Catalog of Diptera of the Oriental Region*, **3** : 557-583. Univ. Hawaii Press, Honolulu.
- MUNRO, H. K. 1938. Studies on Indian Trypetidae (Diptera). *Rec. Indian Mus.*, **40** : 21-37.
- NANDI, B. C. 1977. Sarcophagid flies from Orissa, India (Diptera : Sarcophagidae). *Rec. zool. Surv. India*, **73** : 211-216.

- PONT, A. C. 1977. Family Muscidae. In M. D. Delfinado and D. E. Hardy (eds.) : *A Catalog of Diptera of the Oriental Region*, 3 : 451-523. Univ. Hawaii Press, Honolulu.
- RICARDO, G. 1911a. A revision of the species of *Tabanus* from the Oriental Region, including notes on species from surrounding countries. *Rec. Indian Mus.*, 4 : 111-258.
- RICARDO, G. 1911b. A revision of the Oriental species of the genera of the family Tabanidae other than *Tabanus*. *Rec. Indian Mus.*, 4 : 321-397.
- SABROSKY, C. W. 1977. Family Chloropidae. In M. D. DELFINADO AND D. E. HARDY (eds.) : *A Catalog of Diptera of the Oriental Region*, 3 : 277-319, Univ. Hawaii Press, Honolulu.
- SENIOR-WHITE, R., AUBERTIN, D. AND SMART, J. 1940. *The Fauna of British India including the remainder of the Oriental Region*, Diptera, Calliphoridae, 6 : ix+288 pp., Taylor and Francis, London.
- STEYSKAL, G. C. 1977. Family Micropezidae. In M. D. DELFINADO AND D. E. HARDY (eds.) : *A Catalog of Diptera of the Oriental Region*, 3 : 12-20. Univ. Hawaii Press, Honolulu.
- STONE, A. 1975. Family Tabanidae. In M. D. DELFINADO AND D. E. HARDY (eds.) : *A Catalog of Diptera of the Oriental Region*, 2 : 43-81. Univ. Hawaii Press, Honolulu.
- ZUMPT, F. 1965. Myiasis in man and animals in the world, xv+267 pp., Butterworth & Co. Ltd, London.
- ZUSKA, J. 1977. Family Sepsidae. In M. D. DELFINADO AND D. E. HARDY (eds.) : *A Catalog of Diptera of the Oriental Region*, 3 : 174-181. Univ. Hawaii Press, Honolulu.

ARANEAE-SPIDERS (Families : ARANEIDAE, GNAPHOSIDAE AND SALTICIDAE)

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INTRODUCTION

Pocock (1900) in the Fauna of British India, Arachnida has not mentioned of any spiders species from Orissa. Gravely (1921, 1931) has reported 48 species belonging to 15 families from the State. Tikader and Malhotra (1980) and Tikader (1982) have published fauna volumes on the families Thomisidae and Lycosidae (Volume—I) and on Araneidae and Gnaphosidae (Volume—II), under the “Fauna of India” series, giving a good account of the species known till date with their distribution and present taxonomic position. They have reported another 8 species from the State.

As such 56 species belonging to 15 families of spiders were so far known from the state of Orissa.

Studies on spider fauna of different states and regions of the Indian Union have received some good attention and spiders of Sikkim (Tikader, 1970), of Andaman and Nicobar Islands (Tikader, 1977) and of Calcutta and vicinity (Tikader and Biswas, 1981) have been worked out.

The present work on the study of collections of spiders made during the survey of Orissa state deals with the families Araneidae, Gnaphosidae and Salticidae and as many as 31 species are reported ; out of which 6 were already known and 25 are new records.

Thus 81 species of spiders under 17 families are now known from the state. A list of which is given at the end of this contribution.

TAXONOMIC ACCOUNT

Family I. ARANEIDAE

Genus 1. *Gasteracantha* Sundevall

1. *Gasteracantha kuhlii* C. L. Koch

1838. *Gasteracantha kuhlii* C. L. Koch, *Die Arachniden*, 4 : 20.

1859. *Plectana leucomelas* : Doleschall, *Act. Soc. Ind. Neerl.*, 5 (5) : 42.

1970. *Gasteracantha leucomelaena* : Tikader, *Rec. zool. Surv. India*, 64 (1-4) : 40.

1982. *Gasteracantha kuhlii* : Tikader, *Fauna of India, spiders : Araneae* II (1) : 59-61.

Material examined : 1 ♀, Dankana, Dist. Puri, 19.iii.1974, coll. R. K. Kacker.

Distribution : India : Orissa (new record), West Bengal, Bihar, Assam, Andaman and Nicobar Islands, Sikkim ; Bhutan ; Burma ; Malaysia and Japan.

Genus 2. *Leucauge* White

Key to the species of genus *Leucauge* White

Paired tubercles on dorsum and median caudal tubercle rudimentary	...	<i>celebesiana</i>
Paired tubercle on dorsum and median caudal tubercle highly prominent	...	<i>decorata</i>

2. *Leucauge celebesiana* (Walckenaer)

1841. *Tetragnatha celebesiana* Walckenaer, *Hist. Nat. Ins. Apt.*, 2 : 222.

1982. *Leucauge celebesiana* : Tikader, *Fauna of India, Spiders : Araneae* II (1) : 83-85.

Material examined : 1 ♀, Bolangir, 12.xi.1972, coll. J. M. Julka.

Distribution : India : Orissa (new record), West Bengal, Meghalaya, Tamil Nadu, Assam, Maharashtra, Sikkim ; Sri Lanka and China.

3. *Leucauge decorata* (Blackwall)

1864. *Tetragnatha decorata* Blackwall, *Ann. Mag. nat. Hist.*, 14 (3) : 44.

1982. *Leucauge decorata* : Tikader, *Fauna of India, Spiders : Araneae* II (1) : 78-80.

Material examined : 1 ♀, Jeypore, Dist. Koraput, 3.xii.1973, coll. V. K. Premkumar ; 2 ♀, Tikarpara, Dist. Dhenkanal, 29.xi.1972, coll. J. K. Sen & party ; 1 ♀, Dhanupali, Dist. Sambalpur, 22.xii.1971, coll. P. K. Maiti ; 2 ♀, Forest Rest House Chandili, Dist. Koraput, 26.xi.1973, coll. D. P. Sanyal.

Distribution : India : Orissa, West Bengal, Bihar, Assam, Andaman and Nicobar Islands, Sikkim ; Burma ; Malaysia and Japan.

Genus 3. *Nephila* Leach

4. *Nephila maculata* (Fabricius)

1793. *Aranea maculata* Fabricius, *Ent. Syst.*, 2 : 425.

1982. *Nephila maculata* : Tikader, *Fauna of India, Spiders : Araneae* II (1) : 97-99.

Material examined : 1 ♀, Chotkei, Dist. Dhenkanal, 27.xi.1972, coll. J. K. Sen & party ; 4 ♀, Champagarh, near Lulung Forest Bungalow, Dist. Baripada, 9.xi.1972, coll. J. K. Sen & party ; 2 ♀, Purnakot, Dist. Dhenkanal, 28.xi.1972, coll. J. K. Sen & party ; 1 ♀, Tikarpara, Dist. Dhenkanal, 29.xi.1972, coll. J. K. Sen & party ; 1 ♀, Badrama, Dist. Sambalpur, 25.xii.1972, coll. A. K. Mandal ; 1 ♀, Barsuan, Dist. Sundargarh, 19.iii.1972, coll. S. Khera & party.

Distribution : India : Orissa (new record), West Bengal, Uttar Pradesh, Madhya Pradesh, Gujarat, Karnataka, Assam, Maharashtra, Sikkim, Andaman and Nicobar Islands, Tamil Nadu ; and also Burma, Sri Lanka, China, Australia, Malaysia, Japan and New Guinea.

Genus 4. *Argiope* Audouin

Key to the species of genus *Argiope* Audouin

Dorsum chalk-white in colour, provided with brown transverse band and three pairs of sigilla	...	<i>anasuja</i>
Dorsum yellowish brown in colour, provided with yellow transverse bands and five pairs of sigilla	...	2
2. Labium slightly wider than long ; maxillae broader in front, with blackish distal end	...	<i>catenulata</i>
Labium not wider than long ; maxillae roundish in shape, with dark brown proximal end	...	<i>pulchella</i>

5. *Argiope anasuja* Thorell

1887. *Argiope anasuja* Thorell, *Annali. Mus. civ. Stor. nat.*, Genova, 25 : 152.

1982. *Argiope anasuja* : Tikader, *Fauna of India, Spiders : Araneae* II (1) : 127-129.

Material examined : 1 ♀, Dhanupali, Dist. Sambalpur, 22.xii.1971, coll. P. K. Maiti.

Distribution : India : Orissa, Tamil Nadu, Karnataka, Maharashtra, Bihar, West Bengal, also Sri Lanka and Pakistan.

6. *Argiope catenulata* (Doleschall)

1859. *Epeira catenulata* Doleschall, *Act. Soc. Ind. Neerl.*, 5 : 30.

1982. *Argiope catenulata* : Tikader, *Fauna of India, Spiders : Araneae* II (1) : 121-123.

Material examined : 1 ♀, Baripada, Dist. Mayurbhanj, 19.ix.1972, coll. Y. Chaturvedi ; 1 ♀, Rest House Chandili, Dist. Koraput, 27.xi.1973, coll. D. P. Sanyal ; 1 ♀, Balugaon, Dist. Puri, 20.xii.1960, coll. B. S. Lamba ; 1 ♀, Kaliyugeshwar Island, Chilka Lake, Dist. Puri, 19.iii.1974, coll. R. K. Kacker ; 1 ♀, Madhupatna, Dist. Cuttack, 19.i.1974, coll. S. Biswas ; 1 ♀, Botanical Park, Nandankanan, Dist. Puri, 23.iii.1974, coll. R. K. Kacker ; 2 ♀, Dhanupali, Dist. Sambalpur, 22.xii.1971, coll. P. K. Maiti ; 1 ♀, Kosofal, Chandipur, Dist. Balasore, 24.i.1972, coll. V. K. Premkumar ; 1 ♀, Circuit House Compound, Dist. Puri, 15.iii.1973, coll. V. K. Premkumar ; 1 ♀, Kotagarh, Dist. Phulabani, 14.xii.1973, coll. D. P. Sanyal ; 3 ♀, Nandankanan Bio-Park, Dist. Cuttack, 24.i.1975, coll. S. Biswas ; 1 ♀, Kathpal, Dist. Mayurbhanj, 12.ii.1976, coll. R. L. Chowdhury ; 1 ♀, Rangamati, Kathpal, Dist. Mayurbhanj, 16.ii.1976, coll. R. L. Chowdhury ; 1 ♀, Near Court,

Dist. Sambalpur, 26.ix.1972, coll. *S. Khera & party* ; 1 ♀ , Puri Water Works, Dist. Puri, 15.iv.1972, coll. *Y. Chaturvedi* ; 2 ♀ , Raghunathpur, Nandankanan, Dist. Cuttack, 25.iii.1974, coll. *R. K. Kacker*.

Distribution : India : Orissa (new record), West Bengal, Andra Pradesh, Andaman and Nicobar Islands ; Sri Lanka ; Burma.

7. *Argiope pulchella* Thorell

1881. *Argiope pulchella* Thorell, *Annali Mus. civ. Stor. nat.*, Genova, 18 : 74.

1982. *Argiope pulchella* : Tikader, *Fauna of India, Spiders : Araneae* II (1) : 129-131.

Material examined : 1 ♀ , Barkuda Island, Chilka Lake, Dist. Ganjam, 22.iv.1920, coll. *C. Dover* ; 1 ♀ , Jenabil, Dist. Mayurbhanj, 20.iii.1973, coll. *S. K. Gupta* ; 1 ♀ , Berbera, Dist. Puri, 6.i.1978. coll. *J. M. Dasgupta* ; 2 ♀ , Jurakaman, Rampura, Dist. Kalahandi, 9.xii.1973, coll. *D. P. Sanyal* ; 1 ♀ , Badrama Reserve Forest, Dist. Sambalpur, 5.vi.1972, coll. *D. P. Sanyal*.

Distribution : India : Orissa, West Bengal, Madhya Pradesh, Assam, Maharashtra, Tamil Nadu, Andaman and Lakshadwip Islands, also Burma and Malay Peninsula.

Genus 5. *Cyrtophora* Simon

8. *Cyrtophora citricola* (Forsk.)

1775. *Aranea citricola* Forskal, *Descriptions animalium* : 86.

1982. *Cyrtophora citricola* : Tikader, *Fauna of India, Spiders : Araneae* II (1) : 180-182.

Material examined : 2 ♀ , Dhanupali, Dist. Sambalpur, 22.xii.1971, coll. *P. K. Maiti*.

Distribution : India : Orissa (new record), West Bengal, Karnataka, Tamil Nadu, Maharashtra, Assam, Madhya Pradesh, Punjab, Rajasthan, Gujarat ; also Burma, Sri Lanka, Australia, Madagascar, Malaysia, Egypt, Africa and Europe.

Genus 6. *Larinia* Simon

9. *Larinia phtisica* (L. Koch)

1871. *Epeira phtisica* L. Koch, *Die Arachniden Australiens* I (1) : 193.

1982. *Larinia phtisica* : Tikader, *Fauna of India, Spiders : Araneae* II (1) : 208-209.

Material examined : 1 ♀ , Barsuan, Dist. Sundargarh, 12.xi.1972, coll. *S. Khera & party* ; 1 ♀ , Chilka Lake, March 1910, coll. *N. Annandale*.

Distribution : India : Orissa (new record), West Bengal, Gujarat and also Australia and New Guinea.

Genus 7. *Neoscona* SimonKey to the species of genus *Neoscona* Simon

1. Abdomen elliptical in shape ; brownish white in colour and provided with conspicuous mid-longitudinal chalk-white broad band	...	<i>molemensis</i>
Abdomen sub-triangular in shape ; dark brown in colour and provided with club-shaped greenish white band	...	...
2. Cephalic region provided with a conspicuous dark brown V-shaped patch	...	<i>mukerjei</i>
Cephalic region not provided with a conspicuous dark brown V-shaped patch	...	3
3. Epigyne with a stout and triangular scape provided with a pair of inconspicuous lateral lobes and without any constriction	...	<i>nautica</i>
Epigyne with long and longitudinal scape provided with a pair of conspicuous lateral lobes and with prominent constriction	...	4
4. Labium brownish in colour ; maxillae broader in shape	...	<i>rumpfi</i>
Labium dark brown in colour ; maxillae longer than wide	...	<i>theis</i>

10. *Neoscona molemensis* Tikader & Bal

1981. *Neoscona molemensis* Tikader & Bal, *Rec. zool. Surv. India, Occ. Pap.*, No. 24 : 22.

1982. *Neoscona molemensis* : Tikader, *Fauna of India, Spiders : Araneae* II (1) : 257-259.

Material examined : 1 ♀, Khasra Forest, Dist. Sambalpur, 26.xii.1971, coll. P. K. Maiti.

Distribution : India Orissa (new record), Goa.

11. *Neoscona mukerjei* Tikader

1980. *Neoscona mukerjei* Tikader, *Proc. Indian Acad. Sci.*, 89 : (8) : 247.

1982. *Neoscona mukerjei* : Tikader, *Fauna of India, Spiders : Araneae* II (1) : 248-253.

Material examined : 1 ♀, Ranibagicha, Sundargarh, 21.ix.1972, coll. S. Khera & party.

Distribution : India : Orissa (new record), West Bengal, Maharashtra.

12. *Neoscona nautica* (L. Koch)

1875. *Epeira nautica* L. Koch, *Aegypt. Abyssin Arach. Jickeli* : 17.

1982. *Neoscona nautica* : Tikader, *Fauna of India, Spiders : Araneae* II (1) : 242.

Material examined : 1 ♀, Near Court Area, Dist. Sambalpur, 26.ix.1972, coll. S. Khera & party.

Distribution : India : Orissa (new record), West Bengal, Maharashtra, Gujarat, Meghalaya ; Burma ; Pakistan and North America.

13. *Neoscona rumpfi* (Thorell)

1887. *Araneus rumpfi* Thorell, *Annali Mus. civ. Stor. nat.*, Genova, **13** : 296.

1982. *Neoscona rumpfi* : Tikader, *Fauna of India, Spiders : Araneae* II (1) : 253-255.

Material examined : 1 ♀, Near Court, Sambalpur, 26.ix.1972, coll. S. Khera & party.

Distribution : India : Orissa, West Bengal, Maharashtra. Karnataka, Andhra Pradesh, Tamil Nadu ; Sri Lanka ; Burma ; Pakistan. An Indo Austro-Malaysian sp.

14. *Neoscona theis* (Walckenaer)

1841. *Epeira theis* Walckenaer, *Hist. Nat. Ins. Apt.* **2** : 53.

1982. *Neoscona theis* : Tikader, *Fauna of India, Spiders : Araneae* II (1) : 269-271.

Material examined : 1 ♀, Nandankanan, Dist. Cuttack, 26.iii.1974, coll. R. K. Kacker ; 1 ♂, Near Court, Dist. Sambalpur, 26.vii.1972, coll. S. Khera & party ; 1 ♀, Sargigura village, Titlagarh, Dist. Bolangir, 4.x.1972, coll. S. Khera.

Distribution : India : Orissa : (new record), West Bengal, Maharashtra, Gujarat ; Mariana Island ; and South New Guinea.

Family II. GNAPHOSIDAE

Genus 8. *Gnaphosa* Latreille

15. *Gnaphosa pauriensis* Tikader & Gajbe

1977. *Gnaphosa pauriensis* Tikader & Gajbe, *Rec. zool. Surv. India*, **73** (1-4) : 44.

1982. *Gnaphosa pauriensis* : Tikader, *Fauna of India, Spiders : Araneae* II (2) : 334-336.

Material examined : 2 ♀, Ghatgaon, Dist. Keonjhar, 22.xi.1972, coll. J. K. Sen & party ; 2 ♀, Tikarpara, Dist. Dhenkanal, 29.xi.1972, coll. J. K. Sen & party ; 1 ♀, Chotkai, Dist. Dhenkanal, 27.xi.1972, coll. J. K. Sen & party ; 4 ♀, Sundimunda village, Rairakhol, Dist. Sambalpur, 28.xii.1971, coll. P. K. Maiti.

Distribution : India : Orissa (new record), Uttar Pradesh.

Genus 9. *Drassodes* Westring

Key to the species of genus *Drassodes* Westring

Cephalothorax redish brown and the abdomen deep brown in colour	...	<i>oppenheimeri</i>
Cephalothorax light redish green and abdomen brownish green in colour	...	<i>pashanensis</i>

16. *Drassodes oppenheimeri* Tikader

1979. *Drassodes oppenheimeri* Tikader, *Proc. Indian Acad. Sci.*, **77** (5) : 186.

1982. *Drassodes oppenheimeri* : Tikader, *Fauna of India, Spiders : Araneae* II (2) : 400-402.

Material examined : 1 ♀, Bonaigarh, Dist. Sundargarh, 15.vi.1972, coll. D. P. Sanyal.

Distribution : India : Orissa (new record), West Bengal.

17. *Drassodes pashanensis* Tikader & Gajbe

1977. *Drassodes pashanensis* Tikader & Gajbe, *Rec. zool. Surv. India*, **73** (1-4) : 64-66.

1982. *Drassodes pashanensis* : Tikader, *Fauna of India, Spiders : Araneae* II (2) : 429-431.

Material examined : 1 ♀, Bonaigarh, Dist. Sundargarh, 16.vi.1972, coll. D. P. Sanyal.

Distribution : India : Orissa (new record), Maharashtra.

Genus 10. *Sosticus* Chamberlin**Key to the species of genus *Sosticus* Chamberlin**

Abdomeu provided with two white bands, anterior one dumb-bell-shaped, chelicerae provided with one small tooth on inner margin and three teeth on outer margin	...	...	<i>dherikanalensis</i>
Abdomen provided with many small chalk-white spots all over, chelicerae provided with two small teeth on inner margin and two big-ones on outer margin	...	...	<i>sundargarhensis</i>

18. *Sosticus dherikanalensis* Gajbe

1979. *Sosticus dherikanalensis* Gajbe, *Bull. zool. Surv. India*, **2** (1) : 71.

1982. *Sosticus dherikanalensis* : Tikader, *Fauna of India, Spiders : Araneae* II (2) : 434-436.

Material examined : 1 ♀ (Holotype), Tikarpara, Dist. Dherikanal,* Orissa, India, 29.xi.1972, coll. J. K. Sen & party.

Distribution : India : Orissa, Dherikanal *Dist. Tikarpara (Type-locality).

19. *Sosticus sundargarhensis* Gajbe

1979. *Sosticus sundargarhensis* Gajbe, *Bull. zool. Surv. India*, **2** (1) : 72.

1982. *Sosticus sundargarhensis* : Tikader, *Fauna of India, Spiders : Araneae* II (2) : 438-440.

Material examined : 1 ♀ (Holotype), Bonaigarh, Dist. Sundargarh, Orissa, India, 15.vi.1972, coll. D. P. Sanyal ; 1 ♀ (Paratype), Barkuda Island, Chilka Lake, Orissa, India, 20.vii.1916, coll. F. H. Gravely.

Distribution : India : Orissa, Assam.

*In Orissa, there is no district named Dherikanal ; it is Dhenkanal. The species name *S. dherikanalensis* is incorrectly based on a mistaken name.

Family III. SALTICIDAE

Genus 11. *Phidippus* KochKey to the species of the genus *Phidippus* Koch

1. Abdomen provided with deep brownish patch and with a pair of sigillae encircled by a pair of V-shaped black markings	...	<i>bengalensis</i>
Abdomen without light patch and there is no sigillae which encircled by V-shaped black markings	---	2
2. Cephalothorax brownish red, broader anteriorly and narrower posteriorly	...	<i>indicus</i>
Cephalothorax pale green, narrower anteriorly and broader posteriorly	...	<i>pateli</i>

20. *Phidippus bengalensis* Tikader

1977. *Phidippus bengalensis* Tikader, *Entomon*, 2 (1) : 97.

1981. *Phidippus bengalensis* : Tikader & Biswas, *Rec. zool. Surv. India, Occ. Pap.*, No. 30 : 92-93,

Material examined : 1 ♀, Barkuda Island, Chilka Lake, 15.vii.1916, coll. F. H. Gravely.

Distribution : India : Orissa (new record), West Bengal, Maharashtra, Karnataka, Punjab.

21. *Phidippus indicus* Tikader

1974. *Phidippus indicus* Tikader, *Proc. Indian Acad. Sci.*, 79 (3) : 122.

1981. *Phidippus indicus* : Tikader & Biswas, *Rec. zool. Surv. India, Occ. Pap.*, No. 30 : 92.

Material examined : 1 ♀, Balugaon, Dist. Puri, 12.xii.1960, coll. B. S. Lamba ; 1 ♀, Barkuda Island, Chilka Lake, 16.viii.1920, coll. S. Rabeiro ; 1 ♀, Barkuda Island, Chilka Lake, 4.viii.1917, coll. N. Annandale ; 1 ♀, Barkuda Island, Chilka Lake, 15.vii.1916, coll. F. H. Gravely ; 1 ♀, Chilka Lake, Balugaon, Dist. Puri, 19.iii.1974, coll. R. K. Kacker ; 1 ♀, Barkul, Dist. Puri, 13.xi.1912, coll. F. H. Gravely ; 1 ♀, Nandankanan, Biological Park, Dist. Cuttack, 22.iii.1974, coll. R. K. Kacker ; 1 ♀, Sundargarh, 24.iii.1973, coll. T. K. Sen ; 1 ♀, Barkuda Island, Chilka Lake, 11.xii.1919, coll. F. H. Gravely.

Distribution : India : Orissa (new record), West Bengal, Maharashtra, Gujarat.

22. *Phidippus pateli* Tikader

1974. *Phidippus pateli* Tikader, *Proc. Indian Acad. Sci.*, 79 (3) : 124.

1981. *Phidippus pateli* : Tikader & Biswas, *Rec. zool. Surv. India, Occ. Pap.*, No. 30 : 91.

Material examined : 1 ♀, Sundargarh, 17.ix.1972, coll. S. Khera ; 1 ♀, Nandankanan, Dist. Cuttack, 21.i.1975, coll. S. Biswas.

Distribution : India : Orissa (new record), West Bengal, Maharashtra, Gujarat.

Genus 12. *Marpissa* Koch

Key to the species of genus *Marpissa* Koch

Cephalothorax redish brown in colour, narrower posteriorly	...	<i>decorata</i>
Cephalothorax brown in colour, broader posteriorly	...	<i>dhakuriensis</i>

23. *Marpissa decorata* Tikader

1974. *Marpissa decorata* Tikader, *Proc. Indian Acad. Sci.*, **79** (5) : 206.

1981. *Marpissa decorata* : Tikader & Biswas, *Rec. zool. Surv. India, Occ. Pap.*, No. 80 : 94-95.

Material examined : 1 ♀, Atei Reserve Forest, Ghatgaon, Dist. Keonjhar, 29.iii.1973, coll. S. K. Gupta.

Distribution : India : Orissa (new record), West Bengal.

24. *Marpissa dhakuriensis* Tikader

1974. *Marpissa dhakuriensis* Tikader, *Proc. Indian Acad. Sci.*, **79** (5) : 207.

1981. *Marpissa dhakuriensis* : Tikader & Biswas, *Rec. zool. Surv. India, Occ. Pap.*, No. 80 : 94.

Material examined : 1 ♀, Atei Reserve Forest, Ghatgaon, Dist. Keonjhar, 29.iii.1973, coll. S. K. Gupta.

Distribution : India : Orissa (new record), West Bengal.

Genus 13. *Plexippus* Koch

25. *Plexippus paykullii* (Audouin)

1825. *Attus paykullii* Audouin, *Deser. Egypt. 2nd Ed.*, **22** : 172.

1981. *Plexippus paykullii* : Tikader & Biswas, *Rec. zool. Surv. India, Occ. Pap.*, No. 80 : 100.

Material examined : 1 ♀, Chandipur, Dist. Balasore, 24.i.1972, coll. V. K. Premkumar & party ; 1 ♀, Chilka Lake, Balugaon, Dist. Puri, 19.iii.1974, coll. R. K. Kacker ; 1 ♀, Mathpur, Balugaon, Dist. Puri, 16.vi.1969, coll. K. N. Nair ; 1 ♀, Barkul, Balugaon, 3.viii.1914, coll. F. H. Gravely ; 1 ♀, Barkuda Island, Chilka Lake, 15.vii.1916, coll. F. H. Gravely ; 1 ♀, Udyagiri, 20.i.1972, coll. K. V. Surya Rao ; 1 ♀, Mahakhand, Dist. Bolangir, 31.v.1972, coll. D. P. Sanyal ; 1 ♀, Baripada Dist. Mayurbhanj, 17.iii.1973, coll. S. K. Gupta ; 1 ♀, Jharsuguda, Dist. Sambalpur, 30.x.1972, coll. J. M. Julka ; 1 ♀, Baripada, Dist. Mayurbhanj, 5.iv.1972, J. M. Julka ; 1 ♀, Mahanadi River bed, Dist.

Phulabani, 16.i.1975, coll. *S. Biswas* ; 1 ♀ , Balugaon, Dist. Puri, 12.xii.1960, coll. *B. S. Lamba*.

Distribution : India : Orissa (new record) and all over India ; also Burma, Sri Lanka, America, Europe, Africa, and in all the warmer regions of the world.

Genus 14. *Euophrys* Koch

26. *Euophrys chiriatapuensis* Tikader

1977. *Euophrys chiriatapuensis* : Tikader, *Rec. zool. Surv. India*, **72** (1-4) : 206.

1981. *Euophrys chiriatapuensis* : Tikader & Biswas, *Rec. zool. Surv. India, Occ. Pap.*, No. 30 : 101-102.

Material examined : 1 ♀ , Tourist Lodge Compound, Nandankanan, Dist. Cuttack, 21.i.1975, coll. *S. Biswas & party*.

Distribution : India : Orissa (new record), South Andaman, West Bengal.

Genus 15. *Rhene* Thorell

Key to the species of genus *Rhene* Thorell

Cephalothorax light brown in colour and provided with black longitudinal deep brown patch extending from anterior eye to base of the cephalothorax ...	<i>danieli</i>
Cephalothorax deep brown in colour and not provided with black longitudinal deep brown patch extending from anterior eye to base of the cephalothorax ...	<i>indicus</i>

27. *Rhene danieli* Tikader

1973. *Rhene danieli* Tikader, *Proc. Indian Acad. Sci.*, **78** (2) : 70-72.

1981. *Rhene danieli* : Tikader & Biswas, *Rec. zool. Surv. India, Occ. Pap.*, No. 30 : 103-104.

Material examined : 1 ♀ , Barkuda Island, Chilka Lake, Dist. Ganjam, 15.viii.1920, coll. *N. Annandale*.

Distribution : India : Orissa (new record), West Bengal, Punjab, Maharashtra.

28. *Rhene indicus* Tikader

1973. *Rhene indicus* Tikader, *Proc. Indian Acad. Sci.*, **78** (2) : 68-70.

1981. *Rhene indicus* : Tikader & Biswas, *Rec. zool. Surv. India, Occ. Pap.*, No. 30 : 102-103.

Material examined : 1 ♀ , Barkuda Island, Chilka Lake, Dist. Ganjam, 4.viii.1917, coll. *N. Annandale*.

Distribution : India : Orissa (new record), West Bengal, Punjab.

Genus 16. *Zygoballus* PeckhamKey to the species of genus *Zygoballus* Peckham

Abdomen provided with two pairs of sigilla ; not elliptical in form	...	<i>narmadaensis</i>
Abdomen not provided with two pairs of sigilla and elliptical in shape	...	<i>pashanensis</i>

29. *Zygoballus narmadaensis* Tikader

1975. *Zygoballus narmadaensis* Tikader, *Proc. Indian Acad. Sci.*, 81 (4) : 151.

Material examined : 1 ♀, Bhagwanpur, Nandankanan, Dist. Cuttack, 24.iii.1974, coll. R. K. Kacker ; 1 ♀, Rangamati Village, Kathpal, Dist. Mayurbhanj, 16.ii.1976, coll. R. L. Chowdhury.

Distribution : India : Orissa (new record), Madhya Pradesh.

30. *Zygoballus pashanensis* Tikader

1975. *Zygoballus pashanensis* Tikader, *Proc. Indian Acad. Sci.*, 81 (4) : 151-153.

Material examined : 1 ♀, Ashasagar, Bhawanipatna, 31.i.1972, coll. K. V. Surya Rao.

Distribution : India : Orissa (new record), Maharashtra.

Genus 17. *Myrmarachne* Mac Leay31. *Myrmarachne plataleoides* (Cambridge)

1869. *Saliculus plataleoides* Cambridge, *Ann. Mag. nat. Hist.*, 3 (4) : 68.

1973. *Myrmarachne plataleoides* : Tikader, *Proc. Indian Acad. Sci.*, 78 (2) : 60.

Material examined : 1 ♂, Barakuda Island, Chilka Lake, Dist. Ganjam, 2.xi.1928, coll. N. Annandale.

Distribution : India : Orissa (new record), West Bengal, Bihar, Maharashtra, Tamil Nadu.

ACKNOWLEDGEMENTS

I take this opportunity of expressing my sincere thanks to the Director, Zoological Survey of India, Calcutta, for placing the valuable collection of spiders from Orissa, at my disposal for studies and for going through the manuscript and offering valuable suggestions. Thanks are also due to Dr. S.K. Bhattacharya, Scientist-SF, Joint Director, Dr. O. B. Chhotani, Scientist-SE, Deputy Director and Dr. S. K. Gupta, Scientist-SD for suggestions.

SUMMARY

Not much was so far known about the spider fauna of the state of Orissa. The present study of the collections from the State has revealed 31 species of Araneidae, Gnaphosidae and Salticidae belonging to 17 genera. 25 species are reported from the State for the first time. In whichever genus more than one species were found, keys for identification are provided.

REFERENCES

- GRAVELY, F. H. 1931. The spider and scorpions of Barkuda Island. *Rec. Indian Mus.*, **22** (4) : 399-421.
- GRAVELY, F. H. 1931. Some Indian spiders of the families Ctenidae, Sparassidae, Selenopidae and Clubionidae. *Rec. Indian Mus.*, **33** : 211-281.
- POCOCK, R. I. 1900. *Fauna of British India, Arachnida* : 1-279.
- SINHA, T. B. 1951. Some Indian spiders of the family Argiopidae. *Rec. Indian Mus.*, **49** : 67-88.
- TIKADER, B. K. 1963. Studies on some spider fauna of Maharashtra and Mysore states. Part I. *J. Univ. Poona, Sci. & Tech.*, **24** : 29-54.
- TIKADER, B. K. 1970. Spider fauna of Sikkim. *Rec. zool. Surv. India*, **63** (1-4) : 1-83.
- TIKADER, B. K. 1977. Studies on spider fauna of Andaman & Nicobar Islands, Indian Ocean. *Rec. zool. Surv. India*, **72** : 153-212.
- TIKADER, B. K., & MALHOTRA, M. S. 1980. *Fauna of India, Spiders : Araneae* I (2) : 248-446.
- TIKADER, B. K. & BISWAS BIJAN 1981. Spider fauna of Calcutta and vicinity. *Occ. Pap. Rec. zool. Surv. India*, No. 30 (1) : 1-149.
- TIKADER, B. K. 1982. *Fauna of India, Spiders : Araneae* II (1-2) 1-536.

LIST OF SPIDERS KNOWN FROM ORISSA

<i>Sr. No.</i>	<i>Species</i>	<i>Distribution in Orissa</i>
Family I. BARYCHELIDAE		
1.	<i>Diplothele walshi</i> Cambridge	Barkuda Island, Chilka Lake, Ganjam.
2.	<i>Sasonichus arthropophys</i> Gravely	Barkuda Island, Chilka Lake, Ganjam
Family II. CTENIZIDAE		
3.	<i>Acanthodon barkudensis</i> Gravely	Southernend of the Chilka Lake.
4.	<i>Darmachus excavatus</i> Gravely	Balasore

<i>Sr. No.</i>	<i>Species</i>	<i>Distribution in Orissa</i>

Family III. ERESIDAE

5.	<i>Stegodyphus sarasinorum</i> Karch	Barkuda Island

Family IV. PHOLCIDAE

6.	<i>Artema atlanta</i> Walck.	Barkuda Island

Family IV. THERIDIIDAE

7.	<i>Argyrodus scintillulana</i> Cambridge	Barkuda Island

Family VI. ARANEIDAE

8.	<i>Gasteracantha brevispina</i> (Doleschall)	Barkuda Island
9.	<i>G. hasselti</i> C. L. Koch	Barkuda Island
10.	<i>G. kuhlii</i> C. L. Koch	Dankana, Puri
11.	<i>G. mammosa</i> C. L. Koch	Orissa
12.	<i>Leucauge celebesiana</i> (Walck.)	Bolangir
13.	<i>L. decorata</i> (Blackwall)	Chilka Lake ; Jaypore, Koraput ; Tikarpara, Dhenkanal ; Dhanupali, Sambalpur ; Chandili, Koraput.
14.	<i>L. fastigeta</i> (Simon)	Barkuda Island
15.	<i>Nephila maculata</i> (Fabricius)	Widely distributed
16.	<i>Argiope anasuja</i> Thorell	Barkuda Island, Chilka Lake ; Dhanu- pali, Sambalpur.
17.	<i>A. catenulata</i> (Doleschall)	Throughout the State.
18.	<i>A. pulchella</i> Thorell	Barkuda Island, Chilka Lake ; Jura- khaman, Badrama Reserve Forest, Sambalpur.
19.	<i>Cyrtophora cicatrosa</i> (Stol.)	Barkuda Island, Chilka Lake.
20.	<i>C. citricola</i> (Forskal)	Dhanupali, Sambalpur
21.	<i>Cyclosa insulana</i> (Costa)	Orissa
22.	<i>Larinia phtisica</i> (L. Koch)	Chilka Lake ; Barsuan, Sundargarh
23.	<i>Zygeilla melanocrania</i> (Thorell)	Barkuda Island, Chilka Lake
24.	<i>Araneus melanocrania</i> Thorell	Orissa
25.	<i>A. excelsus</i> Simon	Orissa
26.	<i>A. viridisoma</i> Gravely	Orissa

<i>Sr. No.</i>	<i>Species</i>	<i>Distribution in Orissa</i>
27.	<i>Neoscona molemensis</i> Tikader & Bal	Khasra Forest, Sambalpur
28.	<i>N. mukerjei</i> Tikader	Ranibagicha, Sundargarh
29.	<i>N. nautica</i> (L. Koch)	Sambalpur
30.	<i>N. rumpfi</i> (Thorell)	Sambalpur
31.	<i>N. theis</i> (Walck.)	Orissa
32.	<i>Paraplectana maritata</i> Cambridge	Barkuda Island

Family VII. TETRAGNATHIDAE

33.	<i>Tetragnatha gracilis</i> Stoliczka	Chilka Lake
34.	<i>T. mandibulata</i> Walck.	Chilka Lake
35.	<i>T. viridorufa</i> Gravely	Barkuda Island
36.	<i>Eucta javana</i> Thorell	Chilka Lake

Family VIII. HERSILIDAE

37.	<i>Hersilia savignyi</i> Lucas	Barkuda Island

Family IX. ZODARIIDAE

38.	<i>Hermippoides arjuna</i> Gravely	Barkuda Island
39.	<i>Storena birenifer</i> Gravely	Barkuda Island
40.	<i>Suffucia cingulata</i> Simon	Barkuda Island

Family X. LYCOSIDAE

41.	<i>Hippasa greenalae</i> (Balk.)	Orissa
42.	<i>Hippasa pantherina</i> Pocock	Barkuda Island, Chilka Lake
43.	<i>Pardosa atropalpis</i> Gravely	Barkuda Island, Chilka Lake
44.	<i>Pardosa birmanica</i> Simon	Orissa
45.	<i>P. leucopalpis</i> Gravely	Orissa
46.	<i>Ocyale atalanta</i> Audouin	Orissa
47.	<i>Lycosa madani</i> Pocock	Barkuda Island, Chilka Lake

Family XI. OXYOPIDAE

48.	<i>Peucetia harishankarensis</i> Biswas	Gandhamardan Hill near Hari-shankar, Bolangir
49.	<i>P. viridana</i> (Stolzk.)	Orissa

<i>Sr. No.</i>	<i>Species</i>	<i>Distribution in Orissa</i>

Family XII. GNAPHOSIDAE

50.	<i>Gnaphosa pauriensis</i> Tikader & Gajbe	Dists. Keonjhar, Dhenkanal and Sambalpur, Orissa.
51.	<i>Drassodes oppenheimeri</i> Tikader	Bonaigarh, Sundargarh
52.	<i>D. pashansnsis</i> Tikader & Gajbe	Bonaigarh, Sundargarh
53.	<i>Sosticus sundargarhensis</i> Gajbe	Bonaigarh, Sundargarh
54.	<i>Sosticus dherikanalensis</i> Gajbe	Tikarpara, Dhenkanal

Family XIII. CLUBIONIDAE

55.	<i>Castaneira flavipes</i> Gravely	Barkuda Island
56.	<i>C. zetes</i> Simon	Barkuda Island
57.	<i>Cheiracanthium melanostoma</i> (Thorell)	Chilka Lake
58.	<i>Syrisca barkudensis</i> Gravely	Barkuda Island
59.	<i>Sphingius barkudensis</i> Gravely	Barkuda Island
60.	<i>Oedignatha scrobiculata</i> Thorell	Barkuda Island
61.	<i>Oedignatha microsculata</i> Reimoser	Chahala, Mayurbhanj

Family XIV. SPARASSIDAE

62.	<i>Olios lamarcki</i> (Latal.)	Barkuda Island ; Gopalpur, Ganjam ; Balugaon, Puri.
63.	<i>O. milleti</i> (Pocock)	Barkuda Island, Chilka Lake.
64.	<i>O. punctipes</i> Simon	Gopalpur, Ganjam

Family XV. HETEROPODIDAE

65.	<i>Heteropoda kandiana</i> Pocock	Barkul, Puri
66.	<i>H. sexpunctata</i> Simon	Barkuda Island, Chilka Lake
67.	<i>Spariolenus petricola</i> Gravely	Khandagiri, Puri
68.	<i>Polystes flavidus</i> Simon	Barkuda Island, Chilka Lake

Family XVI. SELENOPIDAE

69.	<i>Selenops radiatus</i> (Latr.)	Rambha, Ganjam

<i>Sr. No.</i>	<i>Species</i>	<i>Distribution in Orissa</i>
Family XVII. SALTICIDAE		
70.	<i>Phidippus bengalensis</i> Tikader	Barkuda Island, Chilka Lake
71.	<i>P. indicus</i> Tikader	Barkuda Island, Chilka Lake ; Nandankanan Biological Park, Cuttack ; Balugaon, Puri.
72.	<i>P. pateli</i> Tikader	Sundargarh ; Nandankanan, Cuttack.
73.	<i>Marpissa decorata</i> Tikader	Atei Reserve Forest, Keonjhar
74.	<i>M. dhakuriensis</i> Tikader	Atei Reserve Forest, Keonjhar
75.	<i>Plexippus paykullii</i> (Aud.)	Widely distributed in Orissa.
76.	<i>Euophrys chiriatapuensis</i> Tikader	Nandankanan, Cuttack
77.	<i>Rhene danieli</i> Tikader	Barkuda Island, Chilka Lake, Gaujam
78.	<i>Rhene indicus</i> Tikader	Barkuda Island
79.	<i>Zygoballus narmadaensis</i> Tikader	Nandankanan, Cuttack ; Rangamati, Mayurbhanj.
80.	<i>Z. pashanensis</i> Tikader	Ashasagar, Bhawanipatna, Kalahandi
81.	<i>Myrmarachne platyleoides</i> (Cambridge)	Barkuda Island, Chilka Lake, Ganjam.

ACARINA : METASTIGMATA (TICKS)

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AND

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INTRODUCTION

While going through the tick specimens collected from zoo-animals in Nandankanan Biological Park, Bhubaneswar, Orissa, by the third and fourth authors of the present paper, some interesting observations related to new records of species and hosts were noted. The present contribution deals with the study of the above mentioned material which has great significance in veterinary research. It also includes a list of all the tick species so far reported from Orissa giving their distribution and hosts from which recorded and also a key to the genera and species for easy identification.

The tick fauna of Orissa was first studied by Sharif (1928) who reported 15 species under 8 genera. Later Pattanayak and Hiregoudar (1973), De (1976) and Kaul *et al.* (1979) reported 9 more species. The present material contains 10 species of which 3 viz., *Amblyomma helvolum*, *A. javanense* and *Haemaphysalis turturis* are new to the state. Thus the total number of species so far known from Orissa stands at 27 in 8 genera (Table 1). Material presently studied is deposited in the National Zoological Collection of Zoological Survey of India, Calcutta.

SYSTEMATIC ACCOUNT

Family Ixodidae

Genus 1. *Amblyomma* Koch

1. *Amblyomma helvolum* Koch

1844. *Amblyomma helvolum* Koch, *Arch. Naturgesch.*, **10** (1) : 230.

1926. *Amblyomma helvolum* : Robinson, *Ticks-Mongr. Ixodoidea*, Pt. 4 (Cambridge Univ. Press) : 216-219.

1928. *Amblyomma helvolum* : Sharif, *Rec. Indian Mus.*, **30** : 325.

Material examined : 12 ♂♂, 53 ♀♀, 22.viii.1982, from neck and body of land monitor (*Varanus flavescens*) and 38 ♂♂, 3 ♀♀, 5 nymphs, 15.iv.1981, from body of King Cobra (*Ophiophagus hannah*).

Remarks : This species is not serious from economic aspect but hosts like large snakes and lizards, if attacked feel discomfort. The species is reported here for the first time from Orissa.

2. *Amblyomma javanense* (Supino)

1897. *Rhipicephalus javanensis* Supino, *Atti. Soc. Veneto-Trent. Sci. Nat.*, **3** (1) : 233.

1968. *Amblyomma javanense* (Supino) : Hoogstraal *et al.*, *Ann. ent. Soc. Am.*, **61** (3) : 722.

Material examined : 18 ♂♂, 4 ♀♀, 5 nymphs, 2.viii.1969, from underneath the scales of the limbs of Indian Pangolin (*Manis crassicaudata*); 1 ♂, 8 nymphs, 25.viii.1972, from body of Ratel (*Mellivora capensis*) and 16 ♂♂, 5 ♀♀, 6 nymphs, 16.ii.1973, from body of Hyena cub (*Hyaena hyaena*).

Remarks : The species is not much important as a disease carrier. It mainly attacks wild mammals. This tick species is recorded here for the first time from Orissa.

3. *Amblyomma testudinarium* Koch

1844. *Amblyomma testudinarium* Koch, *Arch. Naturgesch.*, **10** (1) : 226.

1926. *Amblyomma testudinarium* : Robinson, *Ticks-Mongr. Ixodoidea*, pt. 4 (Cambridge Univ. Press) : 257.

1928. *Amblyomma testudinarium* : Sharif, *Rec. Indian Mus.*, **30** : 330.

Material examined : 56 ♂♂, 2 ♀♀, 17.i.1974, from groins of Indian Wild Boar (*Sus scrofa cristatus*); 9 ♂♂, 10 ♀♀, 17.i.1979, from dewlap of Gour (*Bos gaurus*) and 1 ♂, 15.ix.1982, from neck region of Indian Rhinoceros (*Rhinoceros unicornis*).

Remarks : The species was first reported from Orissa by De (1976) from grass. Krijgsman and Ponto (1932) mentioned that this tick transmits piroplasmiasis and anaplasmosis. Sharif (1938) also recorded the species as a possible vector of some diseases.

Genus 2. *Boophilus* Curtice

4. *Boophilus microplus* (Canestrini)

1887. *Haemaphysalis micropla* Canestrini, *Atti. Soc. Veneto-Trent. Sci. Nat.*, **11** : 104.

1943. *Boophilus microplus* : Fairchild, *Am. J. trop. Med.*, **23** : 586.

1960. *Boophilus microplus* : Arthur, *Ticks-Mongr. Ixodoidea*, pt. 5 (Cambridge Univ. Press) : 207.

Material examined : 1 ♂, 2 ♀♀, 25.viii.1972, from body of Ratel.

Remarks : This species attacks most of the domestic and wild animals causing red water fever, anaplasmosis to cattle and sheep. The species is very common in Orissa.

Genus 3. Dermacentor Koch**5. Dermacentor auratus Supino**

1897. *Dermacentor auratus* Supino, *Atti. Soc. Veneto-Trent. Sci. Nat.*, **3** (2) : 235.

1928. *Dermacentor auratus* : Sharif, *Rec. Indian Mus.*, **30** : 292.

Material examined : 2 ♂♂, 17.i.1974, from groins of Indian wild Boar.

Remarks : *D. auratus* is chiefly reported in India from domestic and wild mammals including man. Rao (1964) isolated KFD virus from this species.

Genus 4. Haemaphysalis Koch**6. Haemaphysalis bispinosa Neumann**

1897. *Haemaphysalis bispinosa* Neumann, *Mem. Soc. zool. Fr.*, **10** : 341.

1928. *Haemaphysalis bispinosa* : Sharif, *Rec. Indian Mus.*, **30** : 255.

1966. *Haemaphysalis bispinosa* : Hoogstraal and Trapido, *J. Parasit.*, **52** : 1188.

Material examined : 7 ♂♂, 10 ♀♀, 27.viii.1972, from axilla and groins of Barking Deer (*Muntiacus muntjak*) and 1 ♂, 29 ♀♀, 27 nymphs, 24.viii.1982, from ear and body of Tiger cub (*Panthera tigris*).

Remarks : The species is responsible for transmitting the KFD viruses in mammals.

7. Haemaphysalis indica Warburton

1910. *Haemaphysalis leachi* var. *indica* Warburton, *Parasitology*, **3** : 403.

1915. *Haemaphysalis leachi* var. *indica* : Nuttall and Warburton, *Ticks-Mongr. Ixodoidea*, pt. 3 (Cambridge Univ. Press) : 467.

1928. *Haemaphysalis leachi* var. *indica* : Sharif, *Rec. Indian Mus.*, **30** : 264.

1970. *Haemaphysalis indica* : Hoogstraal, *J. Parasit.*, **56** (5) : 1013.

Material examined : 2 ♂♂, 3 ♀♀, 25.viii.1972, from body of Ratel.

Remarks : The common hosts of this species are carnivore animals and occasionally rodents and insectivores are also parasitized.

8. Haemaphysalis intermedia Warburton and Nuttall

1909. *Haemaphysalis bispinosa* var. *intermedia* Warburton and Nuttall, *Parasitology*, **2** : 69.

1915. *Haemaphysalis bispinosa* var. *intermedia* : Nuttall and Warburton, *Ticks-Mongr. Ixodoidea* pt. 3 (Cambridge Univ. Press) : 433.

1928. *Haemaphysalis bispinosa* var. *intermedia* : Sharif, *Rec. Indian Mus.*, **30** : 258.

1963. *Haemaphysalis intermedia* : Hoogstraal and Trapido, *J. Parasit.*, **49** (5) : 888.

Material examined : 9 ♂♂, 18 ♀♀, 1 nymph, 7.vi.1968, from ear of Tiger and 7 ♂♂, 10 ♀♀, 27.viii.1972, from axilla and groins of Barking Deer.

Remarks : *H. intermedia* is a parasite of domestic and wild mammals in India. This tick species is also reported to carry KFD virus. Two new arboviruses viz., 'Bhanja' and 'Ganjam' were isolated from this species (Dandawate and Shah, 1969 ; Shah and Work, 1969).

9. *Haemaphysalis turturis* Nuttall and Warburton

1915. *Haemaphysalis turturis* Nuttall and Warburton, *Ticks-Mongr. Ixodoidea*, pt. 3 (Cambridge Univ. Press) : 410.

1928. *Haemaphysalis turturis* : Sharif, *Rec. Indian Mus.*, 30 : 250.

1963. *Haemaphysalis turturis* : Trapido, et al., *J. Parasit.*, 49 (4) : 678.

Material examined : 1 ♂, 1 ♀, 17.i.1974, from groins of Indian Wild Boar.

Remarks : It is a common tick parasitizing wild and domestic mammals including man. The species is also known as carrier of KFD virus. This haemaphysalid tick is reported here for the first time from Orissa.

Genus 5. *Hyalomma* Koch

10. *Hyalomma marginatum isaaci* Sharif

1928. *Hyalomma aegyptium isaaci* Sharif, *Rec. Indian Mus.*, 30 : 307.

1963. *Hyalomma marginatum isaaci* : Kaiser and Hoogstraal, *J. Parasit.*, 49 (1) : 130.

1964. *Hyalomma marginatum isaaci* : Kaiser and Hoogstraal, *Acarologia*, 6 (2) : 257.

Material examined : 6 nymphs, 15.xii.1982, from ear and body of Indian Hare (*Lepus nigricollis*).

Remarks : This species is recognised as pest and vector of diseases to animals. Grobov (1946) isolated the Crimean haemorrhagic fever virus from the nymphs of this tick species.

Key to the genera of ticks from Orissa

1. Eyes absent.	...	...	2
— Eyes present.	...	...	3
2. Capitulum long, no lateral salience on palpal article II ; dorsal retroverted spur absent on trochanter I ; Coxa I usually bifid.	...	<i>Aponomma</i> Neumann	
— Capitulum short, with lateral salience on palpal article II ; blade-like dorsal retroverted spur on trochanter I ; coxa I never bifid.	...	<i>Haemaphysalis</i> Koch	
3. Capitulum long with long narrow palps.	...	...	4
— Capitulum short with short broad palps.	...	...	5

4. Ventral shields present in male ; usually inornate ; eyes spherical and orbital. ...	<i>Hyalomma</i> Koch
— Ventral shields absent in male ; scutum usually ornate ; eyes usually flat and non-orbital. ...	<i>Amblyomma</i> Koch
5. Basis-capituli rectangular dorsally, lateral saliences absent ; scutum ornate ; ventral shields, when present 6 in male. ...	... 6
— Basis-capituli hexagonal dorsally, lateral saliences present ; scutum usually inornate ; ventral shields 4 in male. ...	... 7
6. Ventral shields 6 in male ; coxae subequal. ...	<i>Nosomma</i> Schulze
— Ventral shields absent in male ; coxa IV much larger than others. ...	<i>Dermacentor</i> Koch
7. Spiracle oval ; festoons and groove faint or obsolete ; setiferous ventral plate on palpal article I absent. ...	<i>Boophilus</i> Curtice
— Spiracle sub-triangular or commashaped ; festoons and anal groove well developed ; setiferous ventral plate on palpal article I present. ...	<i>Rhipicephalus</i> Koch

*Key to the species of ticks from Orissa*Genus *Amblyomma*

MALES

1. Marginal grooves present and continuous ; two stout spurs on coxa I ; punctations coarse, irregular ; falciform stripe present ; hypostome 3/3. ...	<i>integrum</i>
— Marginal grooves absent ; coxal spurs small ; punctations usually regular ; falciform stripe present or absent ; hypostome 3/3 or 4/4. ...	... 2
2. Scutum inornate ; two short flat sub-equal spurs on coxa I ; coxae II—IV each with a broad flat spur ; eyes indistinct ; hypostome 3/3. ...	<i>javanense</i>
— Scutum ornate ; two unequal spurs on coxa I ; coxae II—III each with triangular or round spur ; eyes almost distinct ; hypostome 3/3 or 4/4. ...	... 8
3. Scutum deep brown with six pale coloured spots ; falciform stripe absent ; coxae II and III each with short triangular spur ; eyes indistinct ; hypostome 3/3. ...	<i>helvolum</i>
— Scutum yellowish with dark brown ornamentation ; falciform stripe present ; coxae II and III each with broad round spur ; eyes large, flat ; hypostome 4/4. ...	<i>testudinarium</i>

FEMALES

1. Scutum inornate ; coxa I with two short, flat spurs ; coxae II-IV each with a broad salient ridge like spur ; hypostome 3/3. ...	<i>javanense</i>
— Scutum ornate ; coxa I with both short and long spurs ; coxae II-IV with triangular or ridge like spur : hypostome 3/3 or 4/4. ...	... 2
2. Narrow triangular spur on coxae II and III. ...	<i>helvolum</i>
— Broad salient ridge-like spur on coxae II and III. ...	... 3
3. Coxa I with two unequal spurs, internal one stout and blunt, external one longer and pointed ; hypostome 3/3. ...	<i>integrum</i>
— Coxa I with two stout subequal spurs ; hypostome 4/4. ...	<i>studinarium</i>

Genus *Aponomma*

MALES

— Scutum ornate with brown stripes and spots ; puncta- tions large ; coxae I with two subequal spurs. ...	<i>lucasi</i>
— Scutum inornate with yellow-ocher to brick-red colour ; punctations fine ; coxa I with one short pointed spur. ...	<i>laeve</i>

FEMALES

— Scutum ornate with metallic green colour ; densely punctated ; coxa I with two subequal spurs. ...	<i>lucasi</i>
— Scutum inornate with brown colour ; sparsely puncta- ted ; coxa I with one short pointed spur. ...	<i>laeve</i>

Genus *Haemaphysalis*

MALES

1. Salience broad, palpal segment 2 developed into a spur or projection. ...	... 2
— Salience usually not broad, palpal segment 2 rounded. ...	... 5
2. Coxa IV with a single greatly elongated spur. ...	<i>spinigera</i>
— Coxa IV without greatly elongated spur. ...	... 3
3. Dorsal external margin of palpal segment 2 round. ...	<i>minuta</i>
— Dorsal external margin of palpal segment 2 with prominent spur. ...	... 4

4. Basis capituli dorsally 2 times as broad as long ; scutum 1.5 to 1.7 times as long as broad ; scapulae rounded ; punctations very few. ...	<i>indica</i>
— Basis capituli dorsally 1.5 times as broad as long ; scutum 2.0 to 2.2 times as long as broad ; scapulae pointed ; punctations numerous. ...	<i>canestrinii</i>
5. Salience broad, round ; palpal segment 3 without dorsal spur ; dorsal posterointernal angle of palpal segment 3 produced into a retroverted process. ...	<i>wellingtoni</i>
— Salience illdeveloped ; palpal segment 3 usually with a dorsal spur ; dorsal posterointernal angle of palpal segment 3 without retroverted process. ...	... 6
6. Palpal segment 3 without distinct dorsal spur. ...	... 7
— Palpal segment 3 with distinct dorsal spur. ...	... 8
7. Lateral grooves long ; scutal punctations large ; rudimentary ventral spurs on trochanters ; infrain- ternal setae of palpi broad and number 7. ...	<i>silvafelis</i>
— Lateral grooves shallow ; scutal punctations small ; pronounced ventral spurs on trochanters ; infrain- ternal setae of palpi narrow and number four or five. ...	<i>turturis</i>
8. Scutum elongate, punctations few and shallow ; infrainternal setae slender, well spaced ; dorsobasal spur of palpal segment 3 situated internally ; ventral spur of segment 3 small. ...	<i>bispinosa</i>
— Scutum ovate, punctations numerous and deep ; infrainternal setae feathery, close set ; dorsobasal spur of palpal segment 3 situated medially ; ventral spur of segment 3 large. ...	<i>intermedia</i>

FEMALES

1. Salience broad, palpal segment 2 broader than long. ...	... 2
— Salience usually not broad, palpal segment 2 not broader than long. ...	... 5
2. Palpal segment 3 with ventral spur reduced. ...	<i>minuta</i>
— Palpal segment 3 with ventral spur prominent. ...	... 3
3. Ventrobasal margin of palpal segment 2 with a reduced spur. ...	<i>canestrinii</i>
— Ventrobasal margin of palpal segment 2 with a sharp spur. ...	... 4

4. Basis capituli dorsally 2.5 times as broad as long ; dorsobasal margin of palpal segment 3 without spur ; coxa I with round spur. ...	<i>indica</i>
— Basis capituli dorsally 2 times as broad as long ; dorsobasal margin of palpal segment 3 with median triangular spur ; coxa I with long pointed spur. ...	<i>spinigera</i>
5. Profile of capitulum usually broadly deltoid ; palpal segment 3 with sharp dorsobasalinternal retroverted long spur. ...	<i>wellingtoni</i>
— Profile of capitulum not broadly deltoid ; palpal segment 3 usually without spur, if present, spur short. ...	... 6
6. Palpal segment 3 with small dorsal spur. ...	... 7
— Palpal segment 3 with distinct retroverted dorsal spur. ...	... 8
7. Cervical grooves deep, converging anteriorly and diverging posteriorly ; punctations less numerous, large, deep ; spiracular plate subcircular with extended dorsal projection ; infrainternal setae of palpi broad and number 7. ...	<i>silvafelis</i>
— Cervical grooves small, posterior extension shallow ; punctations numerous, small, shallow ; spiracular plate subcircular with short, blunt dorsal projection ; infrainternal setae of palpi narrow and number 4 or 5. ...	<i>turturis</i>
8. Punctations of scutum few and shallow ; dorsobasal spur of palpal segment 3 situated internally ; ventral spur of segment 3 small ; well spaced infrainternal setae. ...	<i>bispinosa</i>
— Punctations of scutum numerous and deep ; dorso-basal spur of palpal segment 3 situated medially ; ventral spur of segment 3 large ; close set infrainternal setae. ...	<i>intermedia</i>

Genus *Hyalomma*

MALES

1. Adanal shields broad ; subanal shields absent. ...	... 2
— Adanal shields elongate ; subanal shields present. ...	... 4
2. Lateral grooves short or absent ; punctations few ; tarsus IV humped. ...	<i>kumari</i>
— Lateral grooves long ; punctations discrete ; tarsus IV flat. ...	... 3

3. Punctations large, few ; median and paramedian grooves deep ; spiracular plates elongate oval. ... *hussaini*
- Punctations small, numerous ; median and paramedian grooves indistinct ; spiracular plates comma-shaped. ... *brevipunctata*
4. Lateral grooves long ; punctations variable ; cervical grooves deep ; parma absent ; legs with white rings near the joints. ... *marginatum isaaci*
- Lateral grooves short or absent ; punctations few ; cervical grooves deep or shallow ; parma present ; legs without rings. ... 5
5. Subanal shields exterior to axis of adanal shields ; adanal shields curved ; posteromedian groove reaching parma ; cervical grooves deep. ... *dromedarii*
- Subanal shields on the axis of adanals ; adanal shields straight ; posteromedian groove not reaching parma ; cervical grooves shallow. ... *anatolicum anatolicum*

FEMALES

1. Adanal shields broad ; subanal shields absent. ... 2
- Adanal shields elongate ; subanal shields present. ... 4
2. Operculum profile slightly bulging ; punctations few ; tarsus IV humped. ... *kumari*
- Operculum profile distinctly bulging ; punctations numerous ; tarsus IV flat. ... 3
3. Operculum wide, depressed medioposteriorly ; punctations large ; cervical grooves distinct. ... *hussaini*
- Operculum elongate oval, not depressed medioposteriorly ; punctations few ; cervical grooves indistinct. *brevipunctata*
4. Operculum profile depressed posteriorly ; scutum with few large punctations ; cervical grooves almost shallow ; legs with or without rings. ... 5
- Operculum profile depressed posteriorly ; scutum with few large punctations ; cervical grooves deep ; legs with rings. *marginatum isaaci*
5. Operculum almost 'V' shaped, surrounded by a narrow raised integumental fold ; scutal surface frequently rugose ; legs usually ringed. ... *dromedarii*
- Operculum knob like ; scutal surface with few large punctations ; legs usually without rings. ... *anatolicum anatolicum*

Genus *Rhipicephalus*

MALES

1. Adanal shields sickle-shaped ; punctations fine ; cervical grooves short converging pits ; spiracle comma-shaped. ... *haemaphysaloides*
- Adanal shields triangular ; punctations large ; cervical grooves oval or elongated semicircles ; spiracle elongated oval or comma-shaped. ... 2
2. Internal margin of adanal shields with a small conical spur-like projection ; eyes flat ; cervical grooves form oval semicircles ; spiracle elongated oval. ... *turanicus*
- Internal margin of adanal shields without conical projection ; eyes slightly convex ; cervical grooves form elongated semicircles ; spiracle comma-shaped... *sanguineus*

FEMALES

1. Punctations few, sparsely scattered, finer ones hardly visible ; scutum oval ; cervical grooves deep. ... *haemaphysaloides*
- Punctations numerous, close-set, irregular, finer ones visible ; scutum usually elongated ; cervical grooves shallow. ... 2
2. Stigmal plates with short and wide dorsal projection ; posterior contour rounded. ... *turanicus*
- Stigmal plates with narrow dorsal projection, posterior contour slightly convex or almost straight. ... *sanguineus*

TABLE 1. species of ticks so far repoted from Orissa with their distribution and hosts reported.

S. No.	Species	Distribution in India and elsewhere	Hosts, etc. recorded in Orissa
1.	<i>Amblyomma helvolum</i> Koch	India : Andaman and Nicobar Islands, Orissa (Bhubaneswar), West Bengal. Elsewhere : Australia, Indonesia, Malayasia, New Guinea, Philippines, Singapore, Taiwan, Thailand, Vietnam	Land monitor (<i>Varanus flaviscens</i>), King cobra (<i>Ophiophagus hannah</i>)
2.	<i>Amblyomma integrum</i> Karsch	India : Goa, Karnataka, Kerala, Orissa (Dhenkanal, Ganjam, Puri), Tamil Nadu. Elsewhere : Sri Lanka	Buffalo, cattle, <i>Felis viverrina</i> , <i>Viverricula malaccensis</i> , on bushes, under stone

TABLE 1. (*Continued*)

S. No.	Species	Distribution in India and elsewhere	Hosts, etc. recorded in Orissa
3.	<i>Amblyomma javanense</i> (Supino)	India : Andhra Pradesh, Bihar, Gujarat, Karnataka, Maharashtra, Orissa, (Bhubaneswar), Punjab, Uttar Pradesh, Rajasthan, (Personal communication), West Bengal. Elsewhere : Bangladesh, Burma, China, Indonesia, Malayasia, Pakistan, Philippines, Thailand, Vietnam.	<i>Manis crassicaudata</i> (Indian Pangolin)
4.	<i>Amblyomma testudinarium</i> Koch	India : Arunachal Pradesh, Aassam, Karnataka, Maharashtra, Orissa (Bhubaneswar, Balasore), Sikkim, Tamil Nadu, West Bengal. Elsewhere : Bangladesh, Sri Lanka, China, Formosa, Indonesia, Japan, Malayasia, Philippines, Vietnam	Indian wild boar, gour, Indian Rhinoceros, grass
5.	<i>Aponomma lucasi</i> Warburton	India : Andaman and Nicobar Islands, Assam, Bihar, Madhya Pradesh, Orissa (Puri), Uttar Pradesh, West Bengal. Elsewhere : Burma, Sri Lanka, Indonesia, Malayasia, Thailand, Vietnam	<i>Lutra macrodus</i>
6.	<i>Aponomma laeve</i> Neumann	India : Karnataka, Maharashtra, Orissa (Puri), Tamil Nadu. Elsewhere : Sri Lanka, Argentina	Snake
7.	<i>Boophilus microplus</i> (Canestrini)	India : Almost all over the country, Orissa (Bolangir, Ganjam, Kalahandi, Keonjhar, Koraput, Puri, Bhubaneswar). Elsewhere : Australia, Central and South America, Southern part of Florida, South and East Africa, Oriental region	Cattle, buffalo, sheep, goat, ratel, barking deer, vegetation
8.	<i>Dermacentor auratus</i> Supino	India : Andaman Islands, Arunachal Pradesh, Assam, Bihar, Karnataka, Maharashtra, Orissa (Bhubaneswar, Ganjam), Uttar Pradesh, West Bengal. Elsewhere : Burma, Sri Lanka, Formosa, Indonesia, Japan, Korea, Philippines, Vietnam	<i>Rattus blanfordi</i> , <i>Suncus murinus</i> , Indian wild boar
9.	<i>Haemaphysalis bispinosa</i> Neumann	India : Almost all over the country, Orissa (Bhubaneswar, Dhenkanal, Ganjam, Koraput, Puri, Sambalpur). Elsewhere : Australia, Burma, Sri Lanka, China, East Africa, Indonesia, Japan, Malayasia, Nepal, New Zealand, Pakistan, Tasmania, Thailand	Cattle, buffalo, goat, dog, sheep, jackal, <i>Coracias bengalensis</i> (Indian Roller), bark- ing deer, tiger cub, grass

TABLE 1. (Continued)

S. No.	Species	Distribution in India and elsewhere	Hosts, etc. recorded in Orissa
10.	<i>Haemaphysalis canestrinii</i> (Supino)	India : Assam, Madhya Pradesh, Orissa (Bolangir, Ganjam, Koraput, Puri). Elsewhere : Burma, Nepal, Pakistan, Taiwan, Thailand, Vietnam	Leopard, jackal, snake (?), <i>Rattus blanfordi</i> , <i>Rattus cutchicus</i>
11.	<i>Haemaphysalis indica</i> Warburton	India : Bihar, Gujarat, Karnataka, Orissa (Bhubaneswar, Puri), West Bengal. Elsewhere : Sri Lanka, Nepal, Pakistan	<i>Lepus</i> sp., <i>Mus booduga</i> , ratel, palm civet cat
12.	<i>Haemaphysalis intermedia</i> Warburton and Nuttall	India : Andhra Pradesh, Bihar, Karnataka, Maharashtra, Orissa (Bhubaneswar, Bolangir, Ganjam, Koraput, Puri), Tamil Nadu. Elsewhere : Sri Lanka	<i>Centropus sinensis</i> , cattle, goat, sheep, tiger, barking deer, forest undergrowth
13.	<i>Haemaphysalis minuta</i> Kahls	India : Karnataka, Madhya Pradesh, Orissa (Koraput, Sambalpur). Elsewhere : Sri Lanka	Forest undergrowth
14.	<i>Haemaphysalis silvafelis</i> Hoogstraal and Trapido	India : Andhra Pradesh, Maharashtra, Orissa (Puri)	Hare (<i>Oryctolagus</i> sp.)
15.	<i>Haemaphysalis spinigera</i> Neumann	India : Andaman and Nicobar Islands, Andhra Pradesh, Assam, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Orissa (Puri), Tamil Nadu, West Bengal. Elsewhere : Sri Lanka	Under stones and on bushes
16.	<i>Haemaphysalis turturis</i> Nuttall and Warburton	India : Karnataka, Kerala, Maharashtra, Orissa (Bhubaneswar), Tamil Nadu, Uttar Pradesh. Elsewhere : Sri Lanka	Indian wild boar
17.	<i>Haemaphysalis wellingtoni</i> Nuttall and Warburton	India : Andaman Islands, Assam, Karnataka, Maharashtra, Orissa (Koraput). Elsewhere : Burma, China, Indonesia, Malayasia, New Guinea, Thailand	Forest undergrowth
18.	<i>Hyalomma anatolicum anatolicum</i> Koch	India : Andhra Pradesh, Delhi, Gujarat, Himachal Pradesh, Madhya Pradesh, Maharashtra, Orissa (Bolangir, Keonjhar, Koraput, Puri, Sambalpur), West Bengal. Elsewhere : Afganistan, Africa, Pakistan. U.A.R., U.S.S.R.	Cattle, buffalo, sheep, forest undergrowth, pasture land
19.	<i>Hyalomma brevipunctata</i> Sharif	India : Andhra Pradesh, Bihar, Delhi, Gujarat, Madhya Pradesh, Maharashtra, Orissa (Dhenkanal, Ganjam, Koraput), Tamil Nadu, West Bengal. Elsewhere : Pakistan	Cattle, <i>Rattus blanfordi</i> , <i>Mus saxicola</i>

TABLE 1. (Continued)

S. No.	Species	Distribution in India and elsewhere	Hosts, etc. recorded in Orissa
20.	<i>Hyalomma dromedarii</i> Koch	India : Andhra Pradesh, Delhi, Gujarat, Orissa (Dhenkanal). Elsewhere : Afghanistan, Africa, Algeria, Argentina, Ethiopia, Iran, Mongolia, Morocco, Pakistan, Tibet, Tripoli, Tunisia, U.A.R., U.S.S.R.	Not known
21.	<i>Hyalomma hussaini</i> Sharif	India : Andhra Pradesh, Bihar, Delhi, Goa, Gujarat, Madhya Pradesh, Maharashtra, Orissa (Dhenkanal, Ganjam, Puri), Tamil Nadu, West Bengal. Elsewhere : Pakistan	Cattle, buffalo, sheep, goat
22.	<i>Hyalomma kumari</i> Sharif	India : Assam, Bihar, Delhi, Gujarat, Kerala, Orissa (Bolangir, Puri), Punjab, Madhya Pradesh, Tamil Nadu, Uttar Pradesh. Elsewhere : Nepal, Pakistan, Tibet	Goat, sheep, dog, <i>Mus saxicola</i>
23.	<i>Hyalomma marginatam isaaci</i> Sharif	India : Andhra Pradesh, Arunachal Pradesh, Bihar, Delhi, Gujarat, Jammu and Kashmir, Karnataka, Madhya Pradesh, Maharashtra, Orissa (Balasore, Bhubaneswar, Dhenkanal, Ganjam, Kalahandi, Koraput, Phulbari, Puri, Sambalpur), Tamil Nadu, Uttar Pradesh. Elsewhere : Sri Lanka, Nepal, Pakistan	Buffalo, cattle, goat, <i>Centropus sinensis</i> , Indian hare (<i>Lepus nigricollis</i>), palm civet cat, rabbit
24.	<i>Nosomma monstrosus</i> Nuttall and Warburton	India : Bihar, Karnataka, Maharashtra, Orissa (Dhenkanal, Ganjam, Koraput, Puri, Sambalpur), West Bengal. Elsewhere : Bangladesh	Buffalo, cattle, <i>Mus booduga</i>
25.	<i>Rhipicephalus haemaphysaloides</i> Supino	India : Distributed all over the country, Orissa (Bolangir, Dhenkanal, Ganjam, Koraput, Sambalpur). Elsewhere : Burma, China, Indonesia, Sri Lanka, Taiwan, Thailand, Vietnam	Jackal, buffalo, cattle, <i>Lepus</i> sp., <i>Felis viverrina</i> , <i>Mus saxicola</i> , <i>Centropus sinensis</i> , <i>Mus booduga</i> , <i>Rattus r. arboreus</i> , <i>Rattus cutchicus</i> , <i>Suncus murinus</i> , forest vegetation

TABLE 1. (Concluded)

S. No.	Species	Distribution in India and elsewhere	Hosts, etc. recorded to Orissa
26.	<i>Rhipicephalus sanguineus</i> Latreille	India : Almost all over the country, Orissa (Cuttack, Keonjhar, Puri). Elsewhere : Distributed on all the continents of earth	Dog, jackal
27.	<i>Rhipicephalus turanicus</i> Pomerantzev	India : Andhra Pradesh, Gujarat, Kashmir, Madhya Pradesh, Maharashtra, Orissa (Puri), Tamil Nadu, West Bengal. Elsewhere : Middle East, U.S.S.R.	<i>Rattus r. arboreus</i>

SUMMARY

Ten species of Ixodid ticks associated with zooanimals in Nandankanan, Orissa are discussed. In addition, the distribution, hosts, and key to all the genera and species so far recorded from Orissa are given.

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REFERENCES

- DANDAWATE, C. N. AND SHAH, K. V. 1969. Ganjam Virus : A new arbovirus isolated from ticks *Haemaphysalis intermedia* Warburton and Nuttall, 1909 in Orissa, India. *Indian J. med. Res.*, **57** (5) : 799-804.
- DE, S. K. 1976. A note on Ticks (Acarina : Ixodidae) from Orissa, in the collection of Zoological Survey of India. *Newsl. zool. Surv. India*, **2** (3) : 107-108.
- GROBOV, A. G. 1946. Carriers of Crimean haemorrhagic fever. *Medskaya Parazit.*, **15** (6) : 59-63.
- KAUL, N. H., DHANDA, V. AND MISHRA, A. C. 1979. A survey of ixodid ticks in Orissa state, India. *Indian J. Anim. Sci.*, **49** (9) : 701-712.
- KRIJGSMAN, B. J. AND PONTO, S. A. S. 1932. De teken van den Oost-Indischen Archipel. *Veeartsenijk. Meded. Dep. Handle. Med.-Indie*, **79** : 1-62.

- PATTANAYAK, P. C. AND HIREGOUDAR, L. S. 1973. A preliminary survey of ticks in Orissa. *Orissa Vet. J.*, **8** (1-4) : 34-36.
- RAO, T. R. 1964. Kyasanur Forest Disease 1957-1964. *Indian Council Med. Res.*, 1-30.
- SHAH, K. V. AND WORK, T. H. 1969. Bhanja Virus : A new arbo-virus from ticks *Haemaphysalis intermedia* Warburton and Nuttall, 1909 in Orissa, India. *Indian J. med. Res.*, **57** (5) : 793-798.
- SHARIF, M. 1928. A revision of the Indian Ixodidae with special reference to the collection in the Indian Museum. *Rec. Indian Mus.*, **30** (3) : 217-344.
- SHARIF, M. 1938. Diseases transmitted by the Indian species of ticks and the possibility of their prevention through biological control. *Indian J. vet. Sci.*, **8** (4) : 353-366.

ACARI (MITES)

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INTRODUCTION

Our information regarding mite fauna of Orissa is scanty and whatever little is known is scattered in various publications (Kuppuswamy, 1942 ; Paramjit *et al.*, 1950 ; Kanungo and Biswas, 1958 ; Satpathy and Mania, 1969 ; Rao, 1970 ; Raut and Maiti, 1971 ; Mahunka, 1971 ; Misra *et al.*, 1972 ; Prasad, 1975 ; Gupta and Gupta, 1976 ; Das and Naik, 1977 ; Gupta, 1977, 1978. Prasad (1974), in his catalogue of Indian mites, included 18 species from Orissa while Gupta (1985) listed 26 species from Orissa. In order to present a summarised information on mite fauna of Orissa, this paper has been prepared to include all the species known from the state including those studied presently. A total of 42 species distributed over 3 orders, 10 families, and 22 genera are dealt with, among those, 27 are plant mites, 6 parasitic mites, 7 moss/soil mites and one each of water and stored grain mites. A key to species of plant mites is provided.

SYSTEMATIC ACCOUNT

I. Plant mites

Order PROSTIGMATA

Family TETRANYCHIDAE

1. *Aponychus corpuzae* Rimando

1966. *Aponychus corpuzae* Rimando, *Philipp. Agric.*, 50 : 107.

1976. *Aponychus corpuzae* : Gupta and Gupta, *News. zool. Surv. India*, 2 (4) : 146.

1985. *Aponychus corpuzae* : Gupta, *Handbk. Plant Mites of India* : 59.

Material examined : 1 ex., Dhenkanal Dist., Angul, Purnakote forest, on bamboo, 9.iv.1973, coll. S. K. Gupta.

Distribution : India : Andaman and Nicobar Islands, Assam, Meghalaya, Orissa (Dhenkanal Dist.). Outside India : Japan, Phillippines, Thailand.

2. *Bakerina orissaensis* Prasad

1975. *Bakerina orissaensis* Prasad, *Internat. J. Acarol.*, 1 (2) : 18-20.

1985. *Bakerina orissaensis* : Gupta, *Handbk. Plant Mites of India* : 70.

Host : Jackfruit.

Distribution : India : Orissa (Bhubaneshwar).

3. *Eotetranychus broodryki* Meyer

1974. *Eotetranychus broodryki* Meyer, *S. Afr. Dept. Agr. Tech. Serv. Ent. Mem.*, No. 36 : 201.

1985. *Eotetranychus broodryki* : Gupta, *Handbk. Plant Mites of India* : 71-72.

Host : Red gram.

Distribution : India : Orissa (Bhubaneswar). Outside India : South Africa.

4. *Eutetranychus orientalis* (Klein)

1936. *Anychus orientalis* Klein, *Bull. Agr. Res. Stn. Rehovoth*, 21 : 3.

1974. *Eutetranychus orientalis* : Prasad, *A catalogue of Mites of India* : 114-115.

1976. *Eutetranychus orientalis* : Gupta and Gupta, *Newsl. zool. Surv. India*, 2 (4) : 145.

1985. *Eutetranychus orientalis*, Gupta, *Handbk. Plant Mites of India* : 66-67.

Material examined : 4 exs., Dhenkanal Dist., Angul, Tulka forest, on rose, 7.iii.1973, coll. S. K. Gupta.

Distribution : India : Assam, West Bengal, Orissa (Dhenkanal Dist.) Uttar Pradesh, Delhi, Punjab, Haryana, Jammu and Kashmir, Maharashtra, Karnataka. Outside India : Pakistan, Afghanistan, Taiwan, Thailand, Turkey, Jordan, Iran, Egypt, Israel, Cyprus, Sudan, South Africa.

5. *Oligonychus indicus* (Hirst)

1923. *Paratetranychus indicus* Hirst, *Proc. Zool. Soc. Lond.*, 1923 : 990.

1974. *Oligonychus indicus* : Prasad, *A catalogue of Mites of India* : 117-118.

1976. *Oligonychus indicus* : Gupta and Gupta, *Newsl. zool. Surv. India*, 2 (4) : 145.

1985. *Oligonychus indicus* : Gupta, *Handbk. Plant Mites of India* : 84-86.

Material examined : 4 exs., Dhenkanal Dist., Angul, Soil Conservation Centre, on paddy, 10.iv.1973, coll. S. K. Gupta.

Distribution : India : Andhra Pradesh, Tamil Nadu, Karnataka, Bihar, Orissa (Dhenkanal Dist.), West Bengal, Uttar Pradesh, Delhi, Haryana, Punjab. Outside India : Pakistan.

6. *Oligonychus mangiferus* (Rahman and Sapra)

1940. *Paratetranychus mangiferus* Rahman and Sapra, *Proc. Indian Acad. Sci.*, 11B : 192.

1974. *Oligonychus mangiferus* : Prasad, *A catalogue of Mites of India* : 118-119.

1976. *Oligonychus mangiferus* : Gupta and Gupta, *Newsl. zool. Surv. India*, 2 (4) : 145.

1985. *Oligonychus mangiferus* : Gupta, *Handbk. Plant Mites of India* : 87-88.

Material examined : 2 exs., Keonjhar Dist., Anandpur, 12.iv.1973, on blackberry, coll. S. K. Gupta.

Distribution : India : Bihar, Orissa (Keonjhar Dist.), West Bengal, Delhi, Haryana, Punjab, Himachal Pradesh, Kerala, Karnataka. Outside India : Hawaii, Mauritius, Egypt, Peru.

7. *Oligonychus oryzae* (Hirst)

1926. *Paratetranychus oryzae* Hirst, *Proc. Zool. Soc. Lond.*, 1926 : 830.
1974. *Oligonuchus oryzae* : Prasad, *A catalogue of Mites of India* : 119.
1976. *Oligonychus oryzae* : Gupta and Gupta, *Newsl. Zool. Surv. India*, 2 (4) : 145.
1985. *Oligonychus oryzae* : Gupta, *Handbk. Plant Mites of India* : 88-89.

Material examined : 3 exs., Dhenkanal Dist., Angul, Soil Conservation Centre, 10.iv.1973, on paddy, coll. S. K. Gupta.

Distribution : India : Andaman and Nicobar Isls., Orissa (Dhenkanal Dist.), Punjab, Tamil Nadu.

8. *Schizotetranychus andropogoni* (Hirst)

1926. *Tetranychus* (*Schizotetranychus*) *andropogoni* Hirst, *Proc. Zool. Soc. Lond.*, 1926 : 829.
1974. *Schizotetranychus andropogoni* : Prasad, *A catalogue of Mites of India* : 121.
1976. *Schizotetranychus andropogoni* : Gupta and Gupta, *Newsl. zool. Surv. India*, 2 (4) : 145.
1985. *Schizotetranychus andropogoni* : Gupta, *Handbk. Plant Mites of India* : 96-97.

Material examined : 2 exs., Mayurbhanj Dist., Baripada, Meghasani forest, 19.iv.1973, on undet. plant, coll. S. K. Gupta.

Distribution : India : Bihar, Orissa (Mayurbhanj Dist.), West Bengal, Delhi, Punjab, Tamil Nadu. Outside India : Pakistan, Thailand, Mexico.

9. *Tetranychus cinnabarinus* (Boisduval)

1867. *Acarus cinnabarinus* Boisduval, *Ent. Hort.* : 88.
1974. *Tetranychus cinnabarinus* : Prasad, *A catalogue of Mites of India* : 122-124.
1976. *Tetranychus cinnabarinus* : Gupta and Gupta, *Newsl. zool. Surv. India*, 2 (4) : 145.
1985. *Tetranychus cinnabarinus*, Gupta, *Handbk. Plant Mites of India* : 106-108.

Material examined : 5 exs., Dhenkanal Dist., Angul, Tulka forest, 11.iv.1973, on date palm, coll. S. K. Gupta.

Distribution : India : Bihar, Orissa (Dhenkanal Dist.), West Bengal, Meghalaya, Kerala, Karnataka, Tamil Nadu, Gujarat, Haryana, Punjab, Rajasthan. Outside India : Cosmopolitan.

10. *Tetranychus neocaledonicus* André

1933. *Tetranychus neocaledonicus* André, *Bull. Hort. natn. Hist. nat. Paris*, 2 (5) : 202.
 1974. *Tetranychus neocaledonicus* : Prasad, *A catalogue of Mites of India* : 125-126.
 1976. *Tetranychus neocaledonicus* : Gupta and Gupta, *Newsl. zool. Surv. India*, 2 (4) : 144.
 1985. *Tetranychus neocaledonicus* : Gupta, *Handbk. Plant Mites of India* : 113-115.

Material examined : 2 exs., Keonjhar Dist., Anandpur, Gohara Agricultural farm, 12.iv.1973, on bamboo, coll. *S. K. Gupta*.

Distribution : India : Orissa (Keonjhar Dist.), Assam, Meghalaya, Uttar Pradesh, Delhi, Punjab, Rajasthan, Haryana, Gujarat, Maharashtra, Karnataka, Kerala. Outside India : Hawaii, Fiji, Bahamas, Africa, U.S.A., Venezuela, Puerto Rico.

Family TENUIPALPIDAE

11. *Brevipalpus phoenicis* (Geijskes)

1939. *Tenuipalpus phoenicis* Geijskes, *Meded Landb Hoogesch Wageningen*, 42 : 23.
 1974. *Brevipalpus phoenicis* : Prasad, *A catalogue of Mites of India* : 110-111.
 1976. *Brevipalpus phoenicis* : Gupta and Gupta, *Newsl. zool. Surv. India*, 2 (4) : 146.
 1985. *Brevipalpus phoenicis* : Gupta, *Handbk. Plant Mites of India* : 130-131.

Material examined : 5 exs., Keonjhar Dist., Anandpur, 2.iv.1973, on undet. plant, coll. *S. K. Gupta* ; 2 exs., Chilka Lake area, 4.iii.1974, on undet. plant, coll. *B. N. Putatunda*.

Distribution : India : Assam, Bihar, Orissa (Keonjhar Dist., Chilka area) Meghalaya, Delhi, Punjab. Himachal Pradesh, Maharashtra, Karnataka, Tamil Nadu. Outside India : U.S.A. (Hawaii, California, Texas, Florida), Argentina, Brazil, Venezuela, Trinidad, Holland, Spain, Portugal, Syria, Sicily, Italy, Kenya, Tanganyika, Ethiopia, Mauritius, Japan (Okinawa Isl.), Malaya, Taiwan, Philippines, Australia.

12. *Raoiella indica* Hirst

1924. *Raoiella indica* Hirst, *Ann Mag. nat. Hist.* (9) 14 : 522.
 1974. *Raoiella indica* : Prasad, *A catalogue of Mites of India* : 111-112.
 1976. *Raoiella indica* : Gupta and Gupta, *Newsl. zool. Surv. India*, 2 (4) : 146.
 1985. *Raoiella indica* : Gupta, *Handbk. Plant Mites of India* : 137.

Material examined : 5 exs. Dhenkanal Dist., Angul, Ghatgaon Atei Reserved forest, 9.iv.1973, on undet plant, coll. *S. K. Gupta*.

Distribution : India : Orissa (Dhenkanal Dist.), Karnataka, Tamil Nadu, Punjab. Outside India : Mauritius.

Family PHYTOSEIDAE

13. *Amblyseius (Amblyseius) largoensis* (Muma)

1955. *Amblyseiopsis largoensis* Muma, *Ann. ent. Soc. Am.*, **48** : 266.
1974. *Amblyseius largoensis* : Prasad, *A catalogue of Mites of India* : 166-167.
1978. *Amblyseius largoensis* : Gupta, *Indian J. Acar.*, **2** (2) : 65.
1985. *Amblyseius (Amblyseius) largoensis* : Gupta, *Handbk. Plant Mites of India* : 139.

Material examined : 1 ex., Keonjhar Dist., Keonjhargarh, 2.iv.1973, on cashewnut, coll. S. K. Gupta ; 1 ex., Dhenkanal Dist., Purnakote, 9.iv.1973, on litchi, coll. S. K. Gupta.

Distribution : India : Andaman Nicobar Islands, Bihar, West Bengal, Meghalaya, Nagaland, Tripura, Manipur, Karnataka, Orissa (Keonjhar Dist. & Dhenkanal Dist.), Pondicherry, Kerala, Tamil Nadu, Gujarat, Himachal Pradesh. Outside India : Hong Kong, Japan, Philippines, Israel, Angola, South Africa, Guatemala, Honduras, Mexico, Puerto Rico, U. S. A., New Zealand.

14. *Amblyseius (Euseius) alstoniae* Gupta

1975. *Amblyseius alstoniae* Gupta, *Internat. J. Acarol.*, **1** (2) : 31-32.
1978. *Amblyseius alstoniae* : Gupta, *Indian J. Acar.*, **2** (2) : 61.
1985. *Amblyseius (Euseius) alstoniae* : Gupta, *Handbk. Plant Mites of India* : 344.

Material examined : 1 ex., Keonjhar Dist., Anandpur, Gohara Agricultural farm, 3.iv.1973, on *Butea frondosa*, coll. S. K. Gupta.

Distribution : India : Assam, Bihar, Orissa, West Bengal, Meghalaya, Tripura, Tamil Nadu, Delhi, Punjab, Rajasthan.

15. *Amblyseius (Euseius) coccineae* Gupta

1975. *Amblyseius coccineae* Gupta, *Internat. J. Acarol.*, **1** (2) : 33.
1978. *Amblyseius coccineae* : Gupta, *Indian J. Acar.*, **2** (2) : 61.
1985. *Amblyseius (Euseius) coccineae* : Gupta, *Handbk. Plant Mites of India* : 345.

Material examined : 1 ex., Keonjhar Dist., Keonjhargarh, 29.ii.1973, on bamboo, coll. S. K. Gupta ; 2 exs., Mayurbhanj Dist., Baripada, Bissoi, 24. iv.1973, on undet. plant, coll. S. K. Gupta.

Distribution : India : Orissa (Keonjhar Dist., Mayurbhanj Dist.), West Bengal, Meghalaya, Andhra Pradesh, Tamil Nadu, Pondicherry.

16. *Amblyseius (Euseius) delhiensis* (Narayanan and Kaur)

1960. *Typhlodromus (Amblyseius) delhiensis* Narayanan and Kaur, *Proc. Indian Acad. Sci.*, 51B : 5-7.
 1974. *Amblyseius delhiensis* : Prasad, *A catalogue of Mites of India* : 162-163.
 1978. *Amblyseius delhiensis* : Gupta, *Indian J. Acar.*, 2 (2) : 62.
 1985. *Amblyseius (Euseius) delhiensis* : Gupta, *Handbk. Plant Mites of India* : 346.

Material examined : 2 exs., Keonjhar Dist., Anandpur, Gohara Agricultural farm, 3.iv.1973, on guava, coll. S. K. Gupta.

Distribution : India : Delhi, Punjab, West Bengal, Orissa (Keonjhar Dist.).

17. *Amblyseius (Euseius) finlandicus* (Oudemans)

1915. *Seiulus finlandicus* Oudemans, *Ent. Ber. Amst.*, 4 : 183.
 1969. *Amblyseius finlandicus* : Sathpathy and Mania, *Jour. Bombay Nat. Hist. Soc.*, 66 (3) : 648.
 1974. *Amblyseius finlandicus* : Prasad, *A catalogue of Mites of India* : 164.
 1985. *Amblyseius (Euseius) finlandicus* : Gupta, *Handbk. Plant Mites of India* : 347.

Habitat : Sugarcane.

Distribution : India : Orissa (Bhubaneswar), West Bengal, Karnataka, Punjab. Outside India : Europe, U. S. S. R., U. S. A., South America, Japan, Indonesia.

18. *Amblyseius (Neoseiulus) longispinosus* (Evans)

1952. *Typhlodromus longispinosus* Evans, *Ann. Mag. nat. Hist.* (12) : 5 : 413-416.
 1974. *Amblyseius longispinosus* : Prasad, *A catalogue of Mites of India* : 167.
 1978. *Amblyseius longispinosus* : Gupta, *Indian J. Acar.*, 2 (2) : 66.
 1985. *Amblyseius (Neoseiulus) longispinosus* : Gupta, *Handbk. Plant Mites of India* : 354-355.

Material examined : 1 ex., Keonjhar Dist., Anandpur, 9.iv.1973, on guava, coll. S. K. Gupta.

Distribution : India : Andaman Nicobar Islands., West Bengal, Bihar, Orissa (Keonjhar Dist.), Pondicherry, Tamil Nadu. Outside India : Hawaii, Japan, Philippines, New Zealand, Jamaica, South Africa.

19. *Amblyseius (Paraphytoseius) multidentatus* (Swirski and Shechter)

1961. *Paraphytoseius multidentatus* Swirski and Shechter, *Israel J. agric. Res.*, 11 (2) : 114-116.
 1978. *Amblyseius bhadrakaliensis* : Gupta, *Indian J. Acar.*, 2 (2) : 61.
 1985. *Amblyseius (Paraphytoseius) multidentatus* : Gupta, *Handbk. Plant Mites of India* : 356-358.

Material examined : 1 ex., Keonjhar Dist., Anandpur, Gohara Agricultural farm, 3.iv.1973, on brinjal, coll. *S. K. Gupta*.

Distribution : India : Andaman Nicobar Isls., Bihar, Orissa (Keonjhar Dist.), West Bengal, Arunachal Pradesh, Assam, Meghalaya, Tripura, Andhra Pradesh, Karnataka, Tamil Nadu, Maharashtra, Uttar Pradesh, Punjab, Jammu and Kashmir. Outside India : Hong Kong, Thailand, Madagascar, Nicaragua.

20. *Amblyseius (Typhlodromalus) kalimpongensis* Gupta

1970. *Amblyseius kalimpongensis* Gupta, *Bull. Entomol. (Ent. Soc. India)*, **10** : 128-129.

1974. *Amblyseius kalimpongensis* : Prasad, *A catalogue of Mites of India* : 166.

1978. *Amblyseius kalimpongensis* : Gupta, 1978, *Indian J. Acar.*, **2** (2) : 68.

1985. *Amblyseius (Typhlodromalus) kalimpongensis* : Gupta, *Handbk. Plant Mites of India* : 362.

Material examined : 1 ex., Mayurbhanj Dist., Amarda Road, 22.iii.1973, on *Shorea* sp., coll. *S. K. Gupta* ; 1 ex., Dhenkanal Dist., Angul, Horticultural farm, 7.iv.1973, on *Citrus* sp., coll. *S. K. Gupta*.

Distribution : India : West Bengal, Assam, Bihar, Orissa (Mayurbhanj Dist., Dhenkanal Dist.), Gujarat, Andhra Pradesh, Tamil Nadu, Karnataka.

21. *Amblyseius (Typhlodromips) suknaensis* Gupta

1970. *Amblyseius suknaensis* Gupta, *Oriental Ins.*, **4** : 185-186.

1974. *Amblyseius suknaensis* : Prasad, *A catalogue of Mites of India* : 170.

1978. *Amblyseius suknaensis* : Gupta, *Indian J. Acar.*, **2** (2) : 73.

1985. *Amblyseius (Typhlodromips) suknaensis* : Gupta, *Handbk. Plant Mites of India* : 370-371.

Material examined : 2 exs., Mayurbhanj Dist., Amarda Road, 22.iii.1973, on *Shorea robusta*, coll. *S. K. Gupta*.

Distribution : India : Andaman Nicobar Isls., West Bengal, Orissa (Mayurbhanj Dist.) Meghalaya, Tripura, Kerala.

22. *Amblyseius (Typhlodromips) syzygii* Gupta

1975. *Amblyseius syzygii* Gupta, *Internat. J. Acarol.*, **1** (2) : 44-45.

1978. *Amblyseius syzygii* : Gupta, *Indian J. Acar.*, **2** (2) : 74.

1985. *Amblyseius (Typhlodromips) syzygii* : Gupta, *Handbk. Plant Mites of India* : 371.

Material examined : 1 ex., Mayurbhanj, Jenabil forest, 21.iii.1973, on leaf litter, coll. *S. K. Gupta*.

Distribution : India : Orissa, West Bengal, Tripura. Outside India : Thailand.

23. *Phytoseius* (*Pennaseius*) *kapuri* Gupta

1969. *Phytoseius* (*Phytoseius*) *kapuri* Gupta, *Israel J. agric. Res.*, **19** : 115-116.
 1974. *Phytoseius kapuri* : Prasad, *A catalogue of Mites of India* : 171.
 1977. *Phytoseius* (*Phytoseius*) *kapuri* : Gupta, *Indian J. Acar.*, **2** (1) : 10.
 1985. *Phytoseius* (*Pennaseius*) *kapuri* : Gupta, *Handbk. Plant Mites of India* : 380-381.

Material examined : 1 ex., Mayurbhanj Dist., Bangriposi ghat, 25.iii.1973, on 'Kendu' leaf, coll. S. K. Gupta ; 1 ex., Amarda Road, 22.iii.1973, on undet. plant, coll. S. K. Gupta.

Distribution : India : Andaman Isls., Orissa (Mayurbhanj Dist.), West Bengal, Assam, Meghalaya, Gujarat, Punjab.

24. *Phytoseius* (*Phytoseius*) *macropilis* (Banks)

1909. *Sejus macropilis* Banks, *Proc. ent. Soc. Wash.*, **11** : 135.
 1974. *Phytoseius macropilis* : Prasad, *A catalogue of Mites of India* : 171.
 1977. *Phytoseius* (*Dubininellus*) *macropilis* : Gupta, *Indian J. Acar.*, **2** (1) : 9.
 1985. *Phytoseius* (*Phytoseius*) *macropilis* : Gupta, *Handbk. Plant mites of India* : 386.

Material examined : 1 ex., Mayurbhanj Dist., Baripada, 23.iii.1973, on *Shorea robusta*, coll. S. K. Gupta.

Distribution : India : Delhi, Orissa (Mayurbhanj Dist.). Outside India : Europe, Canada, U. S. A., U. S. S. R., Mexico, Panama, British West Indies, Australia.

25. *Phytoseius* (*Phytoseius*) *rugosus* Denmark

1966. *Phytoseius* (*Dubininellus*) *rugosus* Denmark, *Bull. Fla. Dep. Agr.*, **6** : 100.
 1977. *Phytoseius* (*Dubininellus*) *rugosus* : Gupta, *Indian J. Acar.*, **2** (1) : 7-9.
 1985. *Phytoseius* (*Phytoseius*) *rugosus* : Gupta, *Handbk. Plant Mites of India* : 389.

Material examined : 1 ex., Keonjhar Dist., Keonjhargarh, 30.iii.1973, on *Terminalia arjuna*, coll. S. K. Gupta.

Distribution : India : Orissa (Keonjhar Dist.). Outside India : Pakistan.

26. *Typhlodromus* (*Amblydromella*) *homalii* Gupta

1970. *Typhlodromus homalii* Gupta, *Oriental Ins.*, **4** : 188-189.
 1974. *Typhlodromus homalii* : Prasad, *A catalogue of Mites of India* : 174.
 1977. *Typhlodromus homalii* : Gupta, *Indian J. Acar.*, **2** (1) : 6.
 1985. *Typhlodromus* (*Amblydromella*) *homalii* : Gupta, *Handbk. Plant Mites of India* : 394-395.

Material examined : 1 ex., Mayurbhanj Dist., Baripada, 3.iv.1973, on *Ficus bengalensis*, coll. S. K. Gupta.

Distribution : India : West Bengal, Orissa (Mayurbhanj Dist.), Meghalaya, Kerala, Tamil Nadu, Punjab.

27. *Typhlodromus (Orientiseius) orissaensis* Gupta

1977. *Typhlodromus orissaensis* Gupta, *Indian J. Acar.*, 2 (1) : 4-6.

1985. *Typhlodromus (Orientiseius) orissaensis* : Gupta, *Handbk. Plant Mites of India* : 401.

Habitat : Undet. plant.

Distribution : India : Orissa (Dhenkanal Dist., Angul).

Key to the families, genera and species of plant mites occurring in Orissa

1. Propodosomal apotele represented by a tined seta situated near the inner basal angle of tarsus ; stigmata situated lateral to coxae III and IV and with elongated peritreme. ...	Order MESOSTIGMATA
Dorsal shield normally with fewer than 20 pairs of setae. ...	Family Phytoseiidae 2
— Pedipalpal apotele absent ; stigmata situated between chelicerae or on the dorsal surface of propodosoma and often with associated peritreme. ...	Order PROSTIGMATA 16
2. Dorsal shield with 4 pairs of prolateral setae. ...	Subfam. Amblyseiinae 3
— Dorsal shield with 5-6 pairs of prolateral setae. ...	Subfam. Phytoseiinae 12
3. Dorsal shield with 5 pairs of postlateral setae. ...	... 4
— Dorsal shield with 2 pairs of postlateral setae. ...	<i>Amblyseius (Paraphytoseius) multidentatus</i>
4. Setae s4, Z5, Z4 being long, whip-like, longer than distances between their bases. ...	<i>Amblyseius (Amblyseius) largoensis</i>
— Setae s4, Z5, Z4 shorter, not whip-like. ...	... 5
5. Sternal shield distinct with straight posterior margin ; ventrianal shield pentagonal or shield shaped. ...	... 6
— Sternal shield indistinct, posterior margin may be trilobate ; ventrianal shield elongate, vase-shaped or concave laterally. ...	... 8
6. Z5 and Z4 serrate ; sternal shield as wide as or wider than long. ...	... 7
— Z5 and Z4 smooth ; sternal shield longer than wide. Setae on dorsal shield mostly long excepting J5, S5 and J1 which are short. ...	<i>Amblyseius (Neosius) longispinosus</i>

7.	Cervix of spermatheca saucer-shaped.	...	<i>Amblyseius (Typhlodromips)</i> <i>syzygii</i>	
—	Cervix of spermatheca elongated, flask-shaped.	...	<i>Amblyseius (Typhlodromips)</i> <i>suknaensis</i>	
8.	Peritreme extending anteriorly upto j3, 1st pair of preanal setae always on the anterior margin of ventrianal shield.	...	<i>Amblyseius (Typhlodromalus)</i> <i>Kalimpongensis</i>	
—	Peritreme never extends upto j3 ; 1st pair of preanal setae away from anterior margin of ventrianal shield.	...	...	9
9.	Dorsal shield smooth.	...	...	10
—	Dorsal shield reticulate.	...	...	11
10.	S2 longer than Z1.	...	<i>Amblyseius (Euseius) alstoniae</i>	
—	S2 and Z1 almost equal.	...	<i>Amblyseius (Euseius) delhiensis</i>	
11.	z2 and z4 almost of same length.	...	<i>Amblyseius (Euseius) finlandicus</i>	
—	z2 noticeably shorter than z4.	...	<i>Amblyseius (Euseius) coccineae</i>	
12.	r3 when present on dorsal shield.	...	<i>Phytoseius</i> 13	
—	r3 when present on lateral integument.	...	<i>Typhlodromus</i> 15	
13.	R1 present, dorsal shield notched at the level of r3.	...	<i>Phytoseius (Pennaseius) kapuri</i>	
—	R1 absent.	...	...	14
14.	Length of s4, s6, Z5 respectively 100, 76, 70.	...	<i>Phytoseius (Phytoseius) macropilis</i>	
—	Length of s4, s6 and Z5 respectively 45, 29, 26.	...	<i>Phytoseius (Phytoseius) rugosus</i>	
15.	j3, z3, s4, s6, S2, S4, j6, J2 long or very long in relation to other dorsal setae.	...	<i>Typhlodromus (Orientiseius)</i> <i>orissaensis</i>	
—	j3, z3, s4, s6, S2, S4, j6 and J2 not very long in relation to the other dorsal setae.	...	<i>Typhlodromus (Amblydomella)</i> <i>homalii</i>	
16.	Without a palpal thumb-claw complex.	...	Fam. Tenuipalpidae	26
—	With a palpal thumb-claw complex.	...	Fam. Tetranychidae	17
17.	Tarsus I with single set of closely associated duplex setae ; or duplex setae absent.	...	...	18
—	Tarsus I with 2 pairs of duplex setae, the proximal member of each pair shorter than distal member, empodium claw-like or splits distally.	...	...	19
18.	Empodial claw absent, with 2 pairs of preanal setae...		<i>Eutetranychus orientalis</i>	
—	Empodial claw absent, with 1 pair of preanal setae ; dorsocentral hysterosomal setae I-III subspatulate.	...	<i>Aponychus corpuzae</i>	
19.	Hysterosoma with 4th pair of dorsocentral setae marginal or absent ; dorsal idiosomal setae 12 pairs, setae leaf-like.	...	<i>Bakerina orissaensis</i>	
—	Hysterosoma with 4th pair of dorsocentral setae in normal dorsal position.	...	...	20

20. With 2 pairs of paraanal setae. ...	21 (<i>Schizotetranychus</i> , <i>Eotetranychus</i>)
— With 1 pair of paraanal setae. ...	22 (<i>Oligonychus</i> , <i>Tetranychus</i>)
21. Empodium claw-like. ...	<i>Schizotetranychus andropogoni</i>
— Empodium ending in a tuft of hairs. ...	<i>Eotetranychus broodrykl</i>
22. Empodium claw-like with proximal hairs, duplex setae of tarsus I distal and approximate. ...	... 23
— Empodium splits distally, usually into 3 pairs of hairs ; duplex setae of tarsus I well separated. ...	... 25
23. Aedeagus bent ventrad forming an acute angle with shaft ; tarsus I with not more than 1 tactile seta on venter just distad of duplex setae. ...	<i>Oligonychus mangiferus</i>
— Aedeagus bent dorsad, although the distal end may be directed ventrad ; tarsus I with 2 tactile setae on venter just distad of duplex setae. ...	... 24
24. Aedeagus with distal end enlarged. ...	<i>O. indicus</i>
— Aedeagus with distal end not enlarged, tip of sigmoidal distal end of aedeagus dorsally directed. ...	<i>O. oryzae</i>
25. Knob of aedeagus berry-like, rounded anterior projection more strongly developed than the posterior convexity. ...	<i>Tetranychus neocaledonicus</i>
— Knob of aedeagus not globular ; the caudal projection angulate. ...	<i>Tetranychus cinnabarinus</i>
26. Hysterosoma with not more than 1 pair of dorsosub-lateral setae or without dorsosublaterals. ...	<i>Brevipalpus phoenicis</i>
— Hysterosoma with 2 or more pairs of dorsosub-laterals. ...	<i>Raoiella indica</i>

II. Parasitic mites

Order PROSTIGMATA

Family DEMODICIDAE

28. *Demodex bovis* Stiles

1892. *Demodex folliculorum* var. *bovis* Stiles, *Can. Ent.*, 24 : 286.

1942. *Demodex bovis* : Kuppaswamy, *Ann. Rep. Vet. Investig. Officer, Orissa*, 1941-1942 : 17.

1974. *Demodex bovis* : Prasad, *A catalogue of Mites of India* : 106.

Host : Goat.

Distribution : India : Orissa (exact locality unknown), Assam, Meghalaya, Uttar Pradesh. Outside India : Cosmopolitan.

29. Demodex caprae Railliet

1895. *Demodex folliculorum* var. *caprae* Railliet, *Zool. Meded. Agric.* : 638.

1972. *Demodex caprae* : Das and Misra, *Indian vet. J.*, **49** : 96-101.

1974. *Demodex caprae* : Prasad, *A catalogue of Mites of India* : 106-107.

Host : Goat (Das & Misra, 1972).

Distribution : India : Orissa (Bhubaneshwar).

Order ASTIGMATA**Family KNEMIDOCOPTIDAE****30. Knemidocoptes mutans (Robin)**

1860. *Sarcoptes mutans* Robin, *Bull. mosk. Obsheh. Ispyt.*, **33** : 184.

1972. *Cnemidocoptes mutans* : Misra, Tripathy and Misra, *Indian vet. J.*, **49** : 424-426.

1974. *Knemidocoptes mutans* : Prasad, *A catalogue of Mites of India* : 12.

Host : Fowl.

Distribution : India : Orissa (Bhubaneshwar), Uttar Pradesh.

Family LISTROPHORIDAE**31. Indochirus utkalensis Kanungo and Biswas**

1958. *Indochirus utkalensis* Kanungo and Biswas, *Indian vet. J.*, **35** : 403-411.

1974. *Indochirus utkalensis* : Prasad, *A catalogue of Mites of India* : 10.

Host : Guineapig.

Distribution : India : Orissa (Cuttack).

Family SARCOPTIDAE**32. Sarcoptes precox Canestrini**

1892. *Sarcoptes scabiei* var. *cuniculi* Neumann, *Revue Veterinaire*, March.

1894. *Sarcoptes precox* Canestrini, *Prosp. Acarof.*, **6** : 750.

1974. *Sarcoptes precox* : Prasad, *A catalogue of Mites of India* : 15.

Host : Rabbit.

Distribution : India : Orissa (Cuttack).

33. Notoedres cati (Hering)

1838. *Sarcoptes cati* Hering, *Nova Acta Leopoldina*, **8** : 605.

1962. *Notoedres cati* : Sen and Fletcher, *Veterinary Entomology and Parasitology for India* : 548.

1974. *Notoedres cati* : Prasad, *A catalogue of Mites of India* : 12-13.

Host : Cat.

Distribution : India : Orissa (Cuttack), Uttar Pradesh. Outside India : Cosmopolitan.

III. Water mites

Order PROSTIGMATA

Family HALACARIDAE

34. *Halacarus anomalus* Trouessart

1894. *Halacarus anomalus* Trouessart, *Bull. Soc. Amis. Sci. nat. Mus. Rouen*, 9 : 156.

1970. *Halacarus anomalus* : Rao, *Curr. Sci.*, 39 : 505-506.

1974. *Halacarus anomalus* : Prasad, *A catalogue of Mites of India* : 127.

Habitat : Sea coast.

Distribution : India : Andaman and Nicobar Islands, Andhra Pradesh, Orissa (Konarak, Puri). Outside India : Baltic North Sea, Gulf of Gascogne, Mediterranean, Atlantic Coast of North America.

IV. Stored grain mites

Order MESOSTIGMATA

Family URODINYCHIDAE

35. *Leiodynychus krameri* (G. and R. Canestrini)

1882. *Uropoda krameri* Canestrini and Canestrini, *Atti. Ist. veneto. Sci.*, 5 : 913.

1971. *Leiodynychus krameri* : Raut and Maiti, *Orissa Univ. Agr. Tech. J. Res.*, 1 : 24-27.

1974. *Leiodynychus krameri* : Prasad, *A catalogue of Mites of India* : 180.

Habitat : Barley, paddy, paddy husk, wheat, wheat flour.

Distribution : India : Orissa (Bhubaneswar and Coastal districts).

V. Moss/Soil mites

Order PROSTIGMATA

Family SCUTACARIDAE

36. *Diversipes simplex* Mahunka

1971. *Diversipes simplex* Mahunka, *Acta zool.*, 17 (1-2) : 26-27.

1974. *Diversipes simplex* : Prasad, *A catalogue of Mites of India* : 315.

Habitat : Mossy fern bases on rocks.

Distribution : India : Orissa (Daitari).

37. *Imparipes longisetosus* Willmann

1971. *Imparipes longisetosus* Willmann, Mahunka, *Acta zool.*, 17 (1-2) : 28.

1974. *Imparipes longisetosus* : Prasad, *A catalogue of Mites of India* : 316.

Habitat : Moss litter.

Distribution : India : Orissa (Daitari), Jammu and Kashmir, Madhya Pradesh.

38. *Scutacarus biswasi* Mahunka

1971. *Scutacarus biswasi* Mahunka, *Acta zool.*, **17** (1-2) : 38-39.

1974. *Scutacarus biswasi* : Prasad, *A catalogue of Mites of India* : 317.

Habitat : Moss on ground.

Distribution : India : Orissa (Daitari).

39. *Scutacarus hamatus* Mahunka

1971. *Scutacarus hamatus* Mahunka, *Acta zool.*, **17** (1-2) : 33-35.

1974. *Scutacarus hamatus* : Prasad, *A catalogue of Mites of India* : 317.

Habitat : Soil in forest undergrowth.

Distribution : India : Orissa (Daitari).

40. *Scutacarus latissimus* Mahunka

1971. *Scutacarus latissimus* Mahunka, *Acta zool.*, **17** (1-2) : 36-38.

1974. *Scutacarus latissimus* : Prasad, *A catalogue of Mites of India* : 318.

Habitat : Mossy fern bases on rocks.

Distribution : India : Orissa (Daitari).

41. *Scutacarus sphaeroides* Karafiat

1971. *Scutacarus sphaeroides* Karafiat, Mahunka, *Acta zool.*, **17** (1-2) : 39.

1974. *Scutacarus sphaeroides* : Prasad, *A catalogue of Mites of India* : 318.

Habitat : Soil and moss.

Distribution : India : Orissa (Daitari), Jammu and Kashmir.

42. *Scutacarus vestigialis* Mahunka

1971. *Scutacarus vestigialis* Mahunka, *Acta zool.*, **17** (1-2) : 35-36.

1974. *Scutacarus vestigialis* : Prasad, *A catalogue of Mites of India* : 318-319.

Habitat : Soil in forest undergrowth.

Distribution : India : Orissa (Daitari).

SUMMARY

A total of 42 species of mites from Orissa belonging to 3 orders, 10 families and 22 genera are dealt with here, among those, 27 are plant mites, 6 parasitic mites, 7 moss/soil mites and one each of stored grain and water mites. Key to orders, families, genera and species of plant mites is given. Relevant references, collection data for those which were examined, host/habitat records and detail distribution are also given for each species.

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REFERENCES

- DAS, D. N. AND MISRA, S. C. 1972. Studies on caprine demodectic mange with institution of effective therapeutic measures. *Indian vet. J.*, **49** : 96-101.
- DAS, M. S. AND NAIK, K. 1977. A new record of the mite *Eotetranychus broodryki* Meyer as a pest of redgram (*Cojanus indicus*) at Bhubaneshwar. *Acar. Newsl.* No. 4 : 6.
- GUPTA, S. K. 1977. New species and records of *Typhlodromus* and *Phytoseius* from Eastern India (Acarina : Phytoseiidae). *Indian J. Acar.*, **2** (1) : 1-11.
- GUPTA, S. K. 1978. Some new species and records of *Amblyseius* from Eastern India (Acari : Phytoseiidae). *Indian J. Acar.*, **2** (2) : 60-77.
- GUPTA, Y. N. AND GUPTA, S. K. 1976. Note on a collection of Tetranychidae and Tenuipalpidae from Orissa (Acarina : Trombidiformes) from India. *Newsl. zool. Surv. India*, **2** (4) : 144-146.
- GUPTA, S.K. 1985. *Handbook. Plant Mites of India*. Zool. Surv. India, Calcutta, 1-520.
- KANUNGO, K. AND BISWAS, G. 1958. A new parasitic mite *Indochirus utkalensis* (Listrophoridae : Acarina) from guineapigs. *Indian vet. J.*, **35** : 403-411.
- KUPPUSWAMY, 1942. Annual Report Veterinary Investigating Officer, Orissa 1941-1942 : 17.
- MAHUNKA, S. 1971. Tarsonemina (Acari) species from India. *Acta zool.*, **17** (1-2) : 11-49.
- MISRA, S. K., TRIPATHY, S. B. AND MISRA, P. K. 1972. Studies on the clinical use of Ectopar in veterinary practice. *Indian vet. J.*, **49** : 424-426.
- PARAMJIT, R. P., VENKATACHALAM, K. AND OJHA, K. N. 1950. The efficacy of tincture of tobacco in the treatment of mange in rabbits. *Indian J. vet. Sci.*, **20** : 13-15.

- PRASAD, V. 1974. *A catalogue of Mites of India*. Indira Acarology Publishing House, : 1-320.
- PRASAD, V. 1975. Plant feeding mites of India (Acarina : Tetranychoidae) : III. Genera *Bakerina*, *Mesobryobia* *Panonychus* and *Porcupinychus*. *Internat. J. Acarol.*, 1 (2) : 18-25.
- RAO, G. C. 1970. On some interstitial fauna in the marine sands on Indian coast. *Curr. Sci.*, 39 (22) : 504-507.
- RAUT, G. AND MAITI, B. K. 1971. Biology of granary mite, *Leiodinychus krameri* G. and R. Canestrini (Uropodidae : Acarina). *Orissa Univ. Agr. Tech. J. Res.*, 1 (1-2) : 24-27.
- SATPATHY, J. M. AND MANIA, P. K. 1969. New record of a phytoseiid mite, *Amblyseius finlandicus* Oudem. occurring on sugarcane with notes on its life history and bionomics. *J. Bombay Nat. Hist. Soc.*, 66 (3) : 648-655.

STOMATOPODA : CRUSTACEA

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INTRODUCTION

The present study was undertaken as a part of the programme initiated by the Zoological Survey of India to assess the faunal richness of the state of Orissa. The work is primarily based on the named as well as unnamed material of stomatopods brought in by recent survey parties from the State

As many as 38 species are reported from eastern coast of the Indian subcontinent between Bangladesh and Tamil Nadu. Of these only 13 species were reported so far from the coastal waters of Orissa (Kemp, 1913 ; Kemp and Chopra, 1915 ; Tiwari and Ghosh, 1973). Here, in this contribution, 16 species are presently recorded including a new species and two new records. Keys to families, genera and species are provided. The new species has been described and illustrated in detail, whereas for the rest of the species, distribution in India and elsewhere and some other important observations have been recorded.

Abbreviations used : TL, Total length ; mm, milimeter ; VKP, V. K. Premkumar ; coll., collected by ; Reg. No., Z. S. I. Registration Number.

SYSTEMATIC ACCOUNT

Superfamily SQUILLOIDEA Latreille, 1803

The superfamily Squilloidea is characterised by having propodi of posterior three maxillipeds slender, not beaded or ribbed ventrally ; telson with distinct median carina with four or more intermediate denticles.

Manning (1980) raised Squillidae to superfamily level to include two families—Harpiosquillidae Manning, 1980 and Squillidae Latreille, 1803. Both the families are represented in Orissa as keyed below :

Key to Families

Carapace with deep excavation on postero-lateral margin ; propodus of raptorial claw with erect spines on opposable margin	...	Harpiosquillidae
Carapace without deep excavation on postero-lateral margin ; propodus of raptorial claw pectinate on opposable margin	...	Squillidae

Family HARPIOSQUILLIDAE Manning, 1980

This monogeneric family is represented by the genus *Harpiosquilla* with two species from the state of Orissa.

Genus *Harpiosquilla* Hothuis, 1964*Key to Species of Harpiosquilla*

Rostrum with slender apical projection ; lateral margin of 5th thoracic somite with a sharp spine ...	<i>raphidea</i>
Rostrum without slender apical projection ; lateral margin of 5th thoracic somite unarmed ...	<i>paradipa</i> n. sp.

1. *Harpiosquilla raphidea* (Fabricius)

1798. *Squilla raphidea* Fabricius, *Ent. Syst. Supp.* : 416.

1964. *Harpiosquilla raphidea* : Holthuis, *Crustaceana*, 7 (2) : 140.

1969. *Harpiosquilla raphidea* : Manning, *Smithson. Contr. Zool.*, No. 36 : 9.

Material examined : 1♂ (TL 110 mm), 1♀ (TL 185 mm) ; Chandipur, Balasore Dist. ; 5.iii.1933 ; Reg. No. C 3011/1 (Reported by Tiwari and Biswas, 1952).

Distribution : India : Orissa (Chandipur), West Bengal, Tamil Nadu, Maharashtra, and Andamans. *Elsewhere* : It is widely distributed in other regions of the Indian Ocean and the western Pacific.

Remarks : *H. raphidea* is the largest known stomatopod till date and is most common in the trawl catches along the Indian coast.

It resembles *H. harpax*, *H. indica* and *H. melanoura* also known from other areas of the eastern coast of India in having a medially projected rostrum but differs in having a spine on the lateral process of the 5th thoracic somite. It also differs from *H. annandalei* and *H. paradipa* new species, in having a much slenderer median projection on the rostrum.

2. *Harpiosquilla paradipa* sp. n.

(Figs. 1-5)

Material examined : 1♂ (TL 148 mm) ; Off Paradip ; VKP coll, ; 31.i.1972, Reg. No. C4070/2.

Description : Antennular peduncle shorter than carapace. Cornea much broader than long (Fig. 1), corneal index 301. Rostrum longer than broad, lateral margins tapering to a narrowly rounded apex (Fig. 2). Carapace with median carina. Dactylus of raptorial claw with 8 teeth, outer margin with angular projection (Fig. 4). Opposable margin of propodus of claw with two or three small spines between the larger spines. Lateral margin

of 5th thoracic somite rounded (Fig. 3). Submedian carinae indistinct on posterior three thoracic somites, intermediate carinae unarmed. Ventral keel on 8th thoracic somite sharp, rounded. Submedian carinae present only on the 6th abdominal somite. Abdominal carinae spined as follows : Submedian 6, intermediate 1-6, lateral 1-6, marginal 1-5. Telson (Fig. 5) almost as long as broad, marginal carina less than twice as long as carina of lateral tooth ; denticles : submedian 4, intermediate 11, lateral 1 ; post-anal keel extending beyond halfway between anus and posterior margin. Uropodal exopod with 9 movable spines on outer margin of proximal segment.

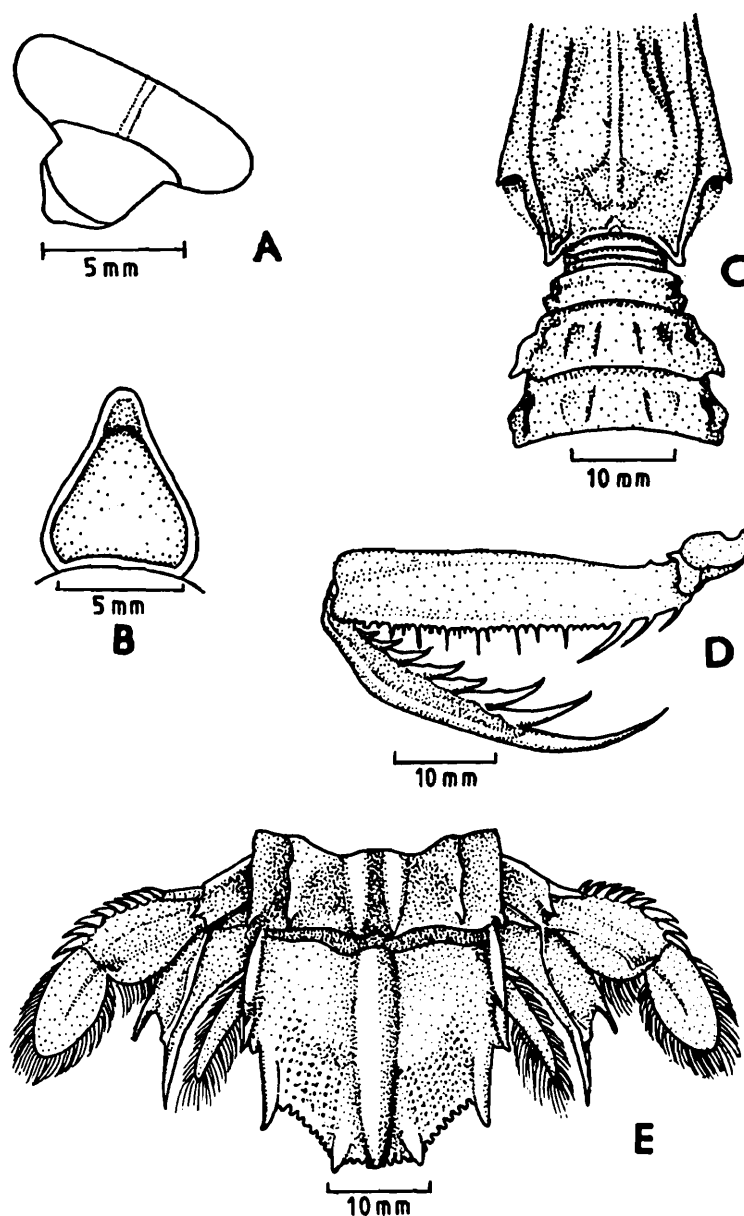


Fig. 1. *Harpiosquilla paradipa*, new species. Holotype : A. eye ; B. rostrum ; C. 5th, 6th, 7th thoracic somites and part of carapace ; D. raptorial claw ; E. 6th abdominal somite, telson and uropods.

Colour : Body colour pale brown without any definite markings.

Sexual dimorphism : Only adult male is known.

Measurements : Total length 148 mm ; length of antennular peduncle 27.4 mm ; length of cornea 2.3 and width 10.3 mm ; length of rostrum 6.6 and width 4.6 mm ; length of carapace 29.5 mm ; length of raptorial propodus 36.0 mm ; length of telson 26.0 and width 26.2 mm.

Type specimen : Holotype : (male), data as above under material examined. Deposited in National Zoological Collections, Zoological Survey of India, Calcutta ; Reg. No. C4070/2.

Affinities : The new species belongs to a group of five other species (*H. annandalei*, *H. japonica*, *H. stephensoni*, *H. intermedia*, *H. melagasiensis*) of the genus in having rostrum without the slender apical projection. Amongst these *H. stephensoni* and *H. intermedia* resemble *H. paradipa* more closely. The main points of resemblances and differences are as follows : *H. paradipa* agrees with *H. stephensoni* in the shape of the rostrum and the ventral keel on the 8th thoracic somite but differs from it in having 8 teeth on the dactylus of raptorial claw and an unarmed lateral process of the 5th thoracic somite. It agrees with *H. intermedia* in having 8 teeth on the dactylus of raptorial claw, an unarmed lateral process of the 5th thoracic somite and an antennular peduncle which is shorter than the carapace but differs from it in the shape of the rostrum, submedian carinae being present only on the 6th abdominal somite, marginal corinae of telson being less than twice as long as lateral tooth and the postanal keel extending beyond half-way between the anus and the posterior margin. *H. paradipa* can also be distinguished from rest of the species as well as from all other members of this group on the basis of the following characters : (1) Rostrum much longer than broad ; (2) Cornea noticeably broader than long (more than five times as broad as long) ; (3) Absence of submedian carinae on the posterior three thoracic somites ; (4) Absence of submedian carinae on the 1st to 5th abdominal somites ; and (5) Abdominal carinae being spined as follows : submedian 6, intermediate 1-6, lateral 1-6, marginal 1-5.

Etymology : The new species has been named after the type locality "Off Paradip" Orissa.

Distribution : Known only from the type locality : Off Paradip, Orissa.

Family SQUILLIDAE Latreille, 1803

This is the largest and the most diverse family of stomatopods and is represented in the coastal waters of Orissa by 14 species distributed into four genera.

Key to Genera

1. Ventral spine on the lateral process of 5th thoracic somite present	...	<i>Kempina</i>
— Ventral spine on the lateral process of 5th thoracic somite absent	...	2
2. Lateral process of 5th thoracic somite a single lobe or spine	...	3
— Lateral process of 5th thoracic somite bilobed	...	<i>Oratosquilla</i>
3. Submedian teeth of telson with fixed apices	...	4
— Submedian teeth of telson with movable apices	...	<i>Clorida</i>
4. Dactylus of raptorial claw with 5-6 teeth	...	<i>Cloridopsis</i>
— Dactylus of raptorial claw with 4-6 teeth	...	<i>Squilloides</i>

Genus *Oratosquilla* Manning, 1968

Of the 10 species of *Oratosquilla*, so far reported from the eastern coast of India, only five are from Orissa. *O. hesperia* and *O. massavensis* included in this report are recorded for the first time from Orissa.

Key to Species of Oratosquilla

1. Anterior bifurcation of median carina of carapace opening anterior to dorsal pit absent	...	2
— Anterior bifurcation of median carina of carapace opening anterior to dorsal pit present	...	4
2. Dactylus of raptorial claw with 5 teeth ; dorsal ridge of carpus of claw not tuberculate	...	<i>quinquedentata</i>
— Dactylus of raptorial claw with 6 teeth ; dorsal ridge of carpus of claw tuberculate	...	3
3. Lateral margin of rostrum straight ; telson with one row of tubercles flanking the median carinae on either side	...	<i>hesperia</i>
— Lateral margin of rostrum sinuous ; telson with two rows of tubercles flanking the median carina on either side.	...	<i>massavensis</i>
4. Anterior bifurcation of median carina of carapace uninterrupted	...	5
— Anterior bifurcation of median carina of carapace interrupted	...	6

5. Anterior bifurcation of median carina of carapace simple, not bicarinate ; submedian carinae of 4th abdominal somite posteriorly spined ... *nepa*
- Anterior bifurcation of median carina of carapace bicarinate, submedian carinae of 4th abdominal somite unarmed posteriorly ... *holoschista*
6. Cornea set slightly obliquely on stalk, submedian carinae on 4th abdominal somite armed ... *interrupta*
- Cornea set very much obliquely on stalk, submedian carinae on 4th abdominal somite unarmed ... *woodmasoni*

3. *Oratosquilla quinquedentata* (Brooks)

1886. *Squilla quinquedentata* Brooks, Voy. H.M.S. 'Challenger' Stomatopoda : 16.

1978. *Oratosquilla quinquedentata* : Manning, Smith. Contr. Zool., No. 272 : 23.

Material examined : 1 ♂ (TL 115 mm. carapace partly broken) ; Balasore Bay, 27m ; 'Golden Crown'. (Reported by Kemp, 1913).

Distribution : India : Orissa (Balasore), Maharashtra (Bombay). *Elsewhere* : Arafura Sea (Brooks, 1886).

Remarks : Manning (1978) in his revision of *Oratosquilla* has given a vivid account of the species together with figures. The presence of 5-teeth on the dactylus of raptorial claw and the presence of a sharp spine on the inferodistal angle of merus of claw will distinguish this species from all other members of the genus.

O. quinquedentata appears to be a rare species as is evident from its limited distribution.

4. *Oratosquilla hesperia* Manning

1968. *Oratosquilla hesperia* Manning, Proc. U. S. Natn. Mus., 124 (3641) : 25.

Material examined : 2 ♀ (TL 54-80 mm), Puri, VKP. coll. 5.ii.1972.

Distribution : India : Orissa (Puri) ; first record from the Indian waters. *Elsewhere* : Arabian Sea (Madagascar and Pakistan).

Remarks : Manning (1968a) described *O. hesperia* based on a single female specimen from Madagascar and tentatively assigned part specimens of *S. nepa* (Miers), *S. woodmasoni* (Kemp) and *S. massavensis* (Ingle) from Zanzibar to this species until further studies.

The presence of a submedian row of tubercles converging under the posterior end of the median carina of telson and lateral projections on the eye-stalk will help distinguish this species from all other members of the genus.

Except for minor colour markings and the submedian carinae being posteriorly spined on the 5th and 6th abdominal somites instead of 4th, 5th and 6th as noted by Manning in his original description of the species, the present specimens agree well with his description.

5. *Oratosquilla massavensis* (Kossman)

1880. *Squilla massavensis* Kossman, *Zool. Ergebn. Roth. Meer.*, 3 : 99.

1980. *Oratosquilla massavensis* Lewinsohn and Manning, *Smith. Contr. Zool.*, No. 305 : 10.

Material examined : 3♂ (TL 61-69 mm) and 1 ♀ (TL 78 mm), Puri, VKP. coll., 5.iii.1972.

Distribution : India : Orissa (Puri), first record from the Indian waters. Elsewhere : Red Sea and the eastern Mediterranean.

Remarks : The presence of two rows of tubercles, unlike one row as in *O. hesperia* flanking both sides of the median carina of telson distinguishes *O. massavensis* from all other members of the genus from Orissa.

6. *Oratosquilla nepa* (Latreille)

1825. *Squilla nepa* Latreille, *Encycl. Method.*, 10 : 471.

1968. *Oratosquilla nepa* : Manning, *Bull. Mar. Sci. Gulf and Carib*, 13 (1) : 184.

Material examined : 2♂ (TL 65-91 mm) and 18 ♀ (TL 65-88 mm), Off Paradip, VKP. Coll., 31.i.1972.

Distribution : India : Orissa, W. Bengal, Tamil Nadu, Kerala and Maharashtra. Elsewhere : Widely distributed in other regions of the Indian Ocean as well as in the W. Pacific.

Remarks : The species shows wide variations in the shape of the anterior bifurcated process of the median carina of carapace as figured by Tirmizi and Manning (1968).

The small eyes, long anterior bifurcation of the median carina of carapace and truncated anterior lobe of the lateral process of 6th thoracic somite should immediately distinguish *O. nepa* from all other members of the genus.

This is the most common species along the entire coastal waters of India and is abundantly caught in fishing nets.

7. *Oratosquilla holoschista* (Kemp)

1911. *Squilla holoschista* Kemp, *Rec. Indian Mus.*, 6 : 97.

1913. *Squilla holoschista* Kemp, *Mem. Indian Mus.*, 4 : 64.

1968. *Oratosquilla holoschista* : Manning, *Bull. Mar. Sci. Gulf and Carib*, 18 (1) : 135.

Material examined : 4♂ (TL 72-90 mm) and 6 ♀ (TL 72-80 mm), Puri, VKP. coll., 5.iii.1972 ; 3♂ (TL 76-80 mm) and 3 ♀ (TL 79-85 mm), Off

Paradip, VKP. coll., 31.i.1972 ; 1♂ (TL 64 mm), Chandipur, Balagudi estuary, P. K. Talwar coll., 13.v.1972.

Distribution : India : Orissa, Andhra Pradesh, W. Bengal, Tamil Nadu and Kerala. Elsewhere : Widely distributed in parts of the Indian Ocean and also in the W. Pacific.

Remarks : *Oratosquilla holoschista* is very close to *O. nepa* but the bicarinate nature of the median carina of carapace in front of the cervical groove, absence of dark transverse patch on the 2nd and 5th abdominal somites and absence of posterior spine on the submedian carinae of 4th abdominal somites easily separate it from the latter species. Distal part of urpodal endopod and proximal segment of exopod are also pitted with dark in this species.

O. holoschista is not as abundantly found as *O. nepa*, but still occurs in relatively large numbers.

8. *Oratosquilla interrupta* (Kemp)

1911. *Squilla interrupta* Kemp, *Rec. Indian Mus.*, 6 : 98.

1913. *Squilla interrupta* : Kemp, *Mem. Indian Mus.*, 4 : 72.

1968. *Oratosquilla interrupta* : Manning, *Bull. Mar. Sci. Gulf and Carib.* 18 (1) : 135.

Material examined : 2♀ (TL 77-115 mm), Puri, VKP. coll., 5.ii.1972 ; 11♂ (TL 87-99 mm) and 10♀ (TL 74-104 mm). Off Paradip, VKP. coll., 31.i.1972 ; 1♂ (TL 100 mm), 4♀ (TL 87-112 mm), Chandipur, P. K. Talwar, 13.v.1972 ; 1♂ (TL 91 mm), Gahirmatha, C. S. Kar coll. ; 26.iii.1983.

Distribution : India : Orissa, W. Bengal, Andhra Pradesh, Tamil Nadu, Maharashtra and Nicobars. Elsewhere : Scattered localities in other parts of the Indian Ocean as well as in the Western Pacific.

Remarks : Posteriorly armed submedian carinae of the 4th abdominal somite and the rounded lobe on the outer margin of inner spine of basal prolongation of urpod distinguish *O. interrupta* from all other members of the genus found along the coastal waters of India.

9. *Oratosquilla woodmasoni* (Kemp)

1911. *Squilla woodmasoni* Kemp, *Rec. Indian Mus.*, 6 : 99.

1913. *Squilla woodmasoni* : Kemp, *Mem. Indian Mus.*, 4 : 74.

1968. *Oratosquilla woodmasoni* : Manning, *Bull. Mar. Sci. Gulf and Carib.* 18 (1) : 135.

Material examined : 1♂, (TL 79 mm) and 1♀ (TL 77 mm), H. Gravely coll., 8.iii.1912, Reg. No. 4850/9.

Distribution : India : Coastal waters of Orissa, W. Bengal, Tamil Nadu and Kerala. Elsewhere : Also reported from other areas of the Indian Ocean and the Western Pacific.

Remarks : The much obliquely set cornea on stalk, truncated apex of the rostrum and also the comparatively larger postanal keel on the ventral surface of telson distinguish *O. woodmasoni* from all other members of the genus.

Genus **Kempina** Manning, 1978

Manning (1978) erected this genus to include *Squilla mikado* Kemp and Chopra, 1921 and *Squilla stridulans* Wood-Mason, 1895. Rugose and pitted body surface, presence of a ventral spine on the lateral margin of the 5th thoracic somite, strongly marked body carinae and sharply divided lateral process of 6th and 7th thoracic somites distinguish *Kempina* from other genera of the family.

The genus is represented in the present study by a single species, *Kempina stridulans*.

10. **Kempina stridulans** (Wood-Mason)

1894. *Squilla stridulans* Wood-Mason, *Ann. Mag. Nat. Hist.* (6) 12 : 409.

1913. *Squilla stridulans* : Kemp, *Mem. Indian Mus.*, 4 : 78.

1968. *Oratosquilla stridulans* : Manning, *Bull. Mar. Sci. Gulf and Carib*, 18 (1) : 185.

1978. *Kempina stridulans* : Manning, *Smith. Contr. Zool.* No. 272 : 39.

Material examined : 2♂ (TL 45-50 mm) and 11♀ (TL 38-66 mm), Orissa coast, 136 metres, 'Investigator' ; Reg. No. 3483-97/9 (Reported by Kemp, 1913).

Distribution : India : Along coasts of Orissa and Tamil Nadu. *Elsewhere* : The only record of this species from outside Indian waters is from Japan (Kemp, 1913).

Remarks : *Kempina stridulans* can be distinguished from its counterpart, *K. mikado*, known only from the Japanese waters, mainly in the absence of a mid-dorsal carina on the rostrum and for the lateral processes of the sixth and seventh thoracic somites being shorter and broader.

Genus **Clorida** Eydoux and Souleyet, 1842

The genus *Clorida* is represented by a single species, *C. latreille* from the state of Orissa.

11. *Clorida latreille* : Eydoux and Souleyet

1842. *Clorida latreille* ; Eydoux and Souleyet, *Vov. de la Bonite' Zool. Crust.*, 1 : 265.

1913. *Squilla latreille* : Kemp, *Mem. Indian Mus.*, 4 : 24.

1968. *Clorida latreille* : Manning, *Bull. Mar. Sci. Gulf and Carib.* 18 (1) : 128.

Material examined : 1 ♂ (TL 46 mm), Orissa coast, 23 metres, 'Investigator', Reg. No. 3454/9 (Reported by Kemp, 1913).

Distribution : India : Coastal Orissa, West Bengal, Andhra Pradesh, Tamil Nadu and Maharashtra. *Elsewhere* : Scattered localities between Red Sea and Japan.

Remarks : *C. latreille* can be separated from *C. decorata*, the only other member of the genus known from the eastern coast of India by the following salient features :— (i) lateral spine on the fifth thoracic somite is directed laterally and not antero-laterally as in *C. decorata* and (ii) ventral surface of telson is smooth and not tuberculate as in *decorata*.

Genus *Cloridopsis* Manning, 1968

Genus *Cloridopsis* apparently resembles *Clorida* but differs from the latter mainly in having : separate ocular scales, full compliment of carinae on carapace, fixed apices on the submedian teeth of telson and a smooth dorsal surface.

Only three species of the genus are represented in the coastal waters of Orissa as in the key below.

Key to Species

1. Raptorial claw with 5-teeth.	...	...	2
— Raptorial claw with 6-teeth.	...		<i>bengalensis</i>
2. Lateral process of 5th thoracic somite with large black spot.	...		<i>scorpio</i>
— Lateral process of 5th thoracic somite without large black spot.	...		<i>Immaculata</i>

12. *Cloridopsis bengalensis* (Tiwari and Biswas)

1952. *Squilla bengalensis* Tiwari and Biswas, *Rec. Indian Mus.*, 49 (3-4) : 352.

1963. *Cloridopsis bengalensis* : Manning, *Bull. Mar. Sci. Gulf and Carib.* 18 (1) : 128.

1973. *Cloridopsis bengalensis* : Tiwari and Ghosh, *Proc. zool. Soc. Calcutta*, 26 : 33.

Material examined : 1 ♂ (TL 91 mm), Chandipur (Balasore Dist.), 27.iv. 1939, Reg. No. Cl030/2 (Reported by Tiwari and Ghosh, 1973).

Distribution : India : Orissa, West Bengal and Andhra Pradesh. *Elsewhere* : the only record of its occurrence from outside Indian waters is from Thailand (Naiyanetr, 1980).

Remarks : *C. bengalensis* is strictly an estuarine form. Described from Salt Lake, lower Bengal, its range of distribution has been reported to extend (Tiwari and Ghosh, 1973) along the eastern coast of India.

It is closely related to *C. scorpio* and *C. immaculata* but can be distinguished from the two in having larger eyes, 6-teeth on the dactylus of raptorial claw and in the absence of a lobe on the inferior margin of the antero-lateral spine of carapace.

Sexual dimorphism in *C. bengalensis* is quite pronounced and the main points of differences between the two sexes are : (i) carapace narrower anteriorly in females than in males, (ii) antero-lateral spines of carapace sharper and more slender in females than in males, (iii) outer margin of dactylus of raptorial claw sinuous in females and (iv) telson denticles more pronounced in females than in males.

13. *Cloridopsis scorpio* (Latreille)

1825. *Squilla scorpio* Latreille, *Encycl. Method.*, **10** : 472.

1913. *Squilla scorpio* : Kemp, *Mem. Indian Mus.*, **4** : 42.

1968. *Cloridopsis scorpio* : Manning, *Bull. Mar. Sci. Gulf and Carib*, **18** (1) : 128.

Material examined : 2♂ (TL 76-81 mm) and 1♀ (TL 86 mm), Chilka Lake, Reg. No. 9243/10 (Reported by Kemp, 1913).

Distribution : India : Orissa, Tamil Nadu, Pondicherry and Maharashtra. *Elsewhere* : Scattered localities in other parts of the Indian Ocean and the western Pacific.

Remarks : Kemp's (1913) material of *C. scorpio* re-examined here fits well with description of the same species from Karachi (Tirmizi and Manning, 1968) except that the intermediate carinae of carapace are distinctly defined. The presence of a large dark spot on the lateral process of fifth thoracic somite separates *C. scorpio* from all other members of the genus.

14. *Cloridopsis immaculata* (Kemp)

1913. *Squilla scorpio* var. *M. immaculata* Kemp, *Mem. Indian Mus.*, **4** : 45.

1968. *Cloridopsis immaculata* : Manning, *Bull. Mar. Sci. Gulf and Carib*, **18** (1) : 128.

Material examined : 4♂ (TL 66-80 mm) and 3♀ (TL 68-75 mm), Chilka Lake, Reg. No. 8492/10 (Reported by Kemp, 1913).

Distribution : India : Orissa and West Bengal. *Elsewhere* : Known also from some other parts of the Indian Ocean.

Remarks : *C. immaculata* closely resembles *C. scorpio*. The main points of differences between the two species are as follows : In *C. immaculata* the rostrum is more longer than broad and its apex is more broadly rounded ; median, intermediate and lateral carinae are more distinct ; and for absence of large dark spot on the lateral process of the fifth thoracic somite.

Genus *Squilloides* Manning, 1968

Manning (1968b), in his revision of the family Squillidae, created this new genus to contain five Indo-West Pacific forms of which *S. gilesi* and *S. tenuispinis* are known to occur in the offshore areas of the Orissa coast.

Key to Species

Median carina of carapace absent ; marginal teeth of telson short.	...	<i>gilesi</i>
Median carina of carapace present ; marginal teeth of telson greatly elongated.	...	<i>tenuispinis</i>

15. *Squilloides gilesi* (Kemp)

1911. *Squilla gilesi* Kemp, *Rec. Indian Mus.*, 6 : 95.

1913. *Squilla gilesi* : Kemp, *Mem. Indian Mus.*, 4 : 39.

Material examined : 1 ♀ (TL 81 mm) ; Off Orissa coast, 19°49' N, 86°43'E ; 'Investigator' ; Reg. No. 5800/9. (Reported by Kemp, 1913).

Distribution : India : Orissa, West Bengal and Tamil Nadu, *Elsewhere* : Scattered localities in the eastern and western Indian Ocean between Red Sea and Burma. *S. gilesi* is a deeper water form and has so far been recorded from depths ranging between 36-201 metres.

16. *Squilloides tenuispinis* (Wood-Mason)

1891. *Squilla tenuispinis* Wood-Mason, *Ann. Mag. Nat. Hist.*, 7 : 271.

1913. *Squilla tenuispinis* : Kemp, *Mem. Indian Mus.* 4 : 48.

1968. *Squilloides tenuispinis* : Manning, *Bull. Mar. Sci. Gulf and Carib.* 18 (1) : 131.

Material examined : 1 ♂ (TL 62 mm), Off Ganjam coast, 18°40'N, 84°46'E, 179-186 metres ; (Syntype) ; 'Investigator' ; Reg. No. 5801/9 ; (Reported by Kemp, 1913).

Distribution : India ; Orissa, Tamil Nadu and the Andamans. *S. tenuispinis* is also a deeper water form so far collected in depths ranging between 179-439 metres.

Remarks : *S. tenuispinis* mainly differs from *S. gilesi* in having a broader rostral apex medially fused and antero-laterally truncated ocular scales, median carina on carapace, four teeth on dactylus of raptorial claw and for greatly elongated marginal teeth on telson.

SUMMARY

This report is based on the named and unnamed material of stomatopods accumulated in the Zoological Survey of India over the last few years from the coasts and offshore areas of Orissa. So far only 13 species were reported from Orissa. In the present study one new species and two new records to the Indian waters have been added bringing the total number of species to 16. Keys for identification and distribution and affinities with different species are provided.

ACKNOWLEDGEMENTS

The author is grateful to the Director, Zoological Survey of India, Calcutta, and Dr. O. B. Chhotani, Dr. (Sm.) G. Chhotani, Dr. (Sm.) M. Deb for their constant encouragements.

REFERENCES

- BROOKS, W. K. 1886. Report on the Stomatopoda collected by H. M. S. 'Challenger' during the years 1873-1876. *Rep. Voy. Challenger, Zoology*, **16** : 1-116.
- KEMP, S. 1911. Preliminary descriptions of new species and varieties of Crustacea Stomatopoda in the Indian Museum. *Rec. Indian Mus.*, **6** : 93-100.
- KEMP, S. 1913. An account of the Crustacea Stomatopoda of the Indo-Pacific region based on the collection in the Indian Museum. *Mem. Indian Mus.*, **4** (1) : 1-217.
- KEMP, S. AND CHOPRA, B. 1915. Fauna of the Chilka : Stomatopoda. *Mem. Indian Mus.*, **5** : 193-197.
- KEMP, S. AND CHOPRA, B. 1921. Notes on Stomatopoda. *Rec. Indian Mus.*, **22** : 297-311.
- LEWINSOHN, C. AND MANNING, R. B. 1980. Stomatopoda Crustacea from the eastern Mediterranean. *Smith. Contr. Zool.*, No. 305 : 1-22.
- MANNING, R. B. 1968a. Stomatopoda Crustacea from Madagascar. *Proc. U. S. nat. Mus.*, **124** (3641) : 1-61.

- MANNING, R. B. 1918b. A revision of the family Squillidae (Crustacea : Stomatopoda) with descriptions of eight new genera. *Bull. Mar. Sci. Gulf. and Carib*, **18** (1) : 105-142.
- MANNING, R. B. 1978. Further observations on *Oratosquilla* with accounts of two new genera and nine species (Crustacea : Stomatopoda : Squillidae). *Smith. Contr. Zool.*, No. 272 : 1-44.
- MANNING, R. B. 1980. The superfamilies, families and genera of recent stomatopod Crustacea, with diagnosis of six new families. *Proc. biol. Soc. Washington*, **93** (2) : 362-372.
- NAIYANETR, P. 1980. Stomatopoda of Thailand. *Dept. Bio. Fac. Sci. Chulalongkorn Univ. Bangkok* : 1-95.
- TIRMIZI, N. N. AND MANNING, R. B. 1968. Stomatopoda Crustacea from W. Pakistan. *Proc. U. S. nat. Mus.*, **125** (3666) : 1-48.
- TIWARI, K. K. AND BISWAS, S. 1952. On two species of the genus *Squilla* Fabr., with notes on other stomatopods in the collection of the Zoological Survey of India. *Rec. Indian Mus.*, **49** (3-4) : 349-363.
- TIWARI, K. K. AND GHOSH, H. C. 1973. Redescription of *Squilla bengalensis* Tiwari and Biswas (Crustacea : Stomatopoda). *Proc. zool. Soc. Calcutta.*, **26** : 33-37.
- WOOD-MASON, J. 1895. Figures and descriptions of nine species of *Squilla* from the collection in the Indian Museum. : 1-11. Trustees Indian Museum, Calcutta.

GASTROTRICHA (FRESHWATER)

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INTRODUCTION

Little is known about the distribution of freshwater gastrotrichs in India and so far only twentythree species are reported from this country (Sharma, 1980). The previous contributions deal with the scattered samples collected from Andhra Pradesh (Vanamala Naidu, 1962 ; Dhanapathi, 1976 ; Rao & Chandra Mohan, 1977), Nagpur in Central India (Visvesvara, 1963, 1964) and West Bengal (Sharma, *loc. cit.*)

While studying the plankton samples from Orissa State in Eastern India, the author came across four species of the genus *Chaetonotus* (Class : Gastrotricha). All these species are new to this State while *C. gastrocyaneus* represents a new record from India. The examined species are briefly described and illustrated. Some observations on the general occurrence of the gastrotrichs and their habitat, and on the studied species are recorded.

MATERIAL AND METHOD

The material for this study was collected from different freshwater bodies from Sambalpur (Lat. 21°28' N ; Long. 84°01' E) and Cuttack (Lat. 20°28' N ; Long. 85°54' E) in Orissa State. The samples were preserved in 5% formalin. Different species were mounted in glycerine for the detailed examination. The drawings are made with a Leitz-Dialux stereoscopic phase contrast microscope. All the measurements are given in micrometers (μm).

TAXONOMIC NOTES

Class : GASTROTRICHA

Family : CHAETONOTIDAE

***Chaetonotus similis* Zelinka, 1889**

(Figs. 1 & 2)

Diagnosis : Head indistinctly five-lobed. Dorsal surface of body convex and with longitudinal rows of spines ; spines increasing in size posteriorly, each spine bifurcated distally and arises on a broad base from a flat cuticular plate.

Measurements : Total length : 192-198.

Remarks : The specimens from Orissa (Sambalpur, Cuttack) are longer than those reported previously from this country.

Distribution : INDIA : Orissa (Sambalpur, Cuttack), Andhra Pradesh and West Bengal.

***Chaetonous anomalus* Brunson, 1950**

(Fig. 3)

Diagnosis : Head distinctly five-lobed. Body with 6-8 long rows of spines, increasing in size posteriorly ; also bears seven long, twice bifurcate spines arising behind the mid region of the trunk and projecting considerably far beyond the other spines.

Measurements : Total length 180-182 ; long spines 62-94.

Remarks : Present specimens are larger than those from Andhra Pradesh and West Bengal but the long spines show intermediate length.

Distribution : INDIA : Orissa (Sambalpur, Cuttack), Andhra Pradesh and West Bengal.

***Chaetonotus vulgaris* Brunson, 1950**

(Fig. 4)

Diagnosis : Head indistinctly five-lobed. Body with 6-8 long rows of spines increasing in size posteriorly, with 8-9 spines in each row.

Measurements : Total length 100-103.

Distribution : Reported in India only from Orissa (Sambalpur, Cuttack) Andhra Pradesh.

***Chaetonotus gastrocyaneus* Brunson, 1950**

(Figs. 5 & 6)

Diagnosis : Head more or less flattened anteriorly. Body with 10-16 long rows of spines ; each spine with three pronged base and bifurcate distally.

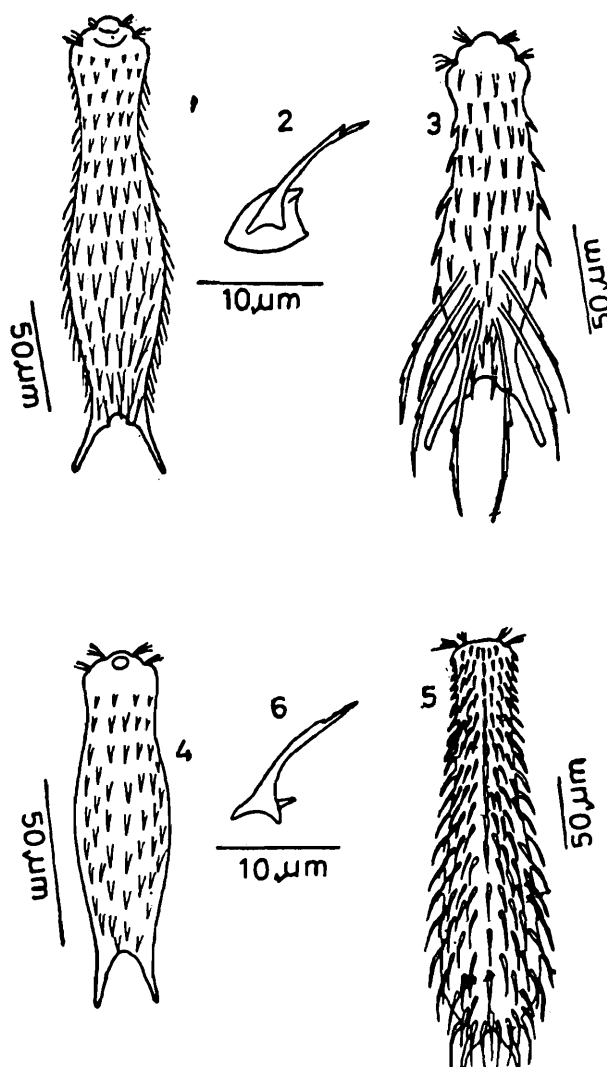
Measurement : Total length : 302.

Distribution : New record from India (Orissa : Cuttack).

OBSERVATIONS ON OCCURRENCE AND HABITAT

Genus *Chaetonotus* is known to occur in marine, brackishwaters and freshwaters (Pennak, 1953). It comprises a dominant fraction (15 species :

refer Sharma, 1980) of Indian freshwater gastrotrichs. Further, all the presently examined species from Orissa belong to this genus. Amongst these, *C. similis* indicates relatively common occurrence while *C. vulgaris* and *C. gastrocyaneus* are very rare in the studied material.



Figs. 1—6 :

Figs. 1. & 2, *Chaetonotus similis* Zelinka : 1, dorsal view, 2, body spine ; 3, *Chaetonotus anomalus* Brunson : dorsal view ; 4, *Chaetonotus vulgaris* Brunson : dorsal view ; 5 & 6, *Chaetonotus gastrocyaneus* Brunson : 5, dorsal view, 6, body spine.

Different species of *Chaetonotus* are reported to occur in association with *Spirogyra*, *Myriophyllum*, *Sphagnum* and *Utricularia* (Brunson, 1959). Indian species of this genus are observed in habitats with *Spirogyra*, *Oscillatoria*, *Hydrilla*, *Utricularia*, *Ceratophyllum*, *Polygonum*, *Chara*, *Marselia* and *Ottelia* (Dhanapathi, 1976 ; Rao & Chandra Mohan, 1977 ; Sharma, 1980). However, in the collections from Orissa State, the different species are noticed to occur alongwith *Spirogyra*, *Oscillatoria*, *Utricularia* and *Hydrilla*. *Chaetonotus* spp. tolerate a wide range of pH and dissolved oxygen variations (Rao &

Chandra Mohan, 1977) while Sharma (1980) also noticed the presence of some species in Calcutta (West Bengal) in localities with very low dissolved oxygen. In the samples from Orissa, only *C. similis* was found to occur in habitats with thick surface scums of *Oscillatoria* and *Spirogyra* and rich in decaying organic matter, obviously with low concentrations of dissolved oxygen.

SUMMARY

This communication deals with four species of gastrotrichs, belonging to the genus *Chaetonotus* (Gastrotricha : Chaetonotidae), collected from different freshwater habitats from Orissa State. All the examined species are new to this state while *C. gastrocyaneus* comprises a new record from India.

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REFERENCES

- BRUNSON, R. B. 1959. Gastrotricha. In : *Fresh-Water Biology* (Ed. W. T. Edmondson). John Wiley & Sons Inc., New York. (Chapter 17 : 406-419).
- DHANAPATHI, M. V. S. S. 1976. Taxonomic notes on some Gastrotricha from coastal Andhra Pradesh. *Mem. Soc. Zool. Guntur*, 1 : 76-78.
- PENNAK, R. W. 1953. *Fresh-Water Invertebrates of the United States*. The Ronald Press Company, New York. (Gastrotricha—Chapter 7 : 148-158).
- RAO, R. K. AND CHANDRA MOHAN, P. 1977. New records of some Gastrotricha from India with notes on their ecology. *Geobios*, 4 : 204-206.
- SHARMA, B. K. 1980. Taxonomic notes on some freshwater Gastrotricha from West Bengal, India. *Hydrobiologia*, 70 : 265-267.
- VANAMALA NAIDU, K. 1962. Three species of Gastrotrichs from fresh waters of Cuddapah, India. *Ann. Mag. Nat. Hist.*, (13) 5 : 1-4.
- VISVESVARA, G. 1963. On some Gastrotricha from India with description of two new species. *Ann. Mag. Nat. Hist.*, (13) 6 : 435-443.
- VISVESVARA, G. 1964. On some Gastrotricha of genus *Chaetonotus* from India. *Ann. Mag. Nat. Hist.*, (13) 7 : 209-216.

ROTIFERA : EUROTATORIA : MONOGONONTA (FRESHWATER)

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INTRODUCTION

The rotifer fauna of Orissa is poorly investigated and so far only thirty-six species have been reported (Sharma, 1977 ; 1980). The present communication, a part of author's attempt on the extensive survey of freshwater rotifers from this state, deals with sixty-nine species (seventy-five taxa) of monogononts spread over thirteen eutotatorian families. Thirty-three species (thirty-seven taxa) represent new records from Orissa and these are illustrated and briefly described. The nature and composition of the studied fauna is discussed and remarks are made on the distribution of various taxa.

MATERIAL AND METHOD

The material for this study was collected from some localities in Orissa State i. e., Sambalpur and Cuttack. The samples were collected with a plankton net of bolting silk (No. 25) from ephemeral pools, fish-ponds and tanks and were preserved in 5% formalin. Permanent mounts of the different taxa were made in Polyvinyl alcohol—lactophenol mixture. The drawings are made with a Leitz-Dialux stereoscopic phase contrast microscope and measurements are given in micrometers (μm).

SYSTEMATIC LIST OF THE ROTIFER TAXA PRESENTLY EXAMINED FROM ORISSA

Class : ROTIFERA
Subclass : EUROTATORIA
Superorder : MONOGONONTA
Order : PLOIMIDA
Family 1. BRACHIONIDAE

1. *Anuraeopsis coelata* (De Beauchamp, 1932)
2. *A. fissa* Gosse, 1851
3. *Brachionus angularis* Gosse, 1851
4. *B. bidentata* Anderson, 1889

5. *B. budapestinensis* Daday, 1885
6. *B. calyciflorus* f. *dorcas* (Gosse, 1851)
7. *B. calyciflorus* f. *borgerti* (A pstein, 1907)
8. *B. calyciflorus* f. *anuraeiformis* (Brehm, 1909)
9. *B. caudatus* f. *personatus* (Ahlstrom, 1940)
10. *B. caudatus* f. *aculeatus* (Hauer, 1937)
11. *B. diversicornis* (Daday, 1893)
12. *B. forficula* (Wierzejski, 1891)
13. *B. forficula* f. *minor* (Voronkov, 1913)
14. *B. falcatus* Zacharias, 1898
15. *B. patulus* (Müller, 1776)
16. *B. patulus macracanthus* (Daday, 1905)
17. *B. plicatilis* Müller, 1776
18. *B. quadridentatus* Hermann, 1783
19. *B. quadridentatus* f. *cluniorbicularis* (Skorikov, 1894)
20. *B. puadridentatus* f. *melheni* (Borris & Daday, 1894)
21. *B. rubens* Ehrenberg, 1838
22. *Keratella tropica* (A pstein, 1907)
23. *K. procurva* (Thorpe, 1891)
24. *K. lenzi* Hauer, 1938
25. *Platyias quadricornis* (Ehrenberg, 1832)

Family 2. EUCHLANIDAE

26. *Euchlanis dilatata* Ehrenberg, 1832
27. *Euchlanis triquetra* Ehrenberg, 1838
28. *Dipleuchlanis propatula* (Gosse, 1885)
29. *Tripleauchlanis plicata* (Levander, 1894)

Family 3. MYTILINIDAE

30. *Mytilina ventralis* (Ehrenberg, 1832)
31. *M. acanthophora* Hauer, 1938

Family 4. TRICHOTRIDAE

32. *Macrochaetus sericus* (Thorpe, 1893)
33. *Trichotria tetractis* (Ehrenberg, 1832)

Family 5. COLURELLIDAE

34. *Colurella sulcata* (Stenroos, 1898)
35. *C. bicuspidata* (Ehrenberg, 1832)
36. *Lepadella* (*Lepadella*) *acuminata* (Ehrenberg, 1834)
37. *L. (L.) longiseta* Myers, 1937
38. *L. (L.) ovalis* (Müller, 1787)
39. *L. (L.) patella* (Müller, 1773)
40. *L. (L.) rhomboides* (Gosse, 1884)
41. *L. (L.) triptera* Ehrenberg, 1830
42. *Lepadella* (*Heterolepadella*) *ehrenbergi* (Perty, 1850)
43. *L. (H.) heterostyla* (Murray, 1917)

Family 6. LECANIDAE

44. *Lecane* (*Lecane*) *aculeata* (Jakubski, 1912)
45. *L. (L.) curvicornis* Murray, 1913
46. *L. (L.) crepida* Murray, 1913
47. *L. (L.) flexilis* (Gosse, 1886)
48. *L. (L.) leontina* (Turner, 1892)
49. *L. (L.) ludwigi* (Eckstein, 1883)
50. *L. (L.) luna* (Müller, 1786)
51. *L. (L.) lateralis* Sharma, 1978
52. *L. (L.) unguolata* (Gosse, 1887)
53. *Lecane* (*Hemimonostyla*) *inopinata* Harring & Myers, 1926
54. *Lecane* (*Monostyla*) *bullata* (Gosse, 1851)
55. *L. (M.) closterocerca* (Schmarda, 1859)
56. *L. (M.) decipiens* (Murray, 1913)
57. *L. (M.) hamata* (Stokes, 1859)
58. *L. (M.) furcata* (Murray, 1913)
59. *L. (M.) pyriformis* (Daday, 1905)
60. *L. (M.) stenroosi* (Meissner, 1908)
61. *L. (M.) unguitata* (Fadeev, 1925)

Family 7. NOTOMMATIDAE

62. *Cephalodella mucronata* Harring & Myers, 1924
63. *Scaridium longicaudum* (Müller, 1786)

Family 8. TRICHOCERCIDAE

- 64. *Trichocerca (Trichocerca) cylindrica* (Imhof, 1891)
- 65. *T. (T.) flagellata* Hauer, 1937
- 66. *T. (T.) rattus* (Müller, 1776)
- 67. *T. (Diurella) similis* (Wierzejski, 1893)

Family 9. ASPLANCHNIDAE

- 68. *Asplanchna brightwelli* Gosse, 1850

Family 10. SYNCHAETIDAE

- 69. *Polyarthra vulgaris* Carlin, 1943

Order : GNESIOTROCHA

Suborder : FLOSCULARIACEA

Family 11. TESTUDINELLIDAE

- 70. *Testudinella patina* (Hermann, 1783)
- 71. *Pompholyx sulcata* Hudson, 1885

Family 13. FILINIIDAE

- 72. *Filinia longiseta* (Ehrenberg, 1834)
- 73. *F. opoliensis* (Zacharias, 1898)
- 74. *F. pejlerei* Hutchinson, 1964

Family : TROCHOSPHAERIDAE

- 75. *Horaella brehmi* Donner, 1949

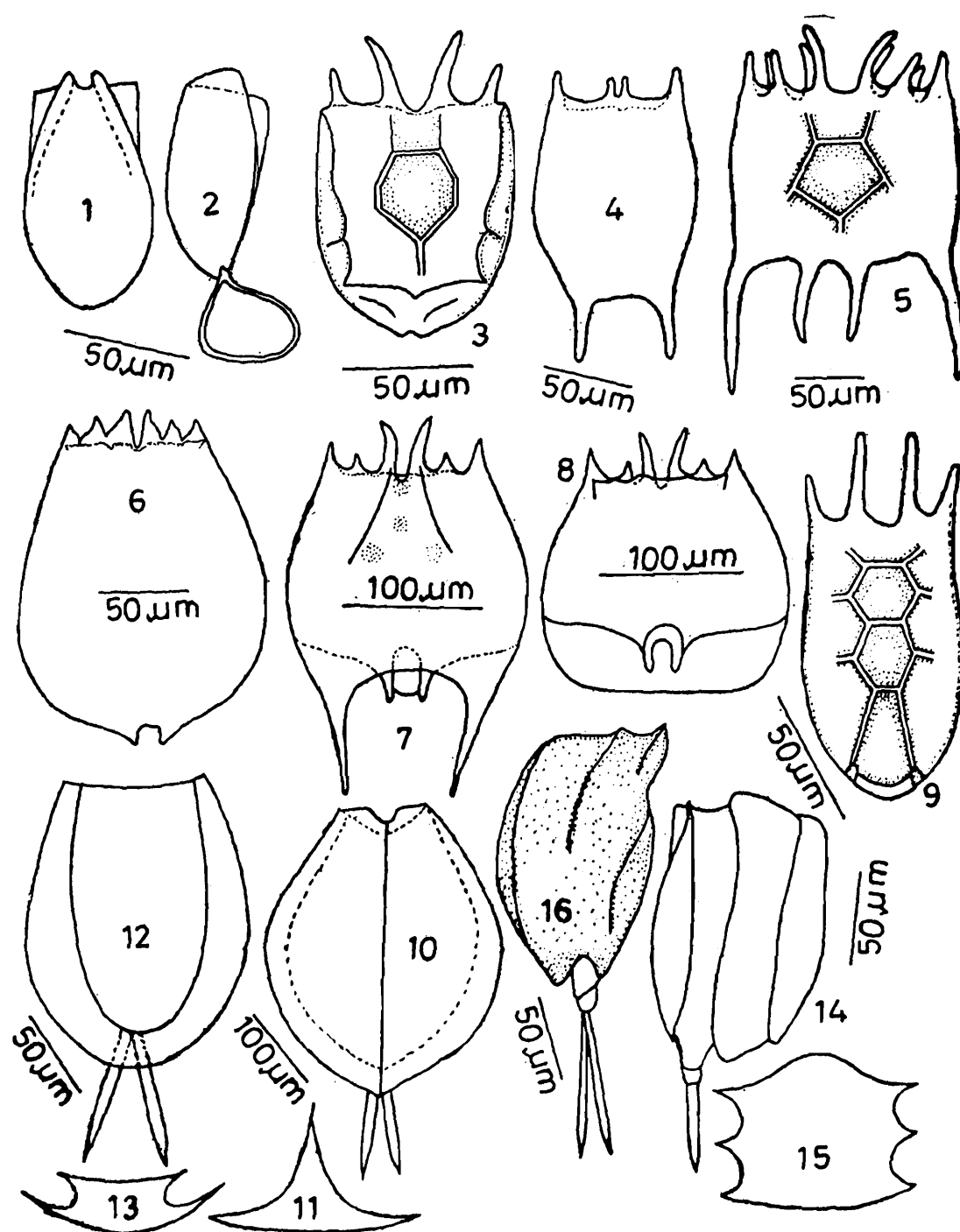
SYSTEMATIC NOTES

Of the above listed taxa, only thirtysix species have previously been reported from this state (Sharma, 1977 ; 1980). Additionally recorded species are briefly described and illustrated in this account.

1. *Anuraeopsis fissa* (Gosse, 1851)

(Figs. 1 and 2)

Lorica ovate and finely stippled. Dorsal plate forming a shallow sinus at anterior end, ventral plate projecting beyond dorsal plate in anterior region.



Figs. 1-16 :

Anuraeopsis fissa (Gosse) : Fig. 1, dorsal view ; Fig. 2 lateral view ;
Brachionus budapestinensis Daday : Fig. 3, dorsal view ;
B. forficula f. *minor* (Voronkov) : Fig. 4, dorsal view ;
B. patulus macracanthus (Daday) : Fig. 5, dorsal view ;
B. plicatilis Müller : Fig. 6, dorsal view ;
B. quadridentatus Hermann : Fig. 7, dorsal view ;
B. quadridentatus f. *chuniorbicularis* (Skorikov) : Fig. 8, ventral view ;
Keratella lensi Hauer : Fig. 9, dorsal view ;
Euchlanis triguetra Ehrenberg : Fig. 10, dorsal view ; Fig. 11, cross-section ;
Dipleuchlanis propatula (Gosse) : Fig. 12, dorsal view ; Fig. 13, cross-section ;
Tripleuchlanis plicata (Levander) : Fig. 14, lateral view ; Text-fig. 15, cross-section ;
Mytilina acanthophora Hauer : Fig. 16, lateral view.

Measurements : Lorica length 96-100 ; maximum width 48-50.

Distribution : India : Rajasthan, Gujarat, Kerala, Panjab, Haryana, West Bengal, Assam, Nagaland, Mizoram, Manipur, Meghalaya, Arunachal Pradesh and Tripura. Elsewhere : Cosmopolitan.

2. *Brachionus budapestinensis* Daday, 1885

(Fig. 3)

Lorica tuberculated, with four occipital spines ; median occipitals longer than laterals.

Measurements : Total length 120-124 ; maximum width 72-76.

Distribution : India : Madhya Pradesh, Panjab, West Bengal and Assam. Elsewhere : Cosmopolitan.

3. *Brachionus forficula* f. *minor* (Voronkov, 1913)

(Fig. 4)

Posterior spines short and without any knob-like swelling ; ratio of length of posterior spines to total body length less than half.

Measurements : Total length 152-160 ; posterior spines 38-48.

Distribution : India : West Bengal, Panjab, Assam, Nagaland and Assam. Elsewhere : Tropics and subtropics.

4. *Brachionus patulus macracanthus* (Daday, 1905)

(Fig. 5)

Posterior spines long ; lateral antennae situated on the postero-lateral spines.

Measurements : Lorica length 260-267 ; posterior spines 100-116.

Distribution : India : Meghalaya. Elsewhere : Neotropics.

5. *Brachionus plicatilis* Müller, 1786

(Fig. 6)

Occipital margin with six spines- almost equal, broad-based, acutely pointed and saw-toothed.

Measurements : Total length 170-175 ; maximum width 126-130.

Distribution : India : Ladak, Rajasthan, West Bengal and Andhra Pradesh. Elsewhere : Cosmopolitan.

6. *Brachionus quadridentatus* Hermann, 1783

(Figs. 7 and 8)

Specimens previously reported from Orissa (Sharma, 1980) refer to f. *melheni* (refer Sharma, 1983). However, the present collections also include typical form (Fig. 7) and f. *cluniorbicularis* (Fig. 8).

7. *Keratella lenzi* Hauer, 1938

(Fig. 9)

Dorsum with three median plaques ; the ultimate plaque much elongated, its arms running towards the posterior end of lorica into a divergent crest.

Measurements : Total length 138-142 ; maximum width 52-58.

Distribution : India : Panjab, West Bengal, Assam and Nagaland. Elsewhere : Tropics and subtropics.

8. *Euchlanis triquetra* Ehrenberg, 1838

(Figs. 10 and 11)

Dorsal plate with a distinct keel having concave sides and produced into lateral flangs.

Measurements : Lorica length 350-358 ; height 180-182 ; maximum width 280-290.

Distribution : India : Meghalaya and Assam. Elsewhere : Cosmopolitan.

9. *Dipleuchlanis propatula* (Gosse, 1886)

(Figs. 12 and 13)

Dorsal plate concave and smaller than the convex ventral plate.

Measurements : Lorica length 162-166 ; maximum width 120-124 ; toes 70-74.

Distribution : India : Kerala, West Bengal and Andhra Pradesh.

Elsewhere : Cosmopolitan.

10. *Tripleuchlanis plicata* (Levander, 1894)

(Figs. 14 and 15)

With distinct lateral sulci separated by flange of stiffened culticle.

Measurements : Lorica length 135-138 ; toes 46-48.

Distribution : India : West Bengal, Andhra Pradesh. Elsewhere : Apparently Cosmopolitan.

11. **Mytilina acanthophora** Hauer, 1938

(Fig. 16)

Lorica with two triangular projections at its anterior end and a deep sinus at posterior end. Toes terminating into acute points.

Measurements : Lorica length 155-160 ; height 92-95 ; toes 88-90.

Distribution : India : West Bengal, and Punjab. Elsewhere : Indonesia, Sri Lanka and North America.

12. **Macrochaetus sericus** (Thorpe, 1892)

(Fig. 17)

Lorica horse-shoe shaped ; eight dorsal spines arranged symmetrically along the median line.

Measurements : Lorica length 128-130 ; toes 20-22.

Distribution : India : Madhaya Pradesh, Andhra Pradesh and West Bengal. Elsewhere : Tropics and subtropics.

13. **Colurella sulcata** (Stenroos, 1898)

(Fig. 18)

Lorica elongated and with a longitudinal sulcus. Foot and toes forwardly directed.

Measurements : Lorica length 70-72 ; toes 18-20.

Distribution : India : Gujarat. Elsewhere : Cosmopolitan.

14. **Coluralla bicuspidata** Ehrenberg, 1832

(Fig. 19)

Lorica with deep ventral head and foot-opening. Foot small and stout ; toes small and pointed.

Measurements : Lorica length 76-78 ; toes 18-22.

Distribution : India : Ladak, Nilgiri Hills, Gujarat and West Bengal. Elsewhere : Apparently Cosmopolitan.

15. **Lepadella (Lepadella) acuminata** (Ehrenberg, 1834)

(Fig. 20)

Lorica usually oval and produced posteriorly into a pointed projection of variable length.

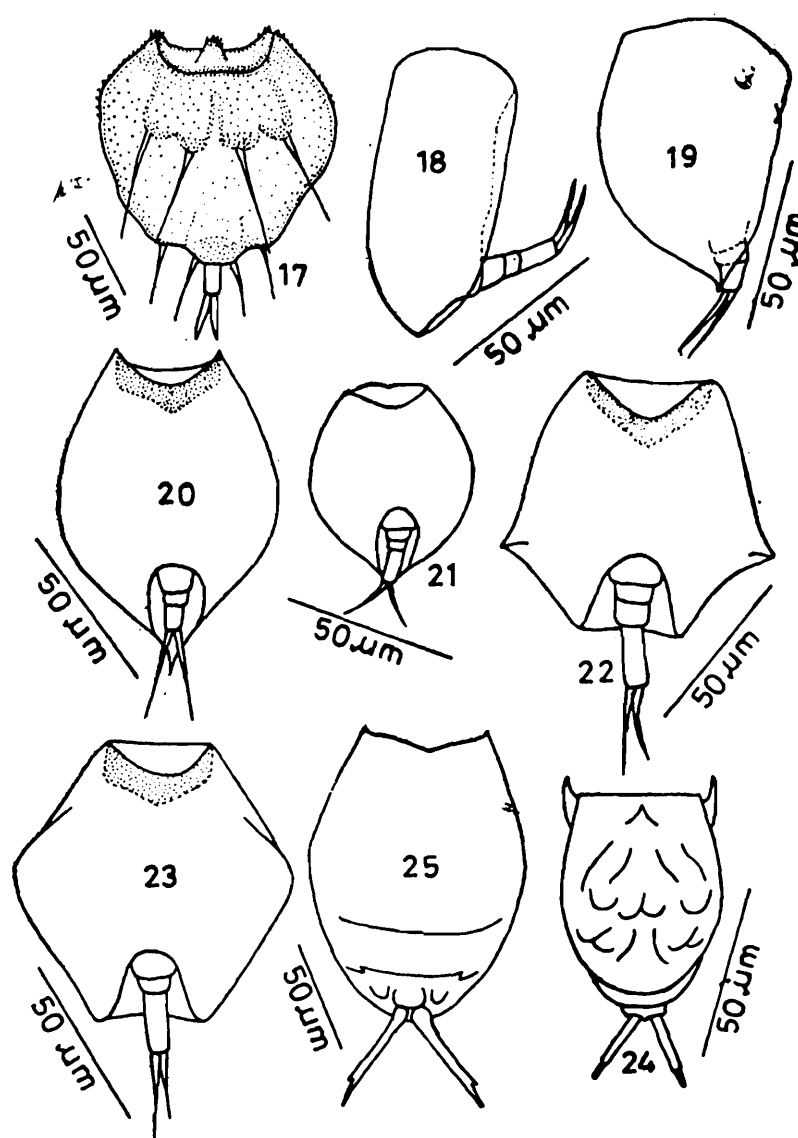
Measurements : Lorica length 78-82 ; width 58-62 ; toes 22-25.

Distribution : India : Nilgiri Hills, West Bengal, Assam, Meghalaya and Arunachal Pradesh. Elsewhere : Cosmopolitan.

16. *Lepadella* (*Lepadella*) *triptera* Ehrenberg, 1830

(Fig. 21)

Lorica almost circular and with a high, thin and distinct dorsal keel.

Measurements : Lorica length 52-55 ; width 45-47 ; toes 12-14.*Distribution* : India : Ladakh, Nilgiri Hills, Panjab, Assam, Meghalaya, Nagaland and West Bengal. Elsewhere : Cosmopolitan.

Figs. 17-25 :

- Macrochaetus sericus* (Thorpe) : Fig. 17, dorsal view ;
Colurella sulcata (Stenroos) : Fig. 18, lateral view ;
C. bicuspidata (Ehrenberg) : Fig. 19, lateral view ;
Lepadella (*Lepadella*) *acuminata* (Ehrenberg) : Fig. 20, ventral view ;
L. (L.) triptera Ehrenberg : Fig. 21, ventral view ;
Lepadella (*Heterolepadella*) *ehrenbergi* (Perty) : Fig. 22, ventral view ;
L. (H.) heterostyla (Murray) : Fig. 23, ventral view ;
Lecane (*Lecane*) *aculeata* (Jakubski) : Fig. 24, dorsal view ;
L. (L.) curvicornis Murray : Fig. 25, ventral view.

17. Lepadella (Heterolepadella) ehmanbergi (Perty, 1850)

(Fig. 22)

Lorica rhomboidal and produced into two lateral spinas behind its middle. Toes unequal ; right toe longer and straight.

Measurements : Lorica length 70-72 ; right toe 24-26 ; left toe 18-20.

Distribution : India : West Bengal, Meghalaya, Assam and Nagaland. Elsewhere : Cosmopolitan.

18. Lepadella (Heterolepadella) heterostyla (Murray, 1913)

(Fig. 23)

Lorica broadly rhomboid, its edges curving upwards from blunt lateral angles. Toes unequal ; left toe short and curved.

Measurements : Lorica length 76-78 ; right toe 22-24 ; left toe 16-18.

Distribution : India : West Bengal, Meghalaya, Assam and Mizoram. Elsewhere : Cosmopolitan.

19. Lecane (Lecane) aculeata (Jakubski, 1912)

(Fig. 24)

Lorica elongate-oval, anterior ventral margin with distinct outcurving spines at its external angles.

Measurements : Lorica length 58-60 ; width 48-50 ; toes 16-18 ; claws 5-7.

Distribution : India : West Bengal. Elsewhere : Tropics and subtropics.

20. Lecane (Lecane) curvicornis Murray, 1913

(Fig. 25)

Anterior margins coincident, with a broad V-shaped sinus and with two large spines at external angles.

Measurements : Lorica length 120-124 ; maximum width 88-92 ; toes 40-42 ; claws 9-12.

Distribution : India : Madhya Pradesh, Andhra Pradesh and West Bengal. Elsewhere : Tropics and subtropics.

21. Lecane (Lecane) flexilis (Gosse, 1886)

(Fig. 26)

Lorica almost semicircular and strongly gibbous. Ventral plate flexible and with small triangular spines at its external angles.

Measurements : Lorica length 70-74 ; toes 16-18 ; claws 5-7.

Distribution : India : Nilgiri Hills, Gujarat and West Bengal. Elsewhere : Cosmopolitan.

22. *Lecane (Lecane) lateralis* Sharma, 1978

(Fig. 27)

Lorica broadly ovate ; anterior dorsal margin slightly concave, anterior ventral margin undulating and with a shallow median sinus. Ventral plate produced into blunt projections at its ventro-lateral angles.

Measurements : Lorica length 135 ; width 120 ; toes 42 ; claws 8.

Distribution : India : Known so far only from its type locality in West Bengal.

23. *Lecane (Hemimonostyla) inopinata* Harring & Myers, 1926

(Fig. 28)

Dorsal plate slightly truncate posteriorly and without surface markings. Toes fused about 1/3 of their length and terminating into small pointed claws.

Measurements : Lorica length 74 ; width 60 ; toes 22 ; claws 6.

Distribution : India : Andhra Pradesh and West Bengal. Elsewhere : Tropics and subtropics.

24. *Lecane (Monostyla) furcata* (Murray, 1913)

(Fig. 29)

Lorica broadly oval ; anterior margins straight and coincident. Toe with two distinct claws separated by a V-shaped notch.

Measurements : Lorica length 66-68 ; width 56-58 ; toe 18 ; claws 6-8.

Distribution : India : West Bengal. Elsewhere : Cosmopolitan.

25. *Lecane (Monostyla) pyriformis* (Daday, 1905)

(Fig. 30)

Anterior margins coincident and with rounded external angles. Toe parallel-sided for about 1/2 of its length and then terminating gradually to pointed apex.

Measurements : Lorica length 60-62 ; width 50-52 ; toe 22.

Distribution : India : West Bengal. Elsewhere : Cosmopolitan.

26. *Lecane (Monostyla) stenroosi* (Meissner, 1908)

(Fig. 31)

Anterior ventral margin with a shallow median sinus flanked with two incurved, hook-like frontal spines.

Measurements : Lorica length 108-112 ; width 90-92 ; toe 36-38 ; claw 10.

Distribution : India : Andhra Pradesh, Gujarat and West Bengal. Elsewhere : Cosmopolitan.

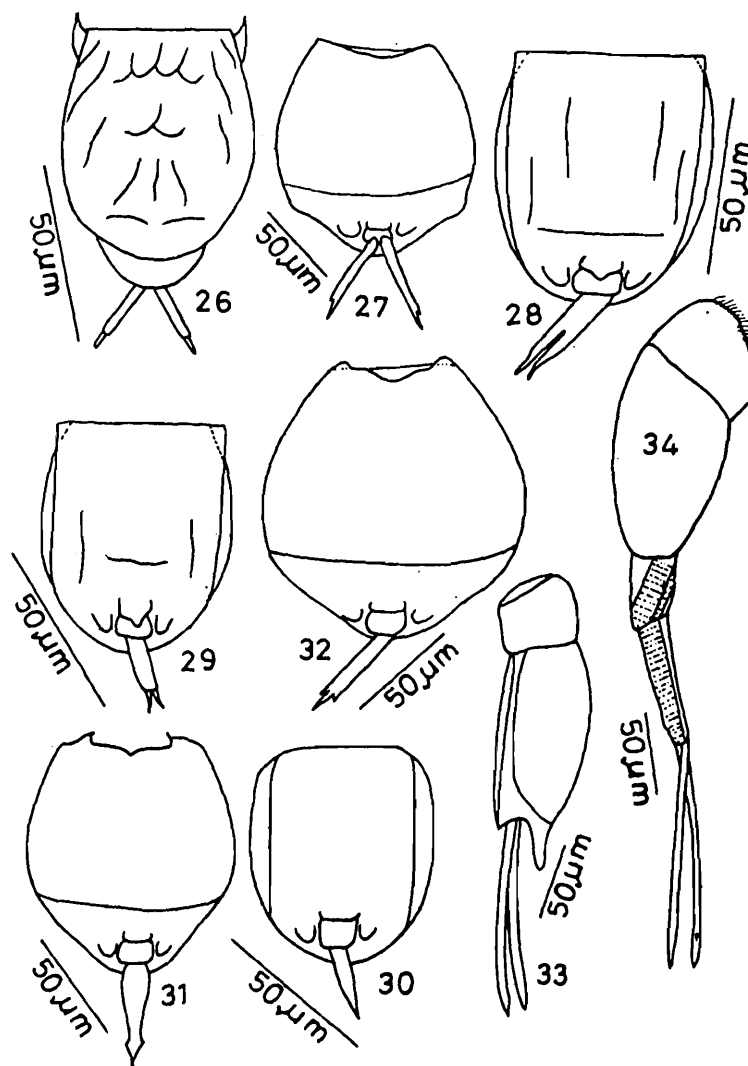
27. *Lecane (Monostyla) unguitata* (Fadeev, 1925)

(Fig. 32)

Anterior ventral margin with distinct rounded external angles and a median sinus flanked with undulating sides.

Measurements : Lorica length 128-130 ; width 110-114 ; toe 32-34 ; claw 10.

Distribution : India : Gujarat, West Bengal and Panjab. Elsewhere : E. Europe, North America, Indonesia and Sri Lanka.



Figs. 26-34 :

Lecane (Lecane) flexilis (Gosse) : Fig. 26, dorsal view ;

L. (L.) lateralis Sharma : Fig. 27, ventral view ;

Lecane (Hemimonostyla) inopinata Harring & Myers : Fig. 28, ventral view ;

Lecane (Monostyla) furcata (Murray) : Fig. 29, ventral view ;

L. (M.) pyriformis (Daday) : Fig. 30, ventral view ;

L. (M.) stenroosi (Meissner) : Fig. 31, ventral view ;

L. (M.) unguitata (Fadeev) : Fig. 32, ventral view ;

Cephalodella mucronata Harring & Myers : Fig. 33, lateral view ;

Scaridium longicaudum (Müller) : Fig. 34, lateral view.

28. **Cephalodella mucronata** Harring & Myers, 1924
(Fig. 33)

Lorica cylindrical and produced posteriorly on the foot into a projection of variable length. Toes long, slender, curved and tapering gradually to acute points.

Measurements : Total length 282-286 ; toes 128-130.

Distribution : India : West Bengal. Elsewhere : Cosmopolitan.

29. **Scaridium longicaudum** (Müller, 1786)
(Fig. 34)

Lorica thin, broadly cylindrical. Foot 3-segmented, distal segment longest. Toes long and with blunt distal ends.

Measurements : Body length 182-190 ; foot 122-125 ; toes 148-150.

Distribution : India : Gujarat, Panjab and West Bengal. Elsewhere : Cosmopolitan.

30. **Trichocerca (Trichocerca) cylindrica** (Imhof, 1891)
(Fig. 35)

Body long and cylindrical ; with a striated area and a dorsal crest. Also with distinct median spine at the anterior end. Left toe long, right toe reduced to a scaly spine.

Measurements : Body length 138-140 ; left toe 124-128 ; right toe 14.

Distribution : India : Kashmir. Elsewhere : Palaearctic and Nearctic regions, also reported from Sri Lanka.

31. **Trichocerca (Trichocerca) flagellata** Hauer, 1937
(Fig. 36)

Body broadly oval ; with a dorsal keel extending about $\frac{2}{3}$ of body length and a broad striated area. Left toe often longer than body, right toe reduced ; basal stylets present.

Measurements : Body length 118-120 ; left toe 175-180 ; right toe upto 30.

Distribution : India : Tamil Nadu. Elsewhere : Malaysia.

32. **Trichocerca (Trichocerca) rattus** (Müller, 1776)
(Fig. 37)

Characterised by a wide keel extending upto $\frac{1}{2}$ of the body length.

Measurements : Body length 189-196 : left toe 112-116.

Distribution : India : Kashmir, Ladak and Gujarat. Elsewhere : Cosmopolitan.

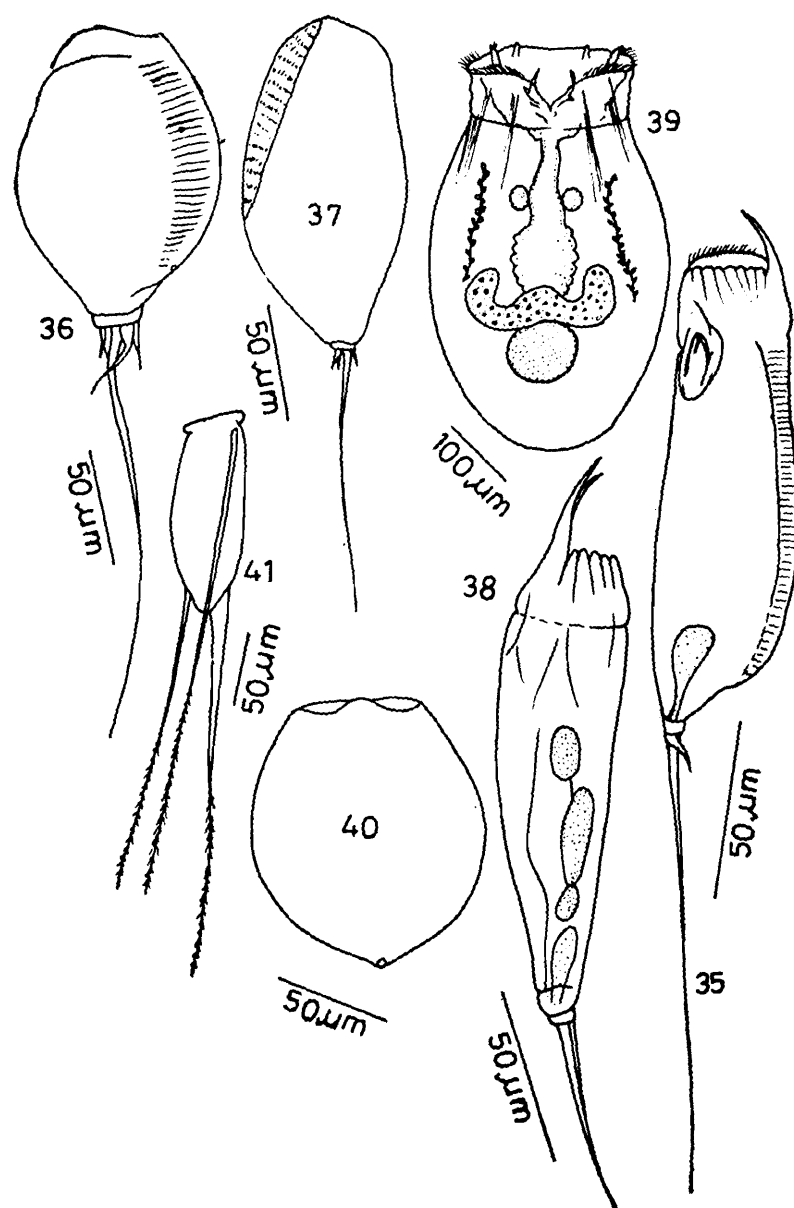
33. *Trichocerca* (*Diurella*) *similis* (Wierzejski, 1893)

(Fig. 38)

Anterior end with two equally long spines ; keel starting from the base of anterior spines and extending about $\frac{1}{3}$ of body length. Toes short and unequal.

Measurements : Body length 128-130 ; right toe 30-38 ; left toe 68-70.

Distribution : India : Gujarat and West Bengal. *Elsewhere* : Cosmopolitan.



Figs. 35-41 :

Trichocerca (*Trichocerca*) *cylindrica* (Imhof) : Fig. 35, lateral view ;

T. (T.) flagellata Hauer : Fig. 36, lateral view ;

T. (T.) rattus (Müller) : Fig. 37, lateral view ;

Trichocerca (*Diurella*) *similis* (Wierzejski) : Fig. 38, lateral view ;

Asplanchna brightwelli Gosse : Fig. 39, dorsal view ;

Pompholyx sulcata Hudson : Fig. 40, dorsal view ;

Filinia pejeri Hutchinson : Fig. 41, lateral view.

34. *Asplanchna brightwelli* Gosse, 1850

(Fig. 39)

Vitellarium band-shaped and with 30-32 nuclei. Protonephredia with 10-20 flame bulbs each.

Measurements : Total length 510-620.

Distribution : India : Kashmir, Ladak, Panjab, Assam and West Bengal. Elsewhere : Cosmopolitan.

35. *Pompholyx sulcata* Hudson, 1885

(Fig. 40)

Lorica with four longitudinal furrows and divided into dorsal and ventral bulges. Anterior dorsal margin raised into a lobe-like projection, ventral margin with a shallow median sinus.

Measurements : Lorica length 108-112.

Distribution : India : Ladak, West Bengal and Panjab. Elsewhere : Cosmopolitan.

36. *Filinia pejeri* Hutchinson, 1964

(Fig. 41)

Body fusiform, width about $\frac{1}{3}$ or $\frac{1}{4}$ of its length. Setae spinulose ; posterior seta with a broad oblique base.

Measurements : Body length 124-130 ; Posterior seta 250-260.

Distribution : India : Tamil Nadu, Rajasthan, Panjab, West Bengal and Assam. Elsewhere : Tropics and subtropics.

NATURE AND COMPOSITION

The rotifer fauna of Orissa appears to be rich and diversified and includes twentytwo genera spread over thirteen eurotatorian families. Cosmopolitan elements comprise a bulk of the reported taxa while tropical and subtropical or pantropical species are also fairly well represented. *Lecane lateralis* Sharma, 1978 is the only endemic species found in the studied collections. Common occurrence of *Brachionus* spp. and absence of *Notholca* imparts a typical tropical character to this fauna. A majority of the listed species constitute eurytopic alkaline forms. The rotifer fauna of Orissa shows 66.4% similary (vide Sorenson Index) with the fauna of West Bengal.

Lecanidae and Brachionidae, in the stated order, form a dominant fraction. The former belong to *Lecane* complex, containing *Lecane s. str.*, *Lecane* (*Monostyla*) and *Lecane* (*Hemimonostyla*) which, in turn, are represented by nine, ten and one species respectively. *L. leontina*, *L. luna*, *L. unguolata*, *L. bulla*, *L. closterocerca*, *L. quadridentata*, *L. stenroosi* and *L. unguitata* are noticed to be widely distributed. *L. luna*, *L. bulla* and *L. closterocerca* are occasionally observed in plankton samples. *L. lateralis*, the sole endemic element in this fauna, is known so far only from its type locality in West Bengal. *L. aculeata*, *L. curvicornis*, *L. crepida*, *L. leontina* and *L. inopinata* represent tropical and subtropical elements.

Brachionids are of common occurrence in the samples collected from Orissa. Amongst 32 species of the brachionids reported from India (Sharma, 1982), only eighteen species are documented from this state. *Anuraeopsis* includes only two species i.e., *A. fissa* and *A. coelata*; the cosmopolitan *A. fissa* appears to be widely distributed. Species of *Brachionus* from Orissa are well comparable with those recorded from West Bengal. *B. angularis*, *B. caudatus*, *B. calyciflorus* and *B. rubens* show relatively common occurrence and swarm in eutrophic waters, often with blooms of blue-green algae. *B. patulus macracanthus*, known so far only from Neotropics (Koste, 1978), has recently been reported by the author (Sharma, 1987) from Meghalaya State in North-Eastern India. Infra-specific variations are noticed presently in *B. calyciflorus*, *B. caudatus*, *B. forficula* and *B. quadridentatus* and hence, different lower taxonomic categories ('forms') are recognised in this account. Genus *Keratella* includes only three species; the cosmopolitan *K. tropica* often dominates the plankton samples while the tropical and subtropical *K. lenzi* and *K. procurva* show only restricted occurrence.

Colurellidae (ten species) also makes important contribution in the rotifer fauna of Orissa. Little is known about the distribution of *Colurella* spp. in India and they are also rare in the examined material. *C. sulcata*, the warm-stenothermal element, shows much restricted distribution in this country. Indian species of *Lepadella* have been reviewed recently by Sharma & Sharma (1987). This genus is presently represented by eight species; six species belonging to *Lepadella s. str.* while only two species are included in the subgenus *Heterolepadella*. *L. longiseta* comprises a rare and interesting element in the rotifer fauna of India. *L. ovalis* and *L. patella* are occasionally noticed in limnetic samples.

Family Trichocercidae includes four species. *T. flagellata* represents a worm-stenothermal species and appears to be restricted to South-East Asia. From India, it has previously been reported only from its type-locality in Madras (Hauer, 1937). *T. cylindrica* is known to be distributed in Palaearctic and Nearctic regions (Koste, 1978) but has also been documented from

Sri Lanka (Chengalath *et. al.*, 1973). The mentioned two species of *Trichocerca* comprise examples of biogeographical interest in the Indian Rotifera while *T. rattus* and *T. similis* are cosmopolitan in their distribution.

Euchlanids are represented by only four species. Amongst these, *Euchlanis triquetra* shows restricted occurrence in Orissa. *Tripleuchlanis plicata*, though common in brackish-waters, has also been reported by the author (Sharma, 1979) from a freshwater tank in Calcutta, West Bengal. Of the other families of ploimid rotifers, Mytilinidae, Trichotridae and Notommatidae include two species each while only one species each belonging to Asplanchnidae and Synchaetidae are examined. *Macrochaetus sericus* shows tropical and subtropical distribution while *Mytilina acanthophora* is reported so far from Indonesia, Ceylon and North America. The latter constitutes a rare and interesting element in the Indian rotifer fauna. However, rest of the listed species of the stated families are cosmopolitan in their distribution.

Order Gnesiotrocha includes only three families in the studied material ; of the presently reported species of this order, *Filinia pejleri* and *Horaella brehmi* are interesting elements in the rotifer fauna of this country.

The list of species recorded from Orissa, though moderately extensive, is yet not complete. It includes fairly good number of planktonic species but periphytic elements are still inadequately investigated. While the bdelloids, in general, are poorly documented from India (Sharma and Michael, 1980 ; Sharma, 1985), there is so far no report of these rotifers from Orissa.

SUMMARY

Sixty nine species of monogonot rotifers, belonging to twenty two genera and thirteen eurotatorian families, are documented from Orissa State in Eastern India. Of these, thirtythree species (thirtyseven taxa) constitute new records from this state. Cosmopolitan eurytopic alkaline species comprise a bulk of the examined taxa while tropical and subtropical elements are also fairly well represented. *Lecane lateralis* Sharma, 1978 is the sole endemic species noticed in this fauna. Remarks are made on the nature and composition of the rotifer fauna of Orissa and on the distribution of various species.

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REFERENCES

- CHENGALATH, R., FERNANDO, C. H. AND KOSTE, W. 1973. Rotifera from Sri Lanka (Ceylon) 2. Further studies on the Eurotatoria including new records. *Bull. Fish. Res. Stn. Sri Lanka (Ceylon)*, **24** : 29-62.
- HAUER, J. 1937. Neue Rotatorienarten aus Indian. II. *Zool. Anz.*, **119** : 284-288.
- KOSTE, W. 1978. Rotatoria. Die Rädertiere Mitteleuropas. Begründet von Max Voigt. Überordnung Monogononta. Gebrüder Borntraeger, Stuttgart.
- SHARMA, B. K. 1977. On a small collection of rotifers (Class : Rotifera) from Orissa. *Newsl. zool. Surv. India*, **3** : 189-190.
- SHARMA, B. K. 1978. Two new lecanid Rotifers from India. *Hydrobiologia*, **60** : 191-192.
- SHARMA, B. K. 1979. Record of the rotifer, *Tripleuchlanis plicata* (Levander) from a freshwater tank in Calcutta, India. *Bull. zool. Surv. India*, **2** : 105.
- SHARMA, B. K. 1980. Contributions to the rotifer fauna of Orissa, India, *Hydrobiologia*, **70** : 225-233.
- SHARMA, B. K. 1983. The Indian species of the genus *Brachionus* (Eurotatoria : Monogononta : Brachionidae). *Hydrobiologia*, **104** : 31-39.
- SHARMA, B. K. 1985. Review of taxonomic studies on Indian Freshwater Rotifera, with remarks on ecology and biogeography. *2nd International Symp. on Life Sciences (Nov. 14-16, 1985), Shillong* : Abstract.
- SHARMA, B. K. 1987. Indian Brachionidae (Eurotatoria : Monogononta) and their distribution. *Hydrobiologia*, **144** : 269-275.
- SHARMA, B. K. AND MICHAEL, R. G. 1980. Synopsis of taxonomic studies on Indian Rotatoria. *Hydrobiologia*, **73** : 229-236.
- SHARMA, B. K. AND SHARMA, SUMITA, 1987. On species of genus *Lepadella* (Eurotatoria ; Monogononta : Colurellidae) from North-Eastern region, with remarks on Indian taxa. *Hydrobiologia*, **147** : 15-22.