

FAUNA OF ORISSA

PART—II

ZOOLOGICAL SURVEY OF INDIA
1989



STATE FAUNA SERIES NO. 1

FAUNA OF ORISSA

PART 2

*Edited by the Director,
Zoological Survey of India*



ZOOLOGICAL SURVEY OF INDIA
1989

© Copyright 1989, Government of India

Published : October, 1989

PRINTED AT SRI AUROBINDO PRESS, 16 HEMENDRA SEN STREET, CALCUTTA-
700 006, PRODUCED BY THE PUBLICATION DIVISION AND PUBLISHED BY
THE DIRECTOR, ZOOLOGICAL SURVEY OF INDIA, CALCUTTA-700 020.

FOREWORD

This volume forms part 2 of the "Fauna of Orissa" which is being published by the Zoological Survey of India under the newly started "State Fauna Series". Part 1 contained contributions on groups such as Protozoa, Porifera, Polychaeta, Orthoptera, Isoptera, Ephemeroptera, Odonata, Neuroptera, Diptera, certain families of orders Hemiptera and Lepidoptera, spiders, ticks, mites, Stomatopoda, Gastrotricha and Rotifera by the different specialists in the Zoological Survey of India and outside. The present part 2 contains article on Meiofauna, Oligochaeta, Trematoda, insect orders Orthoptera, Dermaptera, Dictyoptera and freshwater and terrestrial Mollusca. Two more parts on some other groups of the fauna of Orissa are likely to be brought out ; part 3 containing contributions on Marine mollusca and some other insect groups and part 4 mainly the vertebrate groups.

The fauna of state of Orissa has been thoroughly surveyed and it has made possible for Z. S. I. to bring out a consolidated systematic account on various groups of animals.

I wish to acknowledge my sincere thanks to various specialists for their contributions, to the Publication Division for bringing out this volume and particularly to Dr. O. B. Chhotani, Scientist-SF (Joint Director) for his help in editing.

Prof. Mohammed Shamim Jairajpuri
Director
Zoological Survey of India

September 30th, 1989

FAUNA OF ORISSA

PART 2

CONTENTS

	<i>Page</i>
INTERTIDAL MEIOFAUNA — <i>G. Chandrasekhara Rao</i> ...	1
OLIGOCHAETA—A CHECKLIST — <i>J. M. Julka, B. K. Senapati and R. Paliwal</i> ...	79
INSECTA : ORTHOPTERA : ACARIDOIDEA — <i>S. K. Tandon and M. S. Shishodia</i> ...	93
INSECTA : DERMAPTERA — <i>G. K. Srivastava</i> ...	147
INSECTA : DICTYOPTERA : BLATTARIA — <i>K. P. Mukherjee</i> ...	171
INSECTA : HEMIPTERA — <i>L. K. Ghosh, B. Biswas, S. P. Chakraborty & G. C. Sen</i> ...	181
DIGENETIC TREMATODES OF VERTEBRATES — <i>M. Hafeezullah</i> ...	225
MOLLUSCA (TERRESTRIAL) — <i>N. V. Subba Rao, D. K. Thakur & S. C. Mitra</i> ...	253
MOLLUSCA (FRESHWATER) — <i>N. V. Subba Rao, S. C. Mitra & R. N. Manna</i> ...	277

INTERTIDAL MEIOFAUNA

G. CHANDRASEKHARA RAO

*Andaman & Nicobar Regional Station,
Zoological Survey of India,
Port Blair-744101*

INTRODUCTION

The meiofauna of Orissa coast is sufficiently rich and varied with a large number of species inhabiting the algae, sandy and muddy sediments in the littoral region. Our knowledge on the taxonomy, ecology and distribution of meiofauna of these habitats was limited to the works of Nagabhushanam and Rao (1969), Rao (1969, 1978, 1981), Patnaik (1971), Sarma and Rao (1980) and Sarma *et al.* (1981). Thus, a detailed investigation of the intertidal meiofauna of the Orissa coast needed to be undertaken to have a comprehensive idea of the nature of faunal element of this region.

The present article deals with the results of a collection of meiofauna made on Orissa coast during the exploratory programmes of the Zoological Survey of India in January 1977 and July-September 1989. Eight localities on the coast near Chandipur, Bhadrakh, Paradwip, Konarak, Puri, Rambha Bay (Chilka Lake), Bahuda Estuary and Gopalpur, were investigated (Fig. 1). The material reported here comprises in all 130 species of the diverse groups of meiofauna, while some of it still remains to be studied and identified. Species marked with an asterisk in the text are new records for Orissa coast. All the meiofauna has been collected and examined by the author following the standard methods recommended for the study (Hulings and Gray 1971). The soft fauna was studied in fresh condition, while the hard fauna was preserved for subsequent analysis and identification.

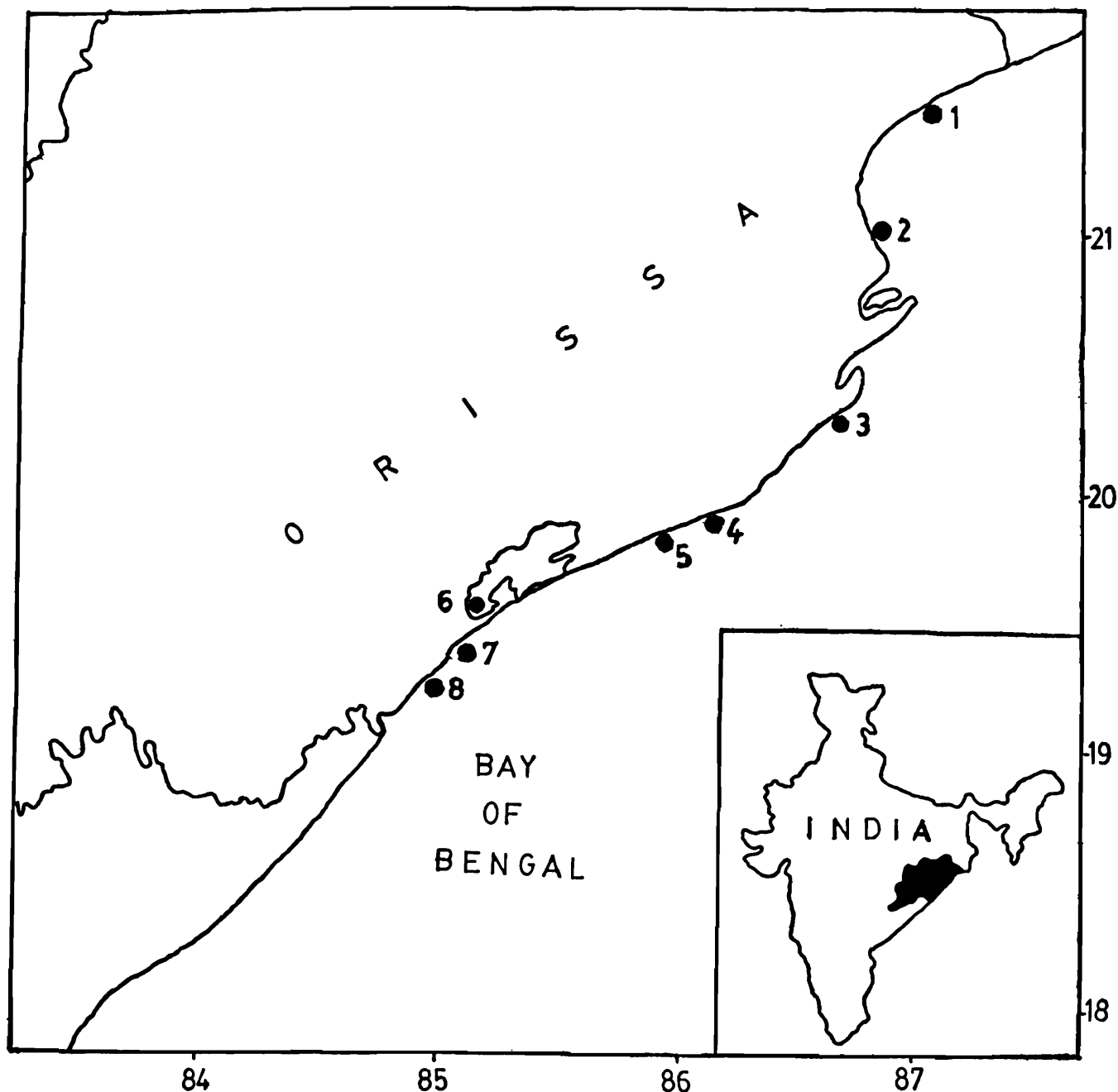


Fig. 1. Map showing the localities 1-8 investigated on Orissa coast.

1. Chandipur, 2. Bhadrakh, 3. Paradwip, 4. Konarak, 5. Puri, 6. Rambha Bay (Chilka Lake), 7. Bahuda estuary, 8. Gopalpur.

The study confirms the growing evidence that many marine meiofauna species are eurytopic, with a wide range of geographical distribution along the coasts of Indian, Pacific and Atlantic Oceans. Further intensive field surveys of these habitats on Orissa coast may quite likely reveal the presence of many more species adding to the existing faunal list.

SYSTEMATIC ACCOUNT

Phylum **CNIDARIA**Class **Hydrozoa**Order **ACTINULIDA**Family **HALAMMOHYDRIDAE**Genus **Halammohydra** Remane, 19271. **Halammohydra octopodides** Remane1927. *Halammohydra octopodides* Remane, *Zeitschr, Morphol. Oekol.*, 7 : 643.*Material examined* : 3 ex., Puri, 22.1.77 ; 2 ex., Puri, 23.1.77.*Diagnostic features* : Aberrant cnidarians with body entirely ciliated. Gastric tube elliptical. Aboral cone globular with adhesive organ. Tentacles in two whorls of 5+5, alternating with a whorl of 5 statocysts of the lithostyle type. Cnidome with micro and macrostentoteles of two size categories.*Measurements* : Length 0.4-0.5 mm and maximum diameter 0.2 mm.*Remarks* : Remane described the species from Baltic and North Sea coasts. Rao and Ganapati (1965) reported the species for the first time from Indian waters. The present material showed some variation from original description mainly in the structure of cnidome. Further, because of the geographical isolation of the areas investigated, it is quite possible that the Indian specimens represent a different species.*Habitat* : Coarse sand 5 cm below surface between low and half-tide levels, intertidal zone.*Distribution* : Baltic Sea, North Sea, North Atlantic, Mediterranean, Bay of Bengal.*2. **Halammohydra** sp.*Material examined* : 2 ex., Gopalpur, 29.1.77.*Description* : Body small and transparent. Aboral cone globular with weakly developed adhesive organ. Two whorls of slender tentacles and statocysts present numbering 4+8+4. Neck short. Gastric tube cylindrical. Cnidome consists of microeuryteles in two size categories. A single gonad present. Weakly thigmotactic cone.*Measurements* : Length 0.4 mm and width 0.1 mm.

Remarks : Although the morphological features of the present material approach *H. chauhani* Rao (1975) described from Andamans, in the absence of detailed studies of the cnidome, confirmation of the species is left to future investigations.

Habitat : Coarse and medium sand between low and half-tide levels, intertidal zone.

Phylum **PLATYHELMINTHES**

Class **Turbellaria**

Order **MACROSTOMIDA**

Family **MACROSTOMIDAE**

Genus **Acanthomacrostomum** Papi and Swedmark,
1959

***3. Acanthomacrostomum gerlachi Ax**

1971. *Acanthomacrostomum gerlachi* Ax, *Microfauna Meeresboden*, 8 : 1.

Material examined : 1 ex., Konark, 25.1.77 ; 7 ex., Puri, 21.1.71 ; 2 ex., Gopalpur, 31.1.77.

Diagnostic features : Aberrant turbellarian. Body flat, oblong and leaf-like. Head truncate and tail pointed. Internal skeleton of spicules directed posteriorly and posterolaterally in 6-8 transverse rows. Spicule size increases from anterior end to posterior end. Mouth ventral and located about one fourth of total body length from anterior end. Hypodermal glands profuse. Body highly thigmotactic.

Measurements : Length 0.4-0.8 mm and maximum width 0.1-0.2 mm.

Remarks : The material conforms with the original description of the species from Maldives. As pointed out by Ax (1971), *A. spiculiferum* Papi and Swedmark (1959) recorded by Rao (1969) on Orissa coast is to be treated as *A. gerlachi*. Hence, this is the first record of the species from Indian waters.

Habitat : Coarse sand with fine shell gravel 5 cm below surface between low and high tide levels, intertidal zone.

Distribution : Maldives, Lakshadweep, Indian subcontinent, Andaman Islands.

Order SERIATA
Family MONOCELIDIDAE
Genus *Monocelis* Ehrenberg, 1931

4. *Monocelis lineata* (O. F. Muller)

1913. *Monocelis lineata* (O. F. Muller) Graff, *Das Tierreich*, 35 : 496.

Material examined : 3 ex., Bhadrakh, 15.1.77 ; 7 ex., Puri, 21.1.77 ; 1 ex., Gopalpur, 27.1.77.

Diagnostic features : Body linear with flattened tail. Proboscis located in the second half of body. Brownish ocular pigment occurs in front of statocyst in the form of a transverse band. Proboscis ventral and located posteriorly in the second half of body.

Measurements : Length 2.0—3.0 mm and diameter 0.2—0.3 mm.

Remarks : The specimens examined fully agree with the description of the species made by Graff (1913) from the European coasts. Graff mentioned that the worms attain upto 5 mm in length, while the local forms are considerably smaller in size.

Habitat : Fine and medium sand to a depth of 10 cm below surface between low and high tide levels, intertidal zone.

Distribution : Baltic Sea, North Sea, North Atlantic, Mediterranean, Black Sea, Bay of Bengal.

Family OTOPLANIDAE
Genus *Otoplana* Du Plessis, 1812

*5. *Otoplana subterranea* Ax

1951. *Otoplana subterranea* Ax, *Zool. Jahrb.*, 80 : 227.

Material examined : 4 ex., Puri, 22.1.77 ; 3 ex., Bahuda estuary, 26.9.80 ; 1 ex., Gopalpur, 27.1.77.

Diagnostic features : Body elongated and flattened, with sensory bristles on the anterior margin. Adhesive papillae 6-8 pairs on tail. Central funnel tube of the copulatory organ is conical, while the stylets have bifurcated tips unequal in length. Proboscis ventral and located about half the length of the body. The species is highly thigmotactic and lurks amidst sand grains.

Measurements : Length 0.8-1.0 mm and width less than 0.1 mm.

Remarks : The type specimens attained a length of 0.7-0.8 mm, while the local forms are considerably longer. The central funnel tube and stylets are also proportionately longer than the Baltic specimens. This is a new record for the Indian coast.

Habitat : Medium and coarse sand 5-10 cm below surface between low and high tide levels of the beach.

Distribution : Baltic Sea, North Sea, Mediterranean, Bay of Bengal.

Order NEORHABDOCOELA

Family POLYCYSTIDAE

Genus *Gyratrix* Ehrenberg, 1831

6. *Gyratrix hermaphroditus* Ehrenberg

1925. *Gyratrix hermaphroditus* Ehrenberg, *Morphol. Okol.*, 3 : 255.

Material examined : 2 ex., Bahuda estuary, 27.8.80.

Diagnostic features : Small unsegmented worms with spindle-shaped body, bulbose pharynx and a protrusible, glandulomuscular undivided proboscis at the anterior end. Two dark eyes behind proboscis. Copulatory bursa with chitinous lining. Penis stylet enclosed in a sheath at the rear. Highly euryhaline and widespread.

Measurements : Length 1.8-2.2 mm and maximum width 3.3 mm.

Remarks : The material examined conforms well with the detailed description of the species given by Meixner (1925),

Habitat : Medium sand rich in organic detritus, intertidal zone.

Distribution : Cosmopolitan in fresh, brackish and salt water habitats.

Phylum NEMATODA

Class Aphasmidea

Order ENOPLIDA

Family ANTICOMIDAE

Genus *Anticoma* Bastian, 1865

7. *Anticoma arctica* Steiner

1916. *Anticoma arctica* Steiner, *Zool. Jahrb. Abt. Syst.*, 39 : 511.

Material examined : 2 ex., Chandipur, 12.1.77 ; 1 ex., Paradwip, 19.1.77 ; 1 ex., Bahuda estuary, 10.9.80.

Diagnosiic features : Cuticle with faint striation. Prominent lateral fields. Labial papillae distinct. Stoma curved and slightly sclerotized. Amphids distinct. Excretory ampulla prominent. Tail conical-cylindrical. Caudal gland 3-celled. Spicule in male 0.8 head diameter long. Cephalic setae short and 0.25 head diameter long.

Measurements : Length 1.8-2.0 mm. Tail 5.0-6.5 anal diameters long.

Remarks : The present specimens agree well with the original description of the species except for the variation of body size and the position of amphids.

Habitat : Fine and medium sand with little detritus or mud between low and high tide levels, intertidal zone.

Distribution : Arctic Sea, North Sea, Atlantic, Pacific, Red Sea, Bay of Bengal.

***8. *Anticoma acuminata* (Eberth)**

1962. *Anticoma acuminata* (Eberth) Gerlach, *Kieler Meeresforsch.*, 18 : 84.

Material examined : 1 ex., Paradwip, 18.1.77.

Diagnostic features : Labial papillae distinct. Cephalic setae less than half the head diameter. Five somatic setae occur about 2.4 head diameters from anterior end. Excretory pore one head diameter behind the anterior end. Amphid distinct at the level of excretory pore. Tail cylindrical, with 3-celled caudal gland.

Measurements : Length 1.8 mm. Tail 6.0 anal diameters long.

Remarks : The specimen examined conforms well with the description of the species given by Gerlach (1962), but for the minor variation in size.

Habitat : Muddy sand near low water level, intertidal zone.

Distribution : Cosmopolitan.

Family LEPTOSOMATIDAE

Genus *Platycoma* Cobb, 1893

9. *Platycoma africanum* (Gerlach)

1959. *Platycomopsis africanus* Gerlach, *Zool. Anz.*, 163 : 361.

Material examined ; 3 ex., Bahuda estuary, 26.9.80.

Diagnostic features : Cuticle smooth and transparent. Labial papillae indistinct. Cephalic setae longer than head width. Amphid prominent and cup-shaped. Tail short and ends in acute tip. Excretory pore located about 4.0 head diameters from anterior end.

Measurements : Length 10.2 mm. Tail 2.2 anal diameters long.

Remarks : The material examined conforms well with the original description of species but for the longer body size.

Habitat : Medium sand rich in detritus between low and half-tide levels, intertidal zone.

Distribution : Red Sea, Maldives, Lakshadweep, Indian Coast, Andaman Islands.

Family OXYSTOMINIDAE

Genus *Oxystomina* Filipjev, 1921

***10. *Oxystomina elongata* (Butschli)**

1961. *Oxystomatina elongata* (Butschli) Timm, *Proc. Pak. Acad. Sci.*, 1 : 38.

Material examined : 4 ex., Rambha Bay, 28.8.80.

Diagnostic features : Four cervical setae at 1/3 of the distance from anterior end to the amphid. Amphid distinct, oblong and located 6 head diameters from anterior end. Stoma slightly sclerotized. Tail cylindrical and bluntly rounded at the tip.

Measurements : Length 1.2-1.4 mm. Tail 5.4 anal diameters long.

Remarks : The specimens agree well with the description of the species given by Timm. This is the first record of the species from Indian waters.

Habitat : Surface layers of fine mud with brackish water conditions.

Distribution : Highly cosmopolitan.

Genus *Halalaimus* De Man, 1888

***11. *Halalaimus setosus* Timm**

1961. *Halalaimus setosus* Timm, *Proc. Pak. Acad. Sci.*, 1 : 36.

Material examined : 7 ex., Rambha Bay, 28.8.80 ; 2 ex., Bahuda estuary, 10.9.80.

Diagnostic features : Cuticle finely striated, Head diameter 1/3 of

the body diameter at the oesophageal base. Neck tapers gradually. Amphids cylindrical. Six cephalic setae and 6 cervical setae present. Tail filiform. Spicule cephalated and 1.8 anal diameters long.

Measurements : Length 1.0-1.2 mm. Tail 16 anal diameter long.

Remarks : The material examined conforms with the original description of the species.

Habit : Fine bottom mud below the water line.

Distribution : Bay of Bengal.

Family ONCHOLAIMIDAE

Genus *Oncholaimus* Dujardin, 1845

12. *Oncholaimus brachycercus* De Man

1889. *Oncholaimus brachycercus* De Man, *Mem. Soc. Zool. France*, 2 : 1.

Material examined : 2 ex., Puri, 23.1.77 ; 1 ex., Bahuda estuary, 26.9.80.

Diagnostic features : Cuticle smooth and transparent. Lips, labial papillae and buccal teeth prominent. Ten cephalic setae present. Amphid about 1/3 of the corresponding body diameter. Excretory pore about 3 head diameters from anterior end. Tail short and conical. Cement glands well developed with long ducts.

Measurements : Length 3.0-3.5 mm. Tail 1.4 anal diameters long.

Remarks : The specimens examined agree with the original description of the species except for the longer spicules in male specimens.

Habitat : Coarse and medium sands between low and half tide levels, intertidal zone.

Distribution : Baltic Sea, North Sea, Arctic, Atlantic and Indian Oceans.

Genus *Viscosia* De Man, 1890

13. *Viscosia* sp.

Material examined : 1 ex., Chandipur, 12.1.77 ; 1 ex., Gopalpur, 31.1.77.

Description : Cuticle faintly striated. Cephalic setae about 1/4 of the head diameter. Stoma deep and 1.5 head diameters. Two sub-

ventral teeth present. Amphids bowl-shaped, $\frac{1}{3}$ of the head diameter wide and located at the tip of the subventral teeth.

Measurements : Length 1.5-1.8 mm. Tail 3.5-4.0 anal diameters long.

Remarks : The material studied approaches the description of the species made by Timm (1961) from Bangladesh. The specific identification needs further study.

Habitat : Fine muddy sand near low water level, intertidal zone.

Order CHROMADORIDA

Family COMESOMATIDAE

Genus **Sabatieria** Re Rouville, 1903

14. **Sabatieria abyssalis** Filipjev

1918. *Parasabatieria abyssalis* Filipjev, *Savastopol Biol. Stan. Ross Akad. Nauk*, 2 : 350.

Material examined : 1 ex. Chandipur, 12.1.77 ; 2 ex., Paradwip, 18.1.77.

Diagnostic features : Cuticle punctate with vertical and horizontal differentiation. Lateral fields with large irregular dots. Labial setae short. Four cephalic setae present attaining $\frac{1}{2}$ the head diameter in length. Cervical setae very short. Amphid spiral type. Tail conical-cylindrical with 3-celled caudal gland.

Measurements : Length 1.5-1.8 mm. Tail 4.6 anal diameters long.

Remarks : The material studied agrees well with the original description.

Habitat : Fine mud and sand with detritus near low water level.

Distribution : Mediterranean Sea, Black Sea, Atlantic, Bay of Bengal.

*15. **Sabatieria hilarula** De Man

1922. *Sabatieria hilarula* De Man, *Tijdschr. Nederl. Dierk. Varen.*, 18 : 127.

Material examined : 1 ex., Bhadrakh, 15.1.77 ; 2 ex., Paradwip, 18.1.77.

Diagnostic features : Cuticular punctation homogeneous. Labial papillae distinct. Four cephalic setae. Cervical setae in 4 groups of 5-10 each. Amphids spiral with 5 turns. Oesophageal base swollen.

Tail conical-cylindrical with 3 terminal spines. Caudal glands well developed. Spicule in male 1.5 anal diameters long. Gubernaculum with triangular apophysis. Preanal supplements are obscure.

Measurements : Length 1.0-1.2 mm. Tail 4.0-4.2 anal diameters long.

Remarks : Compared to the original description, the specimens show minor variation in relation to the Dcmanian values. The material, however, corresponds well with the description of the species given by Timm (1961) from Bangladesh.

Habitat : Weeds and surface mud, intertidal zone.

Distribution : Eurytopic on the coasts of Mediterranean, Atlantic and Indian Oceans.

Family CHROMADORIDAE

Genus **Chromadora** Bastian, 1865

16. **Chromadora vulgaris** Bastian

1865. *Chromadora vulgaris* Bastian, *Trans. Linn. Soc. Lond.*, 25 : 167.

Material examined : 6 ex., Puri, 21.1.77.

Diagnostic features : Body slightly compressed with both ends tapering. Cuticle with distinct transverse striation. A pair of reddish ocelli occur posterior to the base of buccal cavity. Intestine with numerous irregular oil globules. Caudal gland 5-celled. Spicule in male curved and 1.6 anal diameters long.

Measurements : Length 1.8-2.0 mm. Tail 4.5 anal diameters long.

Remarks : The material agrees with the description of the type species except for minor variations in the relative measurements of body.

Habitat ; Algae and detritus sand in littoral zone.

Distribution : Atlantic Ocean, Bay of Bengal.

Genus : **Dichomadora** Kreis, 1929

*17. **Dichromadora simplex** Timm

1961. *Dichromadora simplex* Timm, *Proc. Pak. Acad. Sci.*, 1 : 44.

Material examined : 1 ex., Paradwip, 18.1.77 ; 2 ex., Paradwip, 19.1.77.

Diagnostic features : Cuticle with fine punctation anteriorly and heavy punctation posteriorly. Lateral alae extend whole body length. Four cephalic setae. Amphids indistinct. Stoma with dosal tooth. Ocelli absent. Oesophagus with single bulb. Tail tapers ending in a finger-like tip. Spicule cephalated with a small forked tip.

Measurements : Length 0.52-0.56 mm. Tail 4.2-4.5 anal diameters long.

Remarks : The species was described with male specimens. The female spectmens are longer than males.

Habitat : Muddy sand near low water level, intertidal zone.

Distribution : Bay of Bengal.

Genus **Spilophorella** Filipjev, 1918

***18. Spilophorella paradoxa** (De Man)

1888. *Spilophora paradoxa* De Man, *Mem. Soc. Zool. Fr.*, 1 : 45.

Material examined : 1 ex., Bahuda estuary, 31.7.80.

Diagnostic features : Cuticular ornamentaion typical of the genus. Lateral and sublateral dots distinct. Buccal cavity deep and funnel-shaped. A solid dorsal tooth and few cervical setae present. Oesophageal bulb double, the anterior chamber being smaller than the posterior one. Tail tapers posteriorly to a point.

Measurements : Length 5.0-6.0 mm long. Tail 6.5 anal diameters long.

Remarks : The specimen examined conforms well with the original description of the species.

Habitat : Medium sand rich in organic detritus and algae in the littoral zone.

Distribution : Cosmopolitan.

Family SELACHINEMATIDAE

Genus **Synonchium** Cobb, 1920

***19. Synonchium obtusum** Cobb

1920. *Synonchium obtusnm* Cobb, *Contrb, Sci. Nemat.*, 9 : 290.

Material examined : 2 ex., Puri, 23.1.77.

Diagnostic features : Cuticular punctation shows distinct horizontal

differentiation. Labial papillae small and button-like. Pharynx with powerful jaws characteristic of the species. Amphid distinct and $2\frac{1}{2}$ spiral. Spicule in male is long and stout. Tail very short and ends in a blunt point. Preanal papillae absent. Cuticular ridges occur on either side of cloaca supported by sacular papillae.

Measurements : Length 1.8-2.0 mm long. Tail about half the anal diameter long.

Remarks : The material examined conforms with the original description of the species.

Habitat : Coarse sand with fine silt and little detritus between low and half-tide levels, intertidal zone.

Distribution : Eurytopic on the coasts of tropical and temperate seas.

Order DESMADORIDA

Family DESMODORIDAE

Genus **Desmodora** De Man, 1889

***20. Desmodora brevicollis (Cobb)**

1920. *Bulbonema brevicolle* Cobb, *Contrib. Sci. Nemat.*, 9 264.

Material examined : 1 ex., Bahuda estuary, 31.7.80 ; 2 ex., Gopalpur, 14.7.80.

Diagnostic features : Cuticular annulation deeply ringed. Cephalic papillae very short. Cephalic setae longer than one head diameter. Amphid distinct and $2\frac{1}{2}$ spiral. Tail conical-cylindrical. Buccal cavity cuticularised. Pharyngeal bulb distinct. Accessory plate present.

Measurements : Length 0.8-1.0 mm. Tail 4.5 anal diameters long.

Remarks : The specimens examined conform with the description of the species given by Gerlach (1963) from Maldives in the Indian Ocean. This species is a new record for Indian waters.

Habitat Surface layers of fine detritus sand near half-tide level.

Distribution : Widely distributed on Atlantic and Indian Ocean Coasts.

Family MONOPOSTHIIDAE

Genus **Monoposthia** De Man, 1889

***21. Monoposthia costata (Bastian)**

1865. *Spilophora costata* Bastian, *Trans. Linn. Soc. Lond.*, 25 : 166.

Material examined : 3 ex., Puri, 23.1.77.

Diagnostic features : Cuticular annules distinct and interrupted by longitudinal rows of V-shaped crests. Buccal cavity deep and conical. One large dorsal tooth and two small subventral teeth present. Six labial and cephalic papillae distinct. Cephalic setae about half the head diameter long. Spicule obscure. Gubernaculum epsilon-like. Tail tapers posteriorly ending in a cone.

Measurements : 1.6-1.8 mm. Tail 4.2 anal diameters long.

Remarks : The species has been studied and described in detail by several authors with minor variations. The present specimens, however, agree with the description of the species given by Wieser (1959) from Puget Sound.

Habitat : Medium sand 10 cm below surface near half-tide level.

Distribution : Cosmopolitan.

Genus **Rhinema** Cobb, 1920

*22. **Rhinema exquisita** Timm

1961. *Rhinema exquisita* Timm, *Proc. Pak. Acad. Sci.*, 1 : 60.

Material examined : 2 ex., Chandipur, 12.1.77.

Diagnostic features : Cuticle with 12 rows of longitudinal plates connected by V-shaped markings. Lips distinct with very short labial setae. Cephalic, lateral and cervical setae present. Amphid circular. Stoma deep with a hollow dorsal tooth and a small ventral tooth. Oesophageal bulb double and divided into 4 equal sections. Tail conical ending in a finger-like tip.

Measurements : Length 1.0-1.2 mm. Tail 5.2 anal diameters long.

Remarks : The material conforms well with the original description of the species.

Habitat : Bottom mud near low water level, intertidal zone.

Distribution : Bay of Bengal.

Order DRACONEMATINA

Family EPSILONEMATIDAE

Genus **Metepsilonema** Steiner, 1927

23. **Metepsilonema** sp.

Material examined : 3 ex., Konarak, 24.1.77.

Description : Body with 96 coarse cuticular annules. Head conical. Four cephalic setae present. Amphid monospiral. Oesophagus with cordiac bulb with double internal sclerotization. Paired ambulatory bristles absent. Ten pairs of ventral adhesive tubes present. Sole conical. Spicule cephalated. Gubernaculum plate-like.

Measurements : Length 0.38-0.42 mm. Tail 2.2 anal diameters long.

Remarks : The specimens examined differ from the known species of the genus in the presence of ventral adhesive tubes and the relative dimensions of the body. Specific identification needs further study.

Habitat : Coarse sand with little detritus and fine shell gravel between low and half-tide levels, intertidal zone.

Order DESMOSCOLECIDA

Family DESMOSCOLECIDAE

Genus *Desmoscolex* Claparede, 1863

24. *Desmoscolex bengalensis* Timm

1961. *Desmoscolex bengalensis* Timm, *Proc. Pak. Acad. Sci.* 1 : 63.

Material examined : 1 ex., Chandipur, 12.1.77.

Diagnostic features : Body with 17 broad annules. Head distinct. Four cephalic setae. Amphids on head ovoid. Pigment spots absent. Somatic setae present. Anus on fifteenth annulus.

Measurements : Length 0.3 mm. Tail 1.8 anal diameters long.

Remarks : The specimen examined agreed well with the original description except for the presence of subdorsal somatic setae on anal segment.

Habitat : Muddy sand in littoral zone.

Distribution : Bay of Bengal.

Genus *Paralinhomoeus* De Man, 1907

*25. *Paralinhomoeus dubius* Timm

1961. *Paralinhomoeus dubius* Timm, *Proc. Pak. Acad. Sci.*, 1 : 72.

Material examined : 4 ex., Paradwip, 19.1.77.

Diagnostic features : Cuticle with faint striation. Head truncate. Stoma sclerotized anteriorly. Circular amphids behind stoma.

Oesophagus wide at base. Tail conical-filiform. Ten cephalic and 6 subcephalic setae. Spicule cephalated and internally divided.

Measurements : Length 2.5 mm. Tail 8.0 anal diameters long.

Remarks : The specimens examined correspond well with the original description. This is the first record of the species from Indian waters.

Habitat : Fine mud under estuarine conditions, littoral zone.

Distribution : Bay of Bengal.

Order MONHYSTERIDA

Family LINHOMOEIDAE

Genus *Southerniella* Allgen, 1932

*26. *Southerniella simplex* Allgen

1932. *Southerniella simplex* Allgen, *Nyt. Mag. Naturv.*, 70 : 186.

Material examined : 3 ex., Chandipur, 12.1.77.

Diagnostic features : Cuticle with faint striation. Lateral alae absent. Head with distinct cap at the anterior end. Cephalic setae less than 1/2 head diameter. Amphid distinct and monospiral. Oesophagus with dilated posterior end. Tail conical, ending in a blunt tip. Posterior ovary absent in female.

Measurements : Length 1.0 mm. Tail 5.2 anal diameters long.

Remarks : Despite some variation in the Demanian values, the specimens examined agree with *S. simplex* in all other morphological features. This is the first record of the species from Indian waters.

Habitat : Top layers of muddy sand between low and half-tide levels.

Distribution : Eurytopic along the coasts of Pacific, Atlantic and Indian Oceans.

Genus : *Terschellingia* De Man, 1888

*27. *Terschellingia longicaudata* De Man

1907. *Terschellingia longicaudata* De Man, *Mem. Soc. Zool. Fr.*, 20 : 46.

Material examined : 2 ex., Paradwip, 18.1.77.

Diagnostic features : Six labial papillae and 6 cephalic setae present. Cervical setae distinct. Stoma absent. Amphid circular and less than

1/2 head diameter. Oesophagus with distinct bulb at the base. Tail filiform. Excretory pore lies opposite to beginning of oesophageal bulb.

Measurements : Length 0.8-1.0 mm. Tail 16.0 anal diameters long.

Remarks : The present specimens correspond well with the original description of the species. This is the first record of the species from Indian waters.

Habitat : Surface muddy sand with estuarine conditions, intertidal zone.

Distribution : Eurytopic along the coasts of Pacific, Atlantic and Indian Oceans.

Family SPHAEROLAIMIDAE

Genus *Sphaerolaimus* Bastain, 1865

28. *Sphaerolaimus pacificus* Allgen

1947. *Sphaerolaimus pacificus* Allgen, *Lund Forhandl.*, 17 : 6.

Material examined : 1 ex., Chandipur, 12.1.77 ; 2 ex., Paradwip, 19.1.77.

Diagnostic features : Cuticle striated upto helmet. No sexual dimorphism of head and setae. Six labial papillae, 10 cephalic setae and 8-10 groups of subcephalic setae present. Amphid ovoid. Oesophagus cylindrical. Tail conical-cylindrical with 3 terminal spines.

Measurements : Length 1.5-1.8 mm. Tail 3.4-4.0 anal diameters long.

Remarks : The material examined agrees well with the description of the species given by Timm (1961).

Habitat : Surface muddy sand near half-tide level, intertidal zone.

Distribution : Pacific Ocean, Bay of Bengal.

Family MONHYSTERIDAE

Genus *Monhystera* Bastain, 1965

29. *Monhystera parva* (Bastian)

1865. *Monhystera parva* Bastian, *Trans. Linn. Soc. Lond.*, 25 : 98.

Material examined : 2 ex., Puri, 23.1.77 ; 1 ex., Bahuda estuary, 27.8.80.

Diagnostic features : Cuticle smooth and transparent. Lips and labial papillae distinct. Cephalic and cervical setae present. Amphid circular. Tail conical-cylindrical, with 3-celled caudal gland. Excretory pore 3.5 head diameters from anterior end.

Measurements : Length 1.6-1.8 mm. Tail 5.6-5.8 anal diameters long.

Remarks : The specimens agree well with the description of the species given by the previous workers except for the longer body.

Habitat : Coarse and medium sands with fine shell gravel and little detritus between low and half-tide levels, intertidal zone.

Distribution : Cosmopolitan.

Genus : **Diplolaimelloides** Meyl, 1954

*30. **Diplolaimelloides meyli** Timm

1961. *Diplolaimelloides meyli* Timm, *Proc. Pak. Acad. Sci.*, 1 : 76.

Material examined : 2 ex., Chandipur, 12.1.77.

Diagnostic features : Cuticle smooth. Head truncate. Ten cephalic papillae. Stoma sclerotized. Dorsal tooth absent. Amphids single spiral. Excretory pore posterior to amphids. Tail conical-cylindrical, with clear tip. Male copulatory bursa with 5 genital papillae.

Measurements : Length 1.0 mm. Tail 3.5 anal diameters long.

Remarks : The original description was based on a single male specimen. This is the first record of the species from Indian waters.

Habitat : Muddy sand near low water level, intertidal zone.

Distribution : Bay of Bengal.

Genus : **Theristus** Bastian, 1865

31. **Theristus tortuosa** Timm

1961. *Theristus tortuosa* Timm, *Proc. Pak. Acad. Sci.*, 1 : 79.

Material examined : 1 ex., Bhadrakh, 15.1.77.

Diagnostic features : Cuticle moderately striated on head. Lips large with labial papillae. Stoma simple and unsclerotized. Ten cephalic setae. Cervical setae indistinct. Amphid distinct with $3\frac{1}{2}$ spiral. Tail conical-cylindrical, with 2 spines at the tip. Spicule with knobbed head at the distant end and 1.2 anal diameters long.

Measurements : Length 1.6 mm. Tail 3.8 anal diameters long.

Remarks : The specimen corresponds well with the original description of the species.

Habitat : Fine muddy sand near low water level.

Distribution : Bay of Bengal.

32. *Theristus* sp.

Material examined : 3 ex., Gopalpur, 14.7.80.

Distribution : Cuticle finely striated. Numerous cervical and somotic setae present. Lips distinct with small papillae. Twelve cephalic setae. Amphid circular. Tail setose and tapers posteriorly. Caudal gland 4-celled. Spicule curved, cephalated with a narrow shaft and 1.0 anal diameter long. Gubernaculum vertical.

Measurements : Length 1.8-2.0 mm. Tail 4.8-5.2 anal diameters long.

Remarks : Specific identification of the material needs further study.

Habitat : Surface layers of fine detritus sand near low water level.

Genus : *Rhynchonema* Cobb, 1920

33. *Rhynchonema cinctum* Cobb

1920. *Rhynchonema cinctum* Cobb, *Contrib. Sci. Nemat.*, 9 : 260.

Material examined : 1 ex., Konark, 24.1.77 ; 2 ex., Puri, 22.1.77 ; 1 ex., Gopalpur, 27.1.77 ; 1 ex., Bahuda estuary, 26.9.80.

Diagnostic features : Cuticle coarsely ringed. Buccal cavity cylindrical extending upto the amphid. Ten cephalic and 4 cervical setae present. Amphid circular. Numerous somatic setae in several longitudinal rows. Tail conical and setose. Caudal gland 3-celled.

Measurements : Length 0.80-0.86 mm. Tail 4.0-4.6 anal diameters long.

Remarks : The specimens agree well with the original description of the type species.

Habitat : Coarse and medium sand with little detritus 5-10 cm below surface between low and half-tide levels, intertidal zone.

Distribution : Eurytopic along the coasts of Pacific, Atlantic and Indian Oceans.

Phylum : **GASTROTRICHA**

Order : **MACRODASYIDA**

Family : **LEPIDODASYIDAE**

Genus : **Cephalodasys** Remane, 1926

34. Cephalodasys caudatus Rao

1981. *Cephalodasys caudatus* Rao, *Bull. Zool. Surv. India*, **3** : 137.

Material examined : 3 ex., Puri, 21.1.77 ; 1 ex., Puri, 22.1.77 ; 1 ex., Konarak, 24.1.77.

Diagnostic features : Body transparent and dorsoventrally flattened. Head distinct. Hind end ends in a median process. Three pairs of anterior, 12-15 pairs of lateral and 10-12 posterior adhesive tubes. Elongated seminal receptacle and pear-shaped copulatory bursa.

Measurements : Length 0.7-0.8 mm and width 0.09 mm.

Remarks : The material conforms well with the original description.

Habitat : Coarse and medium sand 5-10 cm below surface between low and half-tide levels, intertidal zone.

Distribution : At present the species is known only from Orissa coast.

Genus : **Paradasys** Remane, 1934

***35. Paradasys lineatus** Rao

1980. *Paradasys lineatus* Rao, *Bull. Zool. Surv. India*, **2** : 213.

Material examined : 2 ex., Gopalpur, 14.7.80.

Diagnostic features : Body dorsoventrally flattened. Head not delineated. Hind end rounded. Two pairs of anterior and 3 pairs of posterior adhesive tubes. Lateral tubes absent. Pharynx 1/3 of total body length. Seminal receptacle oblong. Solitary dorsal ovary.

Measurements : Length 0.7-0.8 mm and width 0.08 mm.

Remarks : The specimens correspond well with the original description of the species.

Habitat : Medium sand with little detritus 5-10 cm below surface near half-tide level, intertidal zone.

Distribution : East coast of India.

***36. *Paradasys littoralis* Rao and Ganapati**

1968. *Paradasys littoralis* Rao and Ganapati, *Proc. Indian. Acad. Sci.*, 67 : 35.

Material examined : 2 ex., Puri, 23.1.77.

Diagnostic features : Body transparent and dorsoventrally flattened. Head indistinct. Two pairs of anterior and 8 posterior adhesive tubes present. Lateral tubes absent. Ovary and receptaculum are dorsal. Pharyngeal pores occur close to the posterior end of pharynx.

Measurements : Length 0.6 mm and width 0.08 mm.

Remarks : The material examined conforms well with the original description of the species.

Habitat : Coarse and medium sands 5-10 cm below surface between low and half-tide levels, intertidal zone.

Distribution : Indian east coast.

Genus *Acanthodasys* Remane, 1927

***37. *Acanthodasys aculeatus* Remane**

1927. *Acanthodasys aculeatus* Remane, *Zool. Jb. (Syst.)*, 54 : 203.

Material examined : 1 ex., Bahuda estuary, 31.7.80.

Diagnostic features : Cuticular armature with nail-shaped unispined hooks. Lateral epidermal glands present. Dorsolateral tubes 6-8 pairs. Caudal lobes with 2 adhesive tubes each. Pharynx forms 1/4 of gut length. Testes paired. Solitary dorsal ovary.

Measurements : Length 0.5-0.6 mm and width 0.06 mm.

Remarks : The specimens conform with the original description of the species except for minor variations in the number and disposition of adhesive tubes.

Habitat : Medium sand with little detritus between low and half-tide levels, intertidal zone.

Distribution : Eurytopic on Atlantic and Indian Ocean coasts.

Family MACRODASYIDAE

Genus *Macrodasys* Remane, 1924

***38. *Macrodasys waltirensis* Rao and Ganapati**

1968. *Macrodasys waltirensis* Rao and Ganapati, *Proc. Ind. Acad. Sci.*, 57 : 39.

Material examined : 3 ex., Gopalpur, 14.7.80.

Diagnostic features : Body dorsoventrally flattened and transparent. Anterior end bluntly rounded, while the posterior end tapers into tail. Lateral pestle organs present. Seven pairs of anterior, 4 pairs of lateral and 6 pairs of posterior adhesive tubes. Testes paired and lateral. Penis pear-shaped. Pharyngeal pores in mid-pharyngeal region.

Measurements : Length 0.85 mm and maximum width 0.09 mm.

Remarks : The family was originally characterised by the presence of pharyngeal pores located anteriorly or in the mid-pharyngeal region. But, subsequently some species were described with the pores located posterior to the mid-pharyngeal region. The specimens examined showed the pores between mid-pharyngeal region and the posterior end of pharynx. This position is, however, higher compared to the original description of the species from Waltair coast with the pores close to the posterior end of pharynx.

Habitat : Medium sand 5 cm below surface between the low and half-tide levels, intertidal zone.

Distribution : Bay of Bengal.

Genus *Urodasys* Remane, 1926

*39 *Urodasys viviparus* Wilke

1954. *Urodasys viviparus* Wilke, *Zool. Jb. (Syst)*, 82 : 592.

Material examined : 1 ex., Puri, 22.1.77.

Diagnostic features : Body dorsoventrally flattened with a long thread-like tail. Numerous anterior, lateral and posterior adhesive tubes present. Pharyngeal pores located in the mid-pharyngeal region. Developing embryo seen in mature specimens. Pestle organs present.

Measurements : Length 0.35 and width 0.05 mm. Tail reaches 0.9 mm in length.

Remarks : The specimen examined agrees well with the description of the type species from Mediterranean coast.

Habitat : Coarse sand with fine shell gravel and little detritus near half-tide level, intertidal zone.

Distribution : Eurytopic on the coasts of Atlantic and Indian Oceans.

Family PLANODASYIDAE

Genus **Planodasys** Rao, 1970

***40. Planodasys marginalis** Rao

1970. *Planodasys marginalis* Rao, *Sarsia*, 42 : 73.

Material examined : 2 ex., Bahuda estuary, 27.8.80.

Diagnostic features : Body flat and ribbon-like. Anterior tubes 14-16 pairs in a diagonal row. Lateral tubes 120-140 pairs. Hind end with 2 distinct oval lobes, each with 12-16 posterior tubes. Cuticular armament absent. Gonads paired. Penis absent. Bursa copulatrix elongated and posteriorly located. Buccal cavity barrel-shaped. Pharyngeal pores at hind end of pharynx.

Measurements : Length 1.2 mm and width 0.1 mm.

Remarks : The specimens examined conform well with the original description of the species from the beach sands of Waltair coast.

Habitat : Medium sand with fine shell gravel and little detritus between low and half-tide levels, intertidal zone.

Distribution : Andhra and Orissa coasts.

Genus **Crasiella** Clausen, 1968

41. Crasiella indica Rao

1981. *Crasiella indica* Rao, *Bull. Zool. Surv. India*, 4 : 3.

Material examined : 3 ex., Gopalpur, 31.1.77 ; 1 ex., Bahuda estuary, 26.9.80.

Diagnostic features : Body dorsoventrally flattened and ribbon-like. Head indistinct and truncate anteriorly. Hind end bilobed. Nine pairs of anterior, 33-40 pairs of lateral and posterior adhesive tubes present. Penis absent. Elongated copulatory bursa and oblong seminal receptacle present. Pharyngeal pores conspicuous at the posterior end of pharynx. Ventral ciliation entire and uniform.

Measurements : Length 0.5 mm and maximum width 0.07 mm.

Remarks : The material conforms well with the original description.

Habitat : Clean medium sands 5 cm below surface between low and half-tide levels, intertidal zone.

Distribution : Orissa coast.

Family THAUMASTODERMATIDAE

Genus *Thaumastoderma* Remane, 192642. *Thaumastoderma heideri* Remane

1926. *Thaumastoderma heideri* Remane, *Z. Morph. Okol.*, 5 : 625.

Material examined : 2 ex., Puri, 23.1.77 ; 1 ex., Gopalpur, 29.1.77 ; 1 ex., Bahuda estuary, 27.8.80.

Diagnostic features : Head with 2 pairs of laterally directed tentacles. Dermal hooks 4-pronged. Five pairs of anterior and 20 pairs of lateral tubes present. Two pairs of reddish eye spots on head are characteristic of the species. Single elongate testis on right side.

Measurements : Length 0.25 mm and maximum width 0.05 mm.

Remarks : Although the material examined corresponds well with the original description of the species from Baltic Sea, the disposition of tentacles and adhesive tubes resemble more the specimens reported by Gerlach (1961) from Maldives.

Habitat : Medium sand with little organic detritus 5-10 cm below surface near half-tide level, intertidal zone.

Distribution : Eurytopic along the coasts of Atlantic and Indian Oceans.

Genus *Tetranchyroderma* Remane, 192643. *Tetranchyroderma littoralis* Rao

1981. *Tetranchyroderma littoralis* Rao, *Bull. Zool. Surv. India*, 3 : 140.

Material examined : 2 ex., Puri, 21.1.77 ; 1 ex., Konarak, 24.1.77.

Diagnostic features : Body flattened with both ends rounded. Cuticular armament of tetrancres present. Head tentacles and pestle organs absent. Five pairs of anterior, 50-60 pairs of lateral and posterior adhesive tubes present. Posterior pedicles absent. Eight pairs of ventral tubes occur in two groups. Copulatory bursa pear-shaped. Seminal receptacle reniform. Ovary dorsal.

Measurements : Length 0.36 mm and width 0.08 mm.

Remarks : The material collected from type locality agrees well with the original description of the species from the beach sands of Orissa coast.

Habitat : Medium sand 10 cm below surface between low and half-tide levels, intertidal zone.

Distribution : Orissa Coast.

***44. *Tetranchyroderma indica* Rao and Ganapati**

1968. *Tetranchyroderma indica* Rao and Ganapati, *Proc. Ind. Acad. Sci.*, 67 : 46.

Material examined : 1 ex., Gopalpur, 27.1.77.

Diagnostic features : Body elongated and dorsoventrally flattened, with both the ends rounded. Cuticular armament of tetrancres. A pair of cephalic and 4 pairs of dorsolateral cirri present. Five pairs of anterior, 20-30 pairs of lateral and 16-20 posterior tubes present. Pedicles absent. Testis single and tubular. Ovary dorsal.

Measurements : Length 0.3 mm and width 0.06 mm.

Remarks : The single specimen examined agrees well with the original description except for the larger number of lateral and posterior adhesive tubes.

Habitat : Medium sand 10 cm below surface near half-tide level.

Distribution : Andhra and Orissa coasts, Andaman Islands.

Genus *Pseudostomella* Swedmark, 1956.

***45. *Pseudostomella indica* Rao**

1970. *Pseudostomella indica* Rao, *Cah. Biol. Mar.*, 11 : 115.

Material examined : 2 ex., Gopalpur, 14.7.80.

Diagnostic features : Body dorsoventrally flattened, with cuticular armament of tetrancres in 11-13 longitudinal rows. Cephalic net with 5 dorsal and 8 ventral papillae. Two pairs of anterior, 24 pairs of lateral and 3 pairs of ventrolateral tubes present. Two pairs of additional tubes occur between posterior pedicles. Testis unpaired.

Measurements : Length 0.2 mm and maximum width 0.05 mm.

Remarks : The specimens conform with the original description of the species except for the larger size of the body.

Habitat : Medium sand 10 cm below surface near mid- water level, intertidal zone.

Distribution : Andhra and Orissa coasts, Lakshadweep.

Family DACTYLOPODOLIDAE

Genus **Dactylopodola** Strand, 1929

46. **Dactylopodola indica** (Rao and Ganapati)

1968. *Dactylopodalia indica* Rao and Ganapati, *Proc. Ind. Acad. Sci.*, 67 : 45.

Material examined : 2 ex., Puri, 22.1.77 ; 1 ex., Konarak, 24.1.77.

Diagnostic features : Head distinct and simple, with neck constriction. Pestle organs and cuticular armament absent. Posterior end bilobed, each lobe with 4 adhesive tubes of unequal length. Two pairs of anterior and 5 pairs of lateral tubes occur implanted on mobile protuberances of cuticle. Pharyngeal pores at posterior end of head.

Measurements : Length 0.35 mm and width 0.06 mm.

Remarks : The specimens agree well with the original description.

Habitat : Medium sand 10 cm below surface near mid-water level.

Distribution : Andhra and Orissa, coasts, Andaman Islands Lakshadweep.

Family TURBANELLIDAE

Genus **Turbanella** Schultze, 1853

47. **Turbanella indica** Rao

1981. *Turbanella indica* Rao, *Bull. Zool. Surv. India*, 3 : 139.

Material examined : 2 ex., Gopalpur, 31.1.77 ; 1 ex., Gopalpur, 14.7.80.

Diagnostic features : Body ribbon-shaped. Head distinct with lateral protuberances. Posterior end bilobed and deeply cleft. Median anal cone absent. Four pairs of anterior, 8-10 pairs of ventrolateral and 5 pairs of posterior tubes present. Dorsal tubes absent.

Measurements : Length 0.35 mm and width 0.05 mm.

Remarks : The specimens agree well with original description.

Habitat : Medium sand 10 cm below surface near half-tide level.

Distribution : Orissa coast.

48. **Turbanella bengalensis** Rao and Ganapati

1968. *Turbanella bengalensis* Rao and Ganapati, *Proc. Ind. Acad. Sci.*, 67 : 40.

Material examined : 1 ex., Bahuda estuary, 26.9.80,

Diagnostic features : Body strap-shaped and tapers slightly to posterior end. Head distinct and triangular with 2 lateral lobes on either side. Twelve pairs of anterior, 30 pairs of lateral and 10 pairs of posterior tubes present. Medium anal cone absent. Ventral ciliation in two longitudinal bands. Lateral epidermal glands numerous.

Measurements : Length 0.5 mm and width 0.06 mm.

Remarks : The single specimen corresponds well with the original description, except for minor variation in the number of lateral adhesive tubes.

Habitat : Medium sand 5 cm below surface between low and half-tide levels.

Distribution : Andhra and Orissa coasts.

Genus **Paraturbanella** Remane, 1927

*49. **Paraturbanella boadeni** Rao and Ganapati

1968. *Paraturbanella boadeni* Rao and Ganapati, *Proc. Ind. Acad. Sci.*, 67 : 42.

Material examined : 2 ex., Gopalpur, 27.1.77.

Diagnostic features : Body strap-like and widest in the middle. Head indistinct. Lateral organs present. Six pairs of anterior, 2 pairs of lateral and five pairs of posterior tubes present. A median anal papilla occurs between the two caudal lobes. Ventral ciliation occurs in two longitudinal bands. Gonads paired and lateral.

Measurements : Length 0.55 mm and width 0.07 mm,

Remarks : The specimens correspond well with the original description except for a variation in the structure of the anterior adhesive organ. The slender cuticular rods supporting the adhesive tubes appeared only as extensions of the cuticle. Buccal cavity cuticularised.

Habitat : Fine detritus sand near low water level, intertidal zone.

Distribution : Andhra and Orissa coasts, Andaman Islands.

*50. **Paraturbanella mesoptera** Rao

1970. *Paraturbanella mesoptera* Rao, *Cah. Biol. Mar.*, 11 : 112.

Material examined : 1 ex., Bahuda estuary, 10.9.80.

Diagnostic features : Body ribbon-like and slightly tapers to both

the ends. Head distinct with lateral lobes. Pestle organs present. Ten pairs of anterior, 2 pairs of lateral and 10 pairs of posterior tubes. A median anal papilla present. Gonads paired and lateral.

Measurements : Length 0.4 mm and width 0.05 mm.

Remarks : The specimen examined corresponds well with the original description but for the larger body size.

Habitat : Medium sand with fine shell gravel and little detritus between low and half-tide levels, intertidal zone.

Distribution : Andhra and Orissa coasts.

Order CHAETONOTIDA

Family XENOTRICHULIDAE

Genus *Xenotrichula* Remane, 1927

51. *Xenotrichula velox* Ramane

1927. *Xenotrichula velox* Remane, *Zool. Anz.*, 71 : 289.

Material examined : 1 ex., Konarak, 24.1.77 ; 2 ex., Puri, 23.1.77 ; 1 ex., Bahuda estuary, 26.6.80 ; 1 ex., Gopalpur, 29.1.77 ; 1 ex., Gopalpur, 14.7.80.

Diagnostic features : Body dorsoventrally flattened and covered with pedunculated scales in 16 longitudinal rows. Head with two lateral tentacles directed backwards and 2 pairs of long sensory bristles directed forwards. Two caudal furca with adhesive tubes. Ventral cirri occur in two longitudinal rows. Pharyngeal pores indistinct.

Measurements : Length 0.25 mm and width 0.06 mm.

Remarks : The specimens agree well with the original description except for minor variation in the length of the body parts and the number of the rows of dermal scales.

Habitat : Coarse and medium sands from top to a depth of 30 cm below surface, intertidal zone.

Distribution : Baltic Sea, Mediterranean, Atlantic and Indian Oceans.

52. *Xenotrichula tentaculatus* Rao

1968. *Xenotrichula tentaculatus* Rao, *Proc. Ind. Acad. Sci.*, 67 : 51.

Material examined : 2 ex., Gopalpur, 29.1.77 ; 1 ex., Bahuda estuary, 10.9.80.

Diagnostic features : Body covered with 12 longitudinal rows of minute scales. Head with a pair of curved tentacles and 2 pairs of sensory bristles directed forwards. Ventral cirri occur in 16 pairs in two groups of 13+3 on either side of digestive tract. Two caudal furca with adhesive tubes. Testis and ovary are paired.

Measurements : Length 0.15 mm and width 0.05 mm.

Remarks : The specimens conform well with the original description of the species.

Habitat : Medium sand 5-10 on below surface near mid-water level.

Distribution : Andhra and Orissa coasts.

Family CHAETONOTIDAE

Genus *Chaetonotus* Ehrenberg, 1830

*53. *Chaetonotus atrox* Wilke

1954. *Chaetonotus atrox* Wilke, *Zool. Jb. (Syst.)*, 82 : 527.

Material examined : 1 ex., Gopalpur, 22.1.77 ; 2 ex., Bahuda estuary, 19.9.88.

Diagnostic features : Body dorsoventrally flattened with distinct head, neck and trunk. Paired tufts of sensory bristles occur on head. Belongs to schultzei group with 9-11 rows of scales with a median and lateral spine. Caudal furca curved to the interior. Scales horse-shoe shaped on anterior region and triangular on posterior region. Spines on scales in mid body region are the longest.

Measurements : Length 0.15 mm. and maximum width 0.04 mm.

Remarks : Although considerable variation has been reported in the disposition of dermal scales of this species from different geographical regions, the local specimens closely approach the description of the species given for the Mediterranean specimens.

Habitat : Fine and medium sands, intertidal zone.

Distribution : Eurytopic along the coasts of Atlantic and Indian Oceans.

54. *Chaetonotus* sp.

Material examined : 2 ex., Gopalpur, 29.1.77 ; 1 ex., Gopalpur, 14.7.80.

Description : Body shape characteristic of the genus. Head unlobed

and bears 2 pairs of long ciliary tufts. Neck narrow. Posterior end rounded ending in two caudal furca. Dorsal surface covered with triangular spined scales in 12 longitudinal rows. Ventral cilia occur in 2 longitudinal bands lateral to the digestive tract. Pharynx non-bulbous. Gonads were not studied in detail, but the presence of paired testes shows that the species is hermaphroditic.

Measurements : Length 0.17 mm and maximum width 0.04 mm.

Remarks : Specific identification of the material needs further study.

Habitat : Fine and medium sands, intertidal zone.

Genus **Aspidophorus** Vogt, 1904

55. **Aspidophorus marinus** Remane

1926. *Aspidophorus marinus* Remane, *Zool. Anz.*, 66 : 243.

Material examined : 2 ex., Puri, 23.1.77 ; 1 ex., Gopalpur, 14.7.80.

Diagnostic features : Chaetonotid body covered with dorsal and lateral scales mostly pedunculated. A pair of lateral refractive bodies on head are characteristic of the species. Two lateral tufts of sensory bristles occur on head. Pharynx about 1/3 of the gut length. Caudal furca slightly curved inside. Single dorsal ovum.

Measurements : Length 0.15 mm and maximum width 0.04 mm.

Remarks : The specimens agree well with the original description of the species.

Habitat : Fine and medium sand between low and half-tide levels, intertidal zone.

Distribution : Eurytopic along the coasts of Atlantic, Pacific and Indian Oceans.

Phylum **KINORHYNCHA**

Class **Cyclorhagea**

Order **NOMOSOMATIDA**

Family **ECHINODERIDAE**

Genus **Echinoderes** Claparede, 1863

*56. **Echinoderes bengalensis** (Timm)

1958. *Echinoderella bengalensis* Timm, *J. Bombay Nat. Hist. Soc.*, 55 : 107.

Material examined : 1 ex., Chandipur, 12.1.77.

Diagnostic features : Mid-dorsal spines absent. Lateral spines occur on zonites 7 and 10 only. No pigmented eye spots. Zonites 3-12 bear

minute hair-like processes. Caudal furca prominent and curved inside. An internal spine occurs at the base of each furca.

Measurements : Length 0.36 mm and maximum width 0.06 mm.

Remarks : The specimen examined corresponds well with the original description of the species from saline muds, Bangladesh.

Habitat : Surface muddy sand near low water level.

Distribution : Bay of Bengal.

Class **Conchorhagea**

Order **CONCHORHAGIDA**

Family **CATERIIDAE**

Genus **Cateria** Gerlach, 1956

***57. *Cateria gerlachi* Higgins**

1968. *Cateria gerlachi* Higgins, *Trans. Amer. Micro. Soc.*, 87 : 21.

Material examined : 1 ex., Puri, 23.1.77 ; 1 ex., Bahuda estuary, 26.9.80.

Diagnostic features : Body long and cylindrical with 11 distinct segments bearing long lateral spines. Midterminal spine equals to body length. Terminal zonite with 2 pairs of elongated spines. Dorsal sensory organ absent between zonites 7 and 8.

Measurements : Length 0.42 mm and maximum diameter 0.06 mm. Midterminal spine 0.4 mm long.

Remarks : The material corresponds well with the original description of the species from Waltair beach sands on Andhra coast.

Habitat : Coarse sand with fine shell gravel and little detritus 10 cm below surface near mid water level, intertidal zone.

Distribution : Andhra and Orissa coasts, Andaman Islands, Lakshadweep.

Phylum **Annelida**

Class **Archiannelida**

Family **POLYGORDIIDAE**

Genus **Polygordius** Schneider, 1868

58. *Polygordius madrasensis* Aiyar and Alikunhi

1944, *Polygordius madrasensis* Aiyar and Alikunhi, *Proc. Nat. Inst. Sci. India*, 10 : 113.

Material examined : 2 ex., Gopalpur, 29.1.77 ; 1 ex., Bahuda estuary, 10.9.80.

Diagnostic features : Body white in colour with 40-60 segments externally indistinct. Hypodermal glands well developed. External ciliation absent. Head distinct with 2 moderately long cephalic tentacles. Eyes absent. Pygidium swollen with a pair of anal cirri shorter than cephalic tentacles. Anal lobes absent. Adhesive glands occur around pygidium in a band. Gonads develop from 15th segment.

Measurements : Length 5.0-6.0 mm and diameter 0.16 mm. Tentacles 0.15 mm. Anal cirri 0.07 mm long.

Remarks : The specimens conform with the original description but for the smaller body size and the gonad bearing segments.

Habitat : Coarse sand with fine shell gravel and little detritus near low water level in exposed beaches.

Distribution : Andaman Islands, Lakshadweep, Indian and South African coasts.

***59. *Polygordius uroviridis* Aiyar and Alikunhi**

1944. *Polygordius uroviridis* Aiyar and Alikunhi, *Proc. Nat. Inst. Sci. India*, 10 : 118.

Material examined : 1 ex., Puri, 21.1.77.

Diagnostic features : Body pale white with 35 segments. Hypodermal glands present. Body ciliation absent. Head distinct with 2 short cephalic tentacles and 2 dark irregular eyes. Pygidium swollen, without anal lobes or cirri, but with a dark band and adhesive glands all around. Gonads develop from tenth segment onwards. Sexes separate.

Measurements : Length 4.0 mm and diameter 0.14 mm. Tentacles 0.14 mm. Anal bulb 0.12 mm.

Remarks : The specimen examined conforms well with the original description of the species from the sandy beach, Madras.

Habitat : Coarse sand near low water level in exposed conditions.

Distribution : Indian and South African coasts, Lakshadweep.

Family PROTODRILIDAE

Genus *Protodrilus* Hatschek, 1881

60. *Protodrilus pierantonii* Aiyar and Alikunhi

1944. *Protodrilus pierantonii* Aiyar and Alikunhi, *Proc. Nat. Inst. Sci. India*, 10 : 121.

Material examined : 1 ex., Puri, 22.1.77 ; 2 ex., Puri, 23.1.77 ; 1 ex., Konarak, 24.1.77 ; 1 ex., Gopalpur, 22.1.77 ; 2 ex., Bahuda estuary, 31.7.80.

Diagnostic features : Body pale white with 30-40 segments. Cuticle sculptured. Hypodermal glands well developed. Head indistinct with 2 long cephalic tentacles, 2 statocysts and 4 incomplete ciliary bands. Eyes absent. Three pygidian lobes, the median one being rudimentary. Lateral lobes adhesive and fan-shaped. Nephridia of macrotype.

Measurements : Length 3-4 mm and width 0.07 mm. Tentacles 0.18 mm.

Remarks : The specimens are identical with original description in all the essential features.

Habitat : Coarse and medium sand with little detritus between low and half-tide levels, intertidal zone.

Distribution : India, Lakshadweep, Andaman Islands, Galapagos Islands.

61. *Protodrilus indicus* Aiyar and Alikunhi

1944. *Protodrilus indicus* Aiyar and Alikunhi, *Proc. Nat. Inst. Sci. India*, 44 : 126.

Material examined : 1 ex., Puri, 23.1.77 ; 2 ex., Konarak, 24.1.77 ; 1 ex., Gopalpur, 31.1.77 ; 1 ex., Bahuda estuary, 26.9.80.

Diagnostic features : Body transparent. Cuticle thin and devoid of external ornamentation. Hypodermal glands few and spindle-shaped. Head indistinct with 2 long cephalic tentacles, 2 statocysts and 4 incomplete ciliary bands. Eyes absent. Nuchal organs conspicuous. Pygidium deeply bifurcated with 2 long adhesive anal lobes.

Measurements : Length 2.0-3.0 mm and width 0.06 mm. Tentacles 0.25 mm.

Remarks : The material conforms well with the original description in all the important features.

Habitat : Medium sand with little detritus between low and mid water levels, intertidal zone.

Distribution : India, Lakshadweep, Andaman Islands, Malaysia, New Caledonia, Galapagos Islands.

Family SACCOCIRRIDAE

Genus *Saccocirrus* Bobretzky, 187162. *Saccocirrus minor* Aiyar and Alikunhi

1944. *Saccocirrus minor* Aiyar and Alikunhi, *Proc. Nat. Inst. Sci. India*, 10 : 129.

Material examined : 2 ex., Puri, 21.1.77 ; 1 ex., Konarak, 24.1.77 ; 1 ex., Gopalpur, 29.1.77 ; 1 ex., Bahuda estuary, 31.7.80.

Diagnostic features : Minute worms with 80-100 setigerous segments. Head conical with a pair of long tentacles, 2 dark eyes and 2 oblique nuchal organs. Pygidium without bifurcation, anal cirri or anal lobes, but with 2 glandular ventral adhesive pads. Setae with expanded tips. Pharynx without ventral muscular pad. Reproductive organs complicated. Gonads in posterior segments.

Measurements : Length 10.0-12.0 mm. Tentacles 0.8-1.0 mm.

Remarks : The specimens examined agree with the original description except for a minor variation in the number of body segments.

Habitat : Coarse and medium sands with little detritus near low water level, intertidal zone.

Distribution : India, Lakshadweep, Andaman Islands, Malaysia.

*63. *Saccocirrus cirratus* Aiyar and Alikunhi

1944. *Saccocirrus cirratus* Aiyar and Alikunhi, *Proc. Nat. Inst. Sci. India*, 10 : 134.

Material examined : 2 ex., Bahuda estuary, 26.9.80.

Diagnostic features : Long worms with 180-200 setigerous segments. Head conical with 2 moniliform tentacles, 2 conspicuous nuchal organs and 2 minute eyes. Pygidium bifurcated. Anal lobes without adhesive papillae. Each anal lobe bears a slender anal cirrus. Pharynx with conspicuous ventral pad. Parapodium with 3 types of setae.

Measurements : Length 24.0 mm. Tentacles 1.3 mm.

Remarks : The specimens described from Madras beach attain a length of 40-45 mm with over 200 setigerous segments. But, the local forms examined are considerably smaller in size, probably representing juveniles.

Habitat : Coarse sand with fine shell gravel near low water level.

Distribution : East coast of India.

***64. *Saccocirrus orientalis* Alikunhi**

1940. *Saccocirrus orientalis* Alikunhi, *Curr. Sci.*, 15 : 140.

Material examined : 1 ex., Puri, 23.1.77 ; 2 ex., Gopalpur, 29.1.77.

Diagnostic features : Minute worms with 50-70 setigerous segments. Several posterior segments achaetous. Head triangular with 2 constricted tentacles, 2 dark eyes and 2 nuchal organs. Medium setae with smooth tips. Pygidium with 2 long anal lobes bearing 4-6 ventral adhesive papillae. Pharynx without a muscular pad.

Measurements : Length 10.0-12.0 mm. Tentacles 1.0 mm.

Remarks : The specimens examined exhibited some minor variations compared to the original description of the species. The number of somatic segments in the local forms are larger exceeding 120. The constrictions on tentacles are also indistinct. The pygidium lobes bear only 3 adhesive papillae, against 4-6 papillae reported for the Madras specimens.

Habitat : Coarse and medium sand between low and half-tide levels, intertidal zone.

Distribution : India, Lakshadweep, South Africa.

Family DINOPHILIDAE

Genus *Dinophilus* Schmidt, 1848

***65. *Dinophilus gyrociliatus* (Schmidt)**

1944. *Dinophilus gyrociliatus* Jagersten, *King. Sevenka Venska. Handl.*, 21 : 15.

Material examined : 2 ex., Paradwip, 19.1.77 ; 1 ex., Gopalpur, 29.1.77.

Diagnostic features : Body transparent, with distinct head and somatic segments. Conspicuous ciliary girdles occur 2 on head and 8 on trunk. Two dark bean-shaped eyes present. Sexual dimorphism occurs, the male being much reduced in size. Gonads paired and lateral. The worm is epipelic and weakly thigmotactic.

Measurements : Length 0.6-0.7 mm and body diameter 0.1 mm.

Remarks : The material corresponds well with the original description of the species, except for a minor variation in size and the disposition of ciliary girdles.

Habitat : Algae and fine muddy sediment between low and half-tide levels, intertidal zone. On the European coasts the species is an inhabitant of the intertidal zone occurring among algae or on the surface sediments and more seldom in the interstitial habitat (Jouin, 1971). In fact, the author observed the species to exhibit a similar distribution on the Indian coast as well. But, Rao and Ganapati (1968) reported the species on Waltair coast at a depth of 20 cm below the surface sand, which is to be considered accidental in the habitat.

Distribution : Eurytopic on the coasts of North Atlantic, Mediterranean and Indian Ocean.

Genus **Diurodrilus** Remane, 1925

66. **Diurodrilus benazzii** Gerlach

1952. *Diurodrilus benazzii* Gerlach, *Zool. Anz.*, 149 : 185.

Material examined : 1 ex., Puri, 27.1.77 ; 1 ex., Konarak, 24.1.77.

Diagnostic features : Minute worms with distinct head and trunk with 8 segments. Head oblong with several sensory hairs. No eyes. Epidermal glands well developed. Pygidium deeply cleft posteriorly ending in two adhesive anal furca. Gonads develop from fifteenth segment backwards. Negatively phototactic.

Measurements : Length 0.28-0.29 mm and width 0.04 mm.

Remarks : The specimens examined correspond well with the original description of the species from Mediterranean coast.

Habitat : Medium sand 5 cm below surface between low and half-tide levels, intertidal zone.

Distribution : Mediterranean, Lakshadweep, India, Andaman Islands.

Genus **Trilobodrillus** Remane, 1925

*67. **Trilobodrillus indicus** Rao

1973. *Trilobodrillus indicus* Rao, *Proc. Ind. Acad. Sci.*, 77 : 101.

Material examined : 1 ex., Puri, 21.1.77 ; 3 ex., Puri, 23.1.77.

Diagnostic features : Body transparent and highly contractile. Head trilobate with several sensory bristles and 2 ciliary girdles. Trunk 13-segmented, with a ciliary girdle on the first. Epidermal

glands spindle-shaped. Pygidium distinct and deeply notched dorsally. Gonads develop after ninth segment. Y-shaped mouth and sack-like salivary glands present. Lateral tufts of cilia absent.

Measurements : Length 1.0-1.2 mm and width 0.1 mm.

Remarks : The specimens conform with the original description of the species from Andhra coast.

Habitat : Coarse and medium sands with little detritus between low and mid water levels, intertidal zone.

Distribution : Andhra and Orissa coasts.

Family NERILLIDAE

Genus *Nerilla* Schmidt, 1848

*68. *Nerilla antennata* Schmidt

1927. *Nerilla antennata* Schmidt, *Fauna de France*, 16 : 482.

Material examined : 1 ex., Gopalpur, 29.1.77 ; 1 ex., Gopalpur, 14.7.80.

Diagnostic features : Minute worms with transparent body. Head distinct with 3 several segmented antennae, 2 palps, 2 pairs of dark eye spots and a pair of lateral nuchal organs. Trunk with parapodial segments. Two lateral tufts of cilia occur between parapodia. Pygidium with 2 long segmented anal cirri. Gonads paired.

Measurements : Length 0.8 mm and width 0.1 mm. Tentacles and anal cirri 0.2 mm long.

Remarks : Some geographical variation has been reported by earlier workers for the lateral tufts of cilia in this species. The Indian specimens, however, consistently supported two tufts of the cilia between parapodia. Other features agree well with the original description and figures given for the species.

Habitat : Coarse and medium sands with fine shell gravel and little detritus between low and half-tide levels, intertidal zone.

Distribution : Widely distributed on the coasts of Baltic, North Sea, Mediterranean, Atlantic, Pacific and Indian Oceans.

Genus *Nerillidium* Remane, 192569. *Nerillidium* sp.

Material examined : 1 ex., Puri, 27.1.77 ; Puri, 31.1.77 ; 1 ex., Bahuda estuary, 10.9.80.

Description : Minute worm, with transparent body. Distinct head and trunk. Two slender tentacles and 2 palps present. Eyes and nuchal organs absent. Eight setigerous segments including pharyngeal segment with simple capillary setae. Pygidium with 2 long, two-jointed cirri. The parent carries a large solitary egg towed to the posterior end of pygidium. Buccal cavity deep. Gonads not observed.

Measurements : Length 0.5-0.6 mm. Tentacles 0.06 mm. Anal cirri 0.2 mm long.

Remarks : The present specimens closely approach *N. mediterraneum* Remane (1928) in the structure and disposition of body organs. However, a further detailed study is necessary to ascertain the specific identification of the material.

Habitat : Medium sand with detritus near mid-water level.

Class **Polychaeta**Order **ERRANTIA**Family **PISIONIDAE**Genus **Pisione** Grube, 185770. *Pisione complexa* Alikunhi

1947. *Pisione complexa* Alikunhi, *Proc. nat. Inst. Sci. India*, **10** : 113.

Material examined : 2 ex., Puri, 23.1.77 ; 4 ex., Gopalpur, 14.7.80 ; 11 ex., Bahuda estuary, 26.9.80.

Diagnostic features : Body vermiform, with 35-40 setigerous segments. Prostomium with 2 dark eyes. Buccal segment with a pair of denticulate acicula. Dorsal and ventral cirri directed forwards. Two long anal cirri occur on semicircular pygidium. Parapodial segments with receptacula seminis not modified. Anal segment without adhesive glands and pads.

Remarks : The material conforms well with the original description.

Habitat : Coarse sand with fine shell gravel between low and half-tide levels, intertidal zone.

Distribution : India, Lakshadweep, Andaman Islands.

***71. *Pisione gopalai* (Alikunhi)**

1941. *Praegeria gopalai* Alikunhi, *Proc. Ind. Acad. Sci.*, 13 : 193.

Material examined : 1 ex., Bahuda estuary, 31.7.80.

Diagnostic features : Body vermiform with 25-30 setigerous segments. Prostomium with 2 dark eyes. Two pairs of cephalic tentacles and 2 anal cirri present. A pair of pear-shaped adhesive pads occur on pygidium. Parapodial segments with receptacula seminis not modified. Two distinct jaws occur in buccal region. Highly thigmotactic.

Measurements : Length 8.0 mm and width 0.18 mm.

Remarks : The specimens examined are smaller in size compared to the original description of the species from Madras coast.

Habitat : Coarse sand with fine shell gravel near low water level, intertidal zone.

Distribution : East coast of India.

Genus *Pisionidens* Aiyar and Alikunhi, 1942

72. *Pisionidens indica* (Aiyar and Alikunhi)

1940. *Pisionella indica* Aiyar and Alikunhi, *Rec. Ind. Mus.*, 42 : 89.

Material examined : 2 ex., Puri, 22.1.77.

Diagnostic features : White cylindrical worms with tapering ends. Reduced parapodia. Two pairs of cephalic cirri, one directed forwards and the other lateral. Eyes absent. Proboscis with 4 chitinous jaws. Two anal cirri. Buccal and 6 succeeding segments non-setigerous. Ventral cirrus of first segment and dorsal cirrus of second segment are quite elongate. Highly agile and negatively phototactic.

Measurements : Length 16.0-18.0 mm and diameter 0.8 mm.

Remarks : The specimens agree well with the original description.

Habitat : Coarse sand with fine shell gravel near low water level.

Distribution : Cosmopolitan in tropical and subtropical beaches.

Family HESIONIDAE

Genus *Microphthalmus* Mecznirow, 1865

***73. *Microphthalmus urofrimbriatus* Alikunhi**

1948. *Microphthalmus urofrimbriatus* Alikunhi, *Jour. Roy. Asia. Soc. Bengal*, 14 : 17.

Material examined : 1 ex., Puri, 21.1.77.

Diagnostic features : Slender worms with 50-70 setigerous segments. Head with 2 small eyes, 2 palps, 3 tentacles, 6 pairs of tentacular cirri and a pair of nuchal organs. Anal segment with a well developed plate with fimbriated margin and 2 long anal cirri. Sexes united. Male elements confined to anterior segments and female elements to posterior segments. Parapodia well developed with simple and compound setae.

Remarks : The material conforms well with the original description of the species except for a variation in body colour. The local specimens are grey in colour, while the type specimens were reported pale yellow. The cephalic tentacles and cirri are also shorter.

Habitat : Coarse sand with fine shell gravel between low and half-tide levels, intertidal zone.

Distribution : India, Andaman Islands, Lakshadweep, South Africa, Red Sea.

Genus *Hesionides* Friedrich, 1937

74. *Hesionides arenaria* Friedrich

1937. *Hesionides arenarius* Friedrich, *Kieler Meeresforsch.*, 1 : 343.

Material examined : 1 ex., Puri, 21.1.77 ; 2 ex., Puri, 23.1.77 ; 1 ex., Konarak, 24.1.77 ; 1 ex., Gopalpur ; 29.1.77 ; 3 ex., Bahuda estuary, 13.9.70, 2 ex., Bahuda estuary, 26.9.80.

Diagnostic features : Minute worms with 15-18 setigerous segments. Head with a median and 2 pairs of dorsal and ventral tentacles. Three pairs of tentacular cirri. Notopodia with elongated dorsal cirri. Two acicula in neuropodium. Pygidium with two distinctly separated and fan-shaped anal lamellae. Two long thread-like anal cirri.

Measurements : Length 1.2-1.6 mm and width 0.08 mm.

Remarks : Compared to the type specimens, the anal lamellae in the local forms are narrower and do not overlap. The specimens, however, agree fairly well with the original description except for minor variations in the length of cephalic appendages.

Habitat : Coarse and medium sands between low and half-tide levels, intertidal zone.

Distribution : Cosmopolitan.

75. *Hesionides gohari* Hartmann-Schroder

1960. *Hesionides gohari* Hartmann-Schroder, *Kieler Meeresforsch.*, 16 : 74.

Material examined : 1 ex., Puri, 22.7.77 ; 1 ex., Konarak, 24.1.77 ; 1 ex., Gopalpur, 29.1.77.

Diagnostic features : Small worms with 12-15 setigerous segments. Dorsal and ventral tentacles nearly equal. First tentacular cirri the longest. Parapodia with 2 simple notosetae of unequal size. Pygidium with anal plate undivided at the base, but divided distally into 2 lamellae. Two long anal cirri. Anal plates highly thigmotactic.

Measurements : Length 0.6-1.0 mm and width 0.06-0.07 mm.

Remarks : The specimens correspond well with the original description of the species from Red Sea coast.

Habitat : Medium sand near mid-water level, intertidal zone.

Distribution : Tropical and temperate beaches on the coasts of Mediterranean, Atlantic and Indian Oceans.

***76. *Hesionides minima* Westheide and Rao**

1977. *Hesionides minima* Westheide and Rao, *Cah. Biol. Mar.*, 18 : 278.

Material examined : 1 ex., Puri, 23.1.77.

Diagnostic features : Minute worms with 12-16 setigerous segments. Anterior end with 11 appendages, Ventral tentacles directed laterally. Neurosetae bidentate. Pygidium with 2 small stump-shaped adhesive lamellae united at the base and distally broadened into semicircular lappets. Anal cirri thread-like with swollen bases. Sexes separate.

Measurements : Length 0.6-0.8 mm and width 0.06 mm.

Remarks : The specimens closely resemble *H. gohari* occurring in the same habitat, but the narrow posterior end, large notosetae, bidentate neurosetae and the position of male opening are distinct from the latter.

Habitat : Medium sand near mid-water level.

Distribution : India, Lakshadweep.

77. *Hesionides similis* Rao

1978. *Hesionides similis* Rao, *Bull. Zool. Surv. India*, 1 : 27.

Material examined : 2 ex., Gopalpur, 14.7.80.

Diagnostic features : Minute contractile worms with elongate and compact body. Dorsal and ventral tentacles equal in length. Noto-setae sharply bent in subdistal part. Neuropodia with 2 slender tapering acicula. Pygidium with 2 distinctly separated and square-shaped anal lamellae. Anal cirri thread-like with swollen bases. Sexes separate.

Measurements : Length 1.0-1.2 mm and width 0.06-0.09 mm.

Remarks : The material corresponds well with the original description.

Habitat : Coarse and medium sands between low and half-tide levels, intertidal zone.

Distribution : Orissa coast.

Family PHYLLODOCIDAE

Genus *Hesionura* Hartmann-Schroder, 1958

78. *Hesionura elongata* (Southern)

1914. *Eteone elongata* Southern, *Proc. Roy. Irish. Acad.*, 31 : 18.

Material examined : 1 ex., Bahuda estuary, 31.7.80.

Diagnostic features : Head triangular with four tentacles at the narrow anterior end and 2 dark eyes at the wider base. Long tentacular cirri on first body segment. Parapodia typical of the genus. Two long anal cirri. Each parapodium with a dorsal and a ventral cirrus, one simple and 4 compound setae bearing expanded blades.

Measurements : Length 4.0 mm and width 0.15 mm.

Remarks : The specimens conform well with the original description of the species but for the longer tentacular and anal cirri.

Habitat : Coarse sand with fine shell gravel near low water level.

Distribution : Tropical and subtropical beaches on coasts of Atlantic and Indian Oceans.

Family SYLLIDAE

Genus *Eusyllis* Malmgren, 1867

79. *Eusyllis homocirrata* Hartmann-Schroder

1958. *Eusyllis homocirrata* Hartmann-Schroder, *Kieler Meeresforsch.*, 14 : 235.

Material examined : 1 ex., Puri, 22.1.77 ; 3 ex., Bahuda estuary, 10.9.80.

Diagnostic features : Small transparent worms with 16-18 setigerous segments. Prostomium with 2 long triangular palps, 3 tentacles and 2 pairs of tentacular cirri. Eyes absent. Dorsal cirri long, but absent on second setigerous segment. Ventral cirri finger-like. Pygidium with 2 long anal cirri. Proboscis with an anterior tooth and cusps.

Measurements : Length 1.2 mm and width 0.1 mm.

Remarks : The tentacular cirri are longer in the local specimens compared to the original description of the species.

Habitat : Coarse and medium sands with fine shell gravel between low and half-tide levels, intertidal zone.

Distribution : Circumtropical.

Genus *Typosyllis* Langerhans, 1879

80. *Typosyllis variegata* (Grube)

1860. *Syllis variegata* Grube, *Arch. Naturgesch.*, 26 : 85.

Material examined : 1 ex., Puri, 23.1.77 ; 1 ex., Gopalpur, 27.1.77 ; 1 ex., Bahuda estuary, 31.7.80.

Diagnostic features : Long and thin worms with 90-120 setigerous segments. Head with 2 pairs of eyes, 2 long palps, one median and 2 lateral tentacles. Tentacles and cirri are ringed. Pygidium with 2 long anal cirri and a finger-like papilla in between. Parynx with an anterior conical tooth. Parapodia short with moniliform dorsal cirrus and finger-like ventral cirrus, 10 compound setae with expanded blades.

Measurements : Length 1.6-1.8 cm and width 0.2 mm.

Remarks : The specimens examined are smaller in size compared to the original description of the species.

Habitat : Coarse sand with fine shell gravel near low water level.

Distribution : Cosmopolitan.

81. *Typosyllis* sp.

Material examined : 1 ex., Bahuda estuary, 10.9.80.

Description : Long slender worms with 70-90 setigerous segments. Head with 2 pairs of circular eyes, 2 oblong palps and 2 lateral

tentacles. Tentacles and dorsal cirri moniliform. Pharynx with conical tooth at the anterior end. Falcate setae conspicuously bidentate. Pygidium with 2 long anal cirri and a conical papilla in between. Parapodia short with moniliform cirri and compound setae.

Measurements : Length 1.2 mm and width 0.16 mm.

Remarks : Specific identification of the material needs further study.

Habitat : Coarse sand with fine shell gravel near low water level.

Genus *Sphaerosyllis* Claparede, 1863

82. *Sphaerosyllis bengalensis* Rao and Ganapati

1966. *Sphaerosyllis bengalensis* Rao and Ganapati, *Proc. Ind. Acad. Sci.*, 58 : 309.

Material examined : 2 ex., Puri, 23.1.77 ; 4 ex., Konarak, 24.1.77.

Diagnostic features : Minute worms with 13-15 setigerous segments tapering towards extremities. Prostomium with a pair of brown eyes, 2 conical palps fused dorsally by a papillated skin, 3 tentacles and a pair of tentacular cirri. Parapodia with one simple and 5 compound setae. Pygidium with 2 club-shaped anal cirri. Proboscis with conical tooth and anterior border fringed with cusps. Sexes separate.

Measurements : Length 1.0-1.2 mm and width 0.08 mm.

Remarks : The material conforms well with the original description of the species from the beach sands of Waltair coast.

Habitat : Coarse and medium sand with little detritus 5-10 cm below surface between low and mid-water levels, intertidal zone.

Distribution : India, Andaman Islands, Lakshadweep, Sri Lanka.

*83. *Sphaerosyllis minima* Hartmann-Schroder

1960. *Sphaerosyllis minima* Hartmann-Schroder, *Kieler Meeresforsch.*, 16 : 104.

Material examined : 1 ex., Gopalpur, 14.7.80.

Diagnostic features : Minute worms with 10 setigerous segments. Prostomium with 2 pairs of eyes, 2 conical palps, 3 tentacles and a pair of tentacular cirri. Tentacles and cirri are club-shaped. Parapodia with one simple and 4 compound setae. Dorsal cirri long and club-shaped. Ventral cirri finger-like and longer than parapodia. Pygidium with 2 club-shaped anal cirri. Gizzard with 10-12 rings.

Measurements : Length 0.8 mm and width 0.1 mm.

Remarks : The material conforms well with the original description of the species from the Red Sea coast.

Habitat : Algae and fine detritus sand between low and half-tide levels, intertidal zone.

Distribution : Red Sea, Bay of Bengal.

Genus **Brania** Quatrefages, 1865

*84. **Brania subterranea** (Hartmann-Schroder)

1956. *Pionosyllis subterranea* Hartmann-Schroder, *Zool. Anz.*, **157** : 89.

Material examined : 1 ex., Bahuda estuary, 27.8.80 ; 1 ex., Puri, 23.1.77.

Diagnostic features : Setigerous segments 24-30. Prostomium with 2 long palps, 3 tentacles and 2 pairs of tentacular cirri. Parapodia with long dorsal cirri. Two pairs of eyes, the anterior ones being larger in size. Pharynx with anterior conical tooth. Pygidium with anal cirri. All tentacles and cirri are club-shaped. Gizzard cylindrical with 20-22 rings. Parapodium with 12 short compound setae.

Measurements : Length 1.8-2.0 mm and width 0.12 mm.

Remarks : The specimens are identical with the description of the type material from the Atlantic coast of Brazil.

Habitat : Coarse sand between low and mid-water levels, intertidal zone.

Distribution : Eurytopic in tropical and subtropical beaches.

Genus **Petitia** Siewing, 1955

85. **Petitia amphophthalma** Siewing

1955. *Petitia amphophthalma* Siewing, *Vie et Milieu*, **6** : 413.

Material examined : 1 ex., Puri, 22.1.77 ; 1 ex., Gopalpur, 31.1.77 ; 7 ex., Bahuda estuary, 27.8.80.

Diagnostic features : Minute transparent worms with 12-16 setigerous segments. Prostomium with 2 elongate palps, 3 tentacles and 2 pairs of tentacular cirri. First pair of parapodia with elongate cirri. Two dark eyes in juveniles. Pygidium with 2 anal cirri and a conical

anal papilla. Pharynx with an anterior conical tooth. Gizzard with 16-20 transverse rings.

Measurements : Length 1.4-1.6 mm and width 0.08 mm.

Remarks : The material conforms with the original description of the species but for the smaller size. The juveniles are, however, more frequently encountered in the habitat compared to the adults.

Habitat : Coarse and medium sand between low and half-tide levels, intertidal zone.

Distribution : Widely distributed in tropical and warm temperate beaches.

Genus *Ehlersia* Quatrefages, 1865

86. *Ehlersia cornuta* (Rathke)

1923. *Syllis (Ehlersia) cornuta* Rathke, *Fauna de France*, 5 : 267.

Material examined : 1 ex., Bahuda estuary, 31.7.80.

Diagnostic features : Slender worms with 90-120 setigerous segments. Anterior tentacles thin and subequal. Palps long and distinct. Two pairs of eyes. Pharynx very long with an anterior tooth. Parapodia with compound setae of two kinds. Two anal cirri. Tentacles and cirri moniliform. Last parapodia with a dorsal and a simple seta.

Measurements : Length 4.2 mm and width 0.2 mm.

Remarks : The specimens correspond well with the original description of the species but for the smaller size and the number of setigerous segments.

Habitat : Coarse sand with fine sand gravel near low water level.

Distribution : Mediterranean, Atlantic and Indian Oceans.

Family GLYCERIDAE

Genus *Goniadides* Hartmann-Schorder, 1960

*87. *Goniadides aciculata* Hartmann-Schorder

1960. *Goniadides aciculata* Hartmann-Schorder, *Kieler Meeresforsch.*, 16 : 116.

Material examined : 1 ex., Puri, 23.1.77 ; 4 ex., Bahuda estuary, 26.9.80.

Diagnostic features : Setigerous segments 40-50. Prostomium conical, 8-ringed, the basal ring the largest, while the distal one bears four 4-ringed tentacles. Eyes absent. Two anal cirri. Pharynx with dark chitinous micro and macro jaws. Parapodia with conical dorsal, ventral and median cirri. One simple acicular and 4 compound setae present. Pygidial segment without parapodia.

Measurements : Length 4.5 mm and width 0.3 mm.

Remarks : The specimens examined correspond well with the original description of the species except for some minor variations in size, segmentation of cephalic tentacles and number of acicular setae.

Habitat : Coarse sand with fine shell gravel near low water level.

Distribution : Red Sea, Lakshadweep, India, Andaman Islands.

Phylum **ARTHROPODA**

Class **Crustacea**

Order **OSTRACODA**

Family **CYTHERIDAE**

Genus **Microcythere** Muller, 1894

88. *Microcythere subterranea* Hartmann

1954. *Microcythere subterranea* Hartmann, *Vie et Milieu*, 4 : 238.

Material examined : 2 ex., Puri, 22.1.77 ; 1 ex., Konarak, 24.1.77.

Diagnostic features : Shell small, elongated and wedge-shaped to suit interstitial life. Antenna 6-jointed with a modified terminal seta. Antenna 5-jointed with a long, curved, outer seta on the first. Three pairs of 4-jointed legs with long claws. Penis double pointed.

Measurements : Length 0.2 mm, width 0.07 mm and height 0.07 mm.

Remarks : The specimens agree well with the original description of the species except for a variation in the shape of modified seta on the terminal segment of antennule.

Habitat : Coarse and medium sand with fine shell gravel 5 cm below surface between low and mid-water levels, intertidal zone.

Distribution : Mediterranean, Arabian Sea, Bay of Bengal.

Order COPEPODA
Suborder Harpacticoida
Family LONGIPEDIIDAE
Genus **Longipedia** Claus, 1863

***89. Longipedia weberi** Scott

1909. *Longipedia weberi* Scott, *Siboga Exped.*, 29 : 196.

Material examined : 2 ex., Gopalpur, 29.1.77.

Diagnostic features : Body fusiform. Rostrum large. Anal operculum well developed. Maxilliped not prehensile. Distal segment of endopod of P. 2 and abdomen spinules are extremely elongate. Intercoxal plates of P.1-P.4 highly ornamented. P. 5 distinctly biramous with basendopod bearing an outer and an inner seta ; exopod a triangular lamina with 6 terminal setae. Caudal ramus as long as broad with 2 developed terminal setae.

Measurements : Length 0.6 mm.

Remarks : The material corresponds well with the original description. The species clearly differs from other members of the genus in the extreme length of abdominal spinules.

Habitat : Fine muddy sand near low water level, intertidal zone.

Distribution : Warm tropical and temperate beaches in the Indo-Pacific region.

90. Longipedia kikuchii Ito

1980. *Longipedia kikuchii*, Ito, *J. Nat. Hist.*, 14 : 18.

Material examined : 2 ex., Rambha Bay, 28.8.80 ; 1 ex., Bahuda estuary, 31.7.80.

Diagnostic features : Fusiform body with large rostrum and anal operculum. Inner ventral and inner terminal setae of caudal ramus elongate. Epidermal lappets of genital segment small. Abdomen ornamented with small spinules. Exopod of P.5 with 6 setae in females. P.5 biramous with exopod bearing 7 setae of varying length.

Measurements : Length 0.8 mm.

Remarks : The specimens conform well with the original description of the species, but their morphology is closely related to *L. coronata* Claus. However, the recent revision of the genus by Wells (1980) clearly differentiates both these species.

Habitat : Fine muddy sediments under brackish and estuarine conditions.

Distribution : Japan, Singapore, Andaman Islands, India, Lakshadweep.

Family ECTINOSOMATIDAE

Genus *Ectinosoma* Boeck, 1864

*91. *Ectinosoma melaniceps* Boeck

1864. *Ectinosoma melaniceps* Boeck, *Forth. Vidensk. Krist.*, 1864 : 254.

Material examined : 1 ex., Gopalpur, 27.1.77 ; 2 ex., Gopalpur, 31.1.77.

Diagnostic features : Body fusiform. Basendopod of P.5 with 2 setae. Abdomen with bands of pustules. Female P. 5 variable. Antennule 5-segmented. Exopod of antenna 3-segmented. P.1-P.4 with both rami 3-segmented. Caudal ramus broader than long with 2 developed setae. Abdomen with bands of pustules. Anal operculum lacking.

Measurements : Length 0.45 mm.

Remarks : The present specimens agree well with the description of the species given by Lang (1965).

Habitat : Detritus sand 5 cm below surface between low and half-tide levels, intertidal zone.

Distribution : Cosmopolitan.

Genus *Arenosetella* Wilson, 1932

92. *Arenosetella germanica* Kunz

1937. *Arenosetella germanica* Kunz, *Kieler Meeresforsch.*, 2 : 95.

Material examined : 1 ex., Puri, 23.1.77.

Diagnostic features : Body fusiform without demarcation between metasome and urosome. Antennule 6-segmented with an aesthete on fourth segment. Exopod of antenna 3-segmented. Distal segment of P.3 of exopod with 2 internal setae. Anal segment with 2 pairs of curved dorsal claws. P. 5 biramous, endopod with 2 and exopod with 3 setae. Caudal ramus longer than broad with 2 developed apical setae.

Measurements : Length 0.5 mm.

Remarks : The specimens conform well with the original description of the species from the beach sands of Kiel Bay.

Habitat : Coarse sand with fine shell gravel and little detritus near low water level, intertidal zone.

Distribution : Widely distributed in the beaches of Atlantic, Pacific and Indian Oceans.

***93. Arenosetella indica Krishnaswamy**

1957. *Arenosetella indica* Krishnaswamy, *Studies on the Copepoda of Madras*, 42.

Material examined : 2 ex., Bahuda estuary, 10.9.80.

Diagnostic features : Body fusiform. Antennule 6-segmented with an aesthete on terminal segment. Exopod of antenna 3-segmented. Distal segment of P.4 of exopod without internal seta. Anal segment with two simple dorsal claws. P.5 biramous, endopod with 2 and exopod with 3 setae. Caudal ramus longer than wide with 2 developed terminal setae. P. 6 in male a rectangular lamina with 2 apical setae.

Measurements : Length 0.48 mm.

Remarks : The specimens conform with original description of the species except for the presence of an aesthete on the fifth segment of antennule. The aesthete has not been described for the type specimens from the beach sands of Madras coast.

Habitat : Coarse detritus sand 5 cm below surface between low and mid-water levels, intertidal zone.

Distribution : Indian coast.

***94. Arenosetella setosus Rao and Ganapati**

1969. *Arenosetella setosus* Rao and Ganapati, *Proc. Ind. Acad. Sci.*, 69 : 1.

Material examined : 2 ex., Konarak, 24.1.77.

Diagnostic features : Body cylindrical. Rostrum triangular. Anal operculum without dorsal claws. Antennule 5-segmented, the last being the longest, the fourth and fifth segments bearing an aesthete. Exopod of antenna 2-segmented. Both rami P.1-P.4 are 3-segmented. Exopod of P.1-P.4 with 3 modified inner setae. P.5 with distinct rami, the basendopod bearing 2 inner setae and exopod 5 terminal setae. P.6 in male with an inner spine and an outer seta.

Measurements : Length 0.52-0.54 mm.

Remarks : The specimens agree well with the original description of the species made from Waltair coast. The species is readily distinguished by the modified inner setae on P.1-P.4.

Habitat : Coarse and medium sand with fine shell gravel between low and half-tide levels, intertidal zone.

Distribution : Indian coast.

Genus **Lineosoma** Wells, 1965

*95. **Lineosoma intermedia** (Wells)

1967. *Noodtiella intermedia* Wells, *Trans. R. Soc. Endinb.*, 67 : 245.

Material examined : 2 ex., Bahuda estuary, 26.9.80.

Diagnostic features : Body linear and cylindrical. Last abdominal segment partially cleft and without anal operculum. Antennule 6-segmented with a terminal aesthete. Exopod of antenna 2-segmented. Second endopod segment of P. 1 with 4 terminal setae. P. 2—P. 4 with both rami 3-segmented. P. 5 with distinct rami, the exopod bearing 3 apical setae. P. 6 in male with a seta on either side.

Remarks : The specimens agree well with the type specimens with a minor variation. The endopod segment of P. 1 bears 4 terminal setae, while it was described 3 setae only for the type material. This is the first record of the species from Indian coast.

Habitat : Medium sand 5 cm below surface near mid-water level, intertidal zone.

Distribution : Mozambique, Lakshadweep, India, Andaman Islands.

Genus **Hastigerella** Nicholls, 1935

*96. **Hastigerella bengalensis** Rao

1972. *Hastigerella bengalensis* Rao, *Cah. Biol. Mar.*, 13 : 306.

Material examined : 3 ex., Puri, 22.1.77 ; 2 ex., Bahuda estuary, 31.7.80.

Diagnostic features : Body cylindrical without demarcation between metasome and urosome. Rostrum prominent and digitiform. Last segment cleft without anal operculum. Caudal ramus longer than wide

with an apical spine and a developed seta. Antennule 6-segmented, with an aesthete on fourth and terminal segments. Exopod of antenna 2-segmented, each with a terminal seta. Endopod of maxilliped with marginal setules. P. 1—P. 4 with both rami 3-segmented. Exopod of P. 2—P. 4 with hastate setae. Exopod of P. 5 with 4 setae.

Measurements : Length 0.58-0.60 mm.

Remarks : The material examined conformed well with the original description of the species made from Andhra coast. A minor variation, however, was noticed in the distribution of the hastate setae on P. 1—P. 4 characteristic of the species. The setae occupied slightly lower position compared with the original description.

Habitat : Coarse sand with fine shell gravel and little detritus near low water level, intertidal zone.

Distribution : Andhra and Orissa coasts.

97. **Hastigerella leptoderma* (Klie)

1929. *Ectinosoma leptoderma* Klie, *Zool. Jb. (Syst.)*, 57 : 335.

Material examined : 2 ex., Puri, 21.1.77 ; 1 ex., Gopalpur, 29.1.77 ; 1 ex., Bahuda estuary, 31.7.80.

Diagnostic features : Body cylindrical. Cephalothorax rectangular. Last abdominal segment cleft without anal operculum. Caudal ramus longer than broad. Antennule 5-segmented, the last one being longest with an aesthete. Exopod of antenna 3 segmented. Both rami P. 1—P. 4 with 3 segments. P. 5 with distinct rami, the exopod bearing 3 terminal setae.

Measurements : Length 0.4 mm.

Remarks : The specimens agree fairly well with the original description of the species except for a variation in the setal formula. Second segment of endopod of P. 2—P. 4 bears two inner setae, instead of the one reported for the type material. This is the first record of the species from Indian coast.

Habitat : Coarse sand with fine shell gravel and little detritus near low water level, intertidal zone.

Distribution : North Atlantic, Mediterranean, South Carolina (America), Mozambique, Lakshadweep, India, Andaman Islands.

Family PELTIDIIDAE

Genus **Peltidium** Philippi, 1839

*98. **Peltidium ovale** Thompson and Scott

1903. *Peltidium ovale* Thompson and Scott, *Rep. Govt. Ceylon Pearl Oyster Fish.*, 1 : 273.

Material examined : 2 ex., Puri, 21.1.77 ; 1 ex., Bahuda estuary, 27.8.80.

Diagnostic features : Body oval with maximum width at posterior end of cephalothorax. Antennule 6-segmented. Exopod of antenna 2-segmented. Exopod of P. 1 with 3 segments, the last one with 3 curved claws. Endopod of P. 1 with 2 segments, each with a spoon-like modified seta in male. P. 2—P. 4 with both rami 3-segmented with long plumose setae. Exopod of P. 5 a triangular lamina with 5 setae. Caudal ramus longer than broad with 4 setae.

Measurements : Length 1.5 mm.

Remarks : The specimens correspond well with the recent description of the species given by Gamo (1969).

Habitat : Detritus sand near low water level, intetidal zone.

Distribution : Sri Lanka, Maldives, Lakshadweep, India, Andaman Islands, Japan, China, Australia.

Family THALESTRIDAE

Genus **Diarthrodes** Thompson, 1882

*99. **Diarthrodes cystoecus** Fahrenbach

1954. *Diarthrodes cystoecus* Fahrenbach, *J. Wash. Acad. Sci.* 44 : 326.

Material examined : 1 ex., Gopalpur, 14.7.80, 1 ex., Bahuda estuary, 31.7.80.

Diagnostic features : Body pyriform. Caudal ramus broader than long, with spinulose posterior edge. Antennule 6-segmented. Exopod of antenna 3-segmented. Rami P.2-P.4 with 3 segments, exopod being longer than endopod. Second endopod segment of antenna with geniculate setae. Maxilliped prehensile. P.5 with distinct rami bearing 2 and 5 setae on basendopod and exopod, respectively.

Measurements : Length 0.6 mm.

Remarks : The species has been described by several workers with

considerable variation. The present specimens, however, approach well the description of the species made by Sewell (1940).

Habitat : Algae and detritus sand between low and mid-water levels, intertidal zone.

Distribution : Atlantic coast of America, Maldives, India, Andaman Islands.

Family PARASTENHELIIDAE

Genus **Parastenhelia** Thompson and Scott, 1903

*100. **Parastenhelia hornelli** Thompson and Scott

1903. *Parastenhelia hornelli* Thompson and Scott, *Rep. Govt. Ceylon Pearl Oyster Fish.*, 1 : 263.

Material examined : 3 ex., Gopalpur ; 14.7.80.

Diagnostic features ; Body elongated. Rostrum pointed apically. Anal operculum simple and naked. Caudal ramus broader than long. Antennule 9-segmented with an aesthete on fourth. Exopod of antenna 2-segmented. Endopod of P.1 with 2 segments, the second one being quite small with 2 long terminal claws. P.2-P.4 with both rami 3-segmented.

Measurements : Length 0.6 mm.

Remarks : The material exhibits some minor variations compared to the original description, particularly in the setal formula. Examination of the material from type locality may throw some light on the validity of these variations.

Habitat : Detritus sand between low and mid water levels, intertidal zone.

Distribution ; Eurytopic on the coasts of warm temperate and tropical seas.

Family DIOSACCIDAE

Genus **Stenhelia** Boeck, 1864

*101. **Stenhelia polluta** Monard

1928. *Stenhelia polluta* Monard, *Arch. Zool. exp. gen.*, 67 : 399.

Material examined : 2 ex., Bahuda estuary, 10.9.80.

Diagnostic features : Body elongate. Rows of spinules on female

abdomen. Antennule 8-segmented. Exopod of antenna 3-segmented. Caudal ramus twice longer than wide. Exopod of P.1 with 3 segments. Endopod of P.1 as long as exopod. Basal segment of P.5 with 3 setae, while the distal one has 5 setae. Caudal ramus thrice longer than wide with 2 developed apical setae.

Measurements : Length 0.5 mm.

Remarks : The specimens agree well with the original description, particularly in possessing rows of spinules on female abdomen and the shape of caudal ramus, which showed variation in the material reported from different areas.

Habitat : Detritus sand near low water level, intertidal zone.

Distribution : Widely distributed along the warm temperate and tropical coasts.

***102. *Stenhelia madrasensis* Wells**

1971. *Stenhelia madrasensis* Wells, *J. nat. Hist.*, 5 : 508.

Material examined : 3 ex., Rambha Bay, 28.8.80.

Diagnostic features : Body elongate. Antennule 8-segmented. Exopod of antenna 3-segmented. Maxilliped non-prehensile, with endopod with 2 segments. Endopod of P.2 with 2 segments in male and 3 segments in female. P.5 biramous, basendopod with 5 and exopod with 6 setae. Caudal ramus four times longer than broad with 2 developed terminal setae. Genetac segment wider anteriorly.

Measurements : Length 0.4 mm.

Remarks : The specimens agree well with the original description of the species except for a variation in antennule and maxilliped. The antennule has 8 segments compared to 7 in the type material. The endopod of maxilliped has 2 segments, while it was reported as one for the type specimens.

Habitat : Bottom mud under brackish water conditions.

Distribution : East coast of India, Andaman Islands.

***103 *Stenhelia indica* Krishnaswamy**

1957. *Stenhelia indica* Krishnaswamy, *Studies on the Copepoda of Madras*, 53.

Material examined : 3 ex., Bahuda estuary, 10.9.80.

Diagnostic features : Body elongate, without ornamentation. Anal operculum simple. Rostrum curious with chitinised beak with bifid apex. Antennule 8-segmented. Exopod of antenna 3-segmented. Maxilliped prehensile. Both rami of P.2-P.4 with 3 segments with reduced setation. P.2 in male not modified. Caudal ramus longer than board with 3 setae. P. 6 in male a lappet without setae.

Measurements : Length 0.4 mm.

Remarks : The specimens correspond fairly well with the original description but for the far smaller body size.

Habitat : Detritus sand between low and mid water levels, intertidal zone.

Distribution : East coast of India, Andaman Islands.

Genus **Diosaccus** Boeck, 1872

*104. **Diosaccus monardi** Sewell, 1940

1940. *Diosaccus monardi* Sewell, *Scient. Rep. John Murray Exped.*, 7 : 244.

Material examined : 7 ex., Bhadrakh, 15.1.77 ; 2 ex., Paradwip, 19.1.77.

Diagnostic features : Rostrum short and broad. Abdomen without ornamentation. Antennule 8-segmented. Exopod of antenna 3-segmented. Mandible without endopod. Maxillule and maxilla highly modified. Endopod of P.1 short and unique. Caudal ramus as long as broad with principal seta bulbous at its base. P.5 fused with 3 and 5 setae. P.6 in male a single plate with a long spine and 2 setae.

Measurements : Length 0.8-0.9 mm

Remarks : The original description was based only on a single female and the present material corresponds well with it. This species occupies a unique position in the genus in respect of the endopod of P.1, mandible, maxillule and maxilla.

Habitat : Coarse detritus sand near low water level, intertidal zone.

Distribution : Andaman Islands, Indian coast.

Genus **Robertsonia** Brady, 1880

105. **Robertsonia proprinqua** Scott

1894. *Robertsonia proprinqua* Scott, *Trans. Linn. Soc. Lond.*, 6 : 99.

Material examined : 2 ex., Rambha Bay, 28.8.80 ; 1 ex., Bahuda estuary, 26.9.80.

Diagnostic features : Abdomen with dense spinules. Antennule 5-segmented. Exopod of mandible with 4 setae. Basis of maxillule with 5 setae. Endopod of maxilla 3-segmented. First endopod segment of P.2-P.4 with an inner seta. Inner setae of basendopod of P.5 stout and bifid. Caudal ramus broader than long with 2 developed apical setae.

Measurements : Length 0.8-0.9 mm.

Remarks : This species has been studied and reported from different geographical regions with considerable variation. As all the workers agree in major morphological features of the species, these differences are to be treated as local variations.

Habitat : Detritus sand and mud in brackish and estuarine conditions.

Distribution : Widely distributed along the coasts of warm temperate and tropical seas.

Genus *Amphiascoides* Nicholls, 1941

*106. *Amphiascoides subdebilis* (Willey)

1935. *Amphiascus subdebilis* Willey, *Ann. Mag. Nat. Hist.*, 10 : 64.

Material examined : 2 ex., Gopalpur, 31.1.77.

Diagnostic features : Body linear. Abdominal ornamentation entirely absent. Antennule 8-segmented, fourth segment twice as long as broad. Exopod of antenna 3-segmented. Endopod of P.1 quite stout. Distal segment of exopod of P.4 with 2 inner setae. Caudal rami thrice as wide as long with 2 well developed terminal setae.

Measurements : Length 0.8 mm.

Remarks : This species reported from different geographical regions exhibits considerable morphological variability.

Habitat : Algae and detritus sand, intertidal zone.

Distribution : Cosmopolitan.

Genus **Balucopsylla** Rao, 1972***107. Balucopsylla similis** Rao

1972. *Balucopsylla similis* Rao, *Cah. Biol. Mar.*, 13 : 308.

Material examined : 2 ex., Puri, 22.1.77 ; 1 ex., Bahuda estuary, 31.7.80.

Diagnostic features : Body cylindrical. Rostrum lanceolate. Anal operculum bare. Caudal ramus longer than broad. Antennule 8-segmented, second segment being the longest. Exopod of antenna 2-segmented. Rami of P.1-P.4 with 3 segments. Exopod of P.5 elongate with 5 setae. P.6 in male a distinct plate with 3 apical setae.

Measurements : Length 0.56-0.58 mm.

Remarks : The specimens conform well with the original description of the species made from Andhra coast.

Habitat : Coarse sand with fine shell gravel and little detritus 5 cm below surface between low and half-tide levels, intertidal zone.

Distribution : East coast of India.

Family **AMEIRIDAE**Genus **Ameira** Boeck, 1864***108. Ameira parvula** (Claus)

1866. *Canthocamptus parvula* Claus, *Schr. Ges. Beford, ges. Naturw. Marburg*. 1 : 30.

Material examined : 4 ex., Puri, 21.1.77 ; 2 ex., Gopalpur, 14.7.80 ; 1 ex., Bahuda estuary, 27.8.80.

Diagnostic features : Body cylindrical. Antennule 8-segmented. Exopod of antenna 2-segmented. Basis of endopod of P.1 longer than second and third segments together. Middle segment of exopod of P.2 with inner seta. Third exopod segment of P.4 with 3 inner setae. Distal segment of P.5 with 5 setae. Caudal rami rectangular and as wide as long with 2 developed terminal setae.

Measurements : Length 0.6 mm.

Remarks : Great morphological variation has been reported for this widely distributed species. The present material, however, approaches well with the original description of the species.

Habitat : Algae and detritus sand, intertidal zone.

Distribution : Cosmopolitan.

***109. *Ameira bengalensis* Rao and Ganapati**

1969. *Ameira bengalensis* Rao and Ganapati, *Proc. Ind. Acad. Sci.*, 69 : 12.

Material examined : 2 ex., Gopalpur, 14.7.80 ; 1 ex., Bahuda estuary, 31.7.80.

Diagnostic features ; Body cylindrical and slightly compressed laterally. Rostrum prominent and triangular. Antennule 7-segmented, with aesthete on fourth. Exopod of antenna 1-segmented. Distal segment of P.5 with 5 setae, basendopod with 2 setae. Caudal ramus twice longer than wide, with 2 developed terminal setae.

Measurements : Length 0.5 mm.

Remarks : The material corresponds well with the original description based on female specimens from the beach sands of Waltair coast.

Habitat : Medium sand between low and half-tide levels, Intertidal zone.

Distribution : Andhra and Orissa coasts.

Genus *Sicameira* Klie, 1950

***110. *Sicameira langi* Rao**

1972. *Sicameira langi* Rao, *Cah. Biol. Mar.*, 13 : 316.

Material examined : 1 ex., Puri, 22.1.77 ; 1 ex., Bahuda estuary, 26.9.80.

Diagnostic features : Body cylindrical and slightly tapers posteriorly. Distinct ornamentation lacking. Anal operculum bare. Antennule 7-segmented with an aesthete on fourth. Exopod of antenna 2-segmented, the distal being quite small with 2 long setae. Mandible lacks exopod. Both the rami of P.1-P.4 are 3-segmented. Exopod of P.5 oval with 5 setae. P.6 in male is represented by 3 short setae.

Measurements : Length 0.52 mm.

Remarks : The specimens agree well with the original description of the species based on female specimens. The male specimens, however, remain unknown.

Habitat : Coarse and medium sands with fine shell gravel between low and half-tide levels, intertidal zone.

Distribution : Indian coast, Lakshadweep, Andaman Islands.

Genus *Nitocra* Boeck, 1864*111. *Nitocra affinis rijekana* Petkovski

1954. *Nitocra affinis rijekana* Petkovski, *Acta Mus. Macee. Sci. Natur.*, 2 : 104.

Material examined : 2 ex., Bahuda estuary, 10.9.80.

Diagnostic features : Caudal ramus wider than long. Antennule 8-segmented, with an aesthete on fourth. Exopod of antenna single-segmented. Both rami of P.1-P.4 with 3 segments. Exopod of P.5 with 6 setae. Male with modified spine on basal segment of P.1. Caudal ramus wider than long with 2 developed terminal setae.

Measurements : Length 3.52-0.58 mm.

Remarks : The subspecies has been reported with minor variation from different geographical regions. The local forms, however, conform with description of the species made for the Atlantic specimens (Noodt, 1958).

Habitat : Coarse detritus sand near low water level.

Distribution : The species is widely distributed on coasts of tropical and warm temperate seas.

Genus *Parapseudoleptomesochra* Lang, 1965112. *Parapseudoleptomesochra trisetosa* (Krishnaswamy)

1957. *Ameira trisetosa* Krishnaswamy, *Studies on Copepoda of Madras*, 230.

Material examined : 4 ex., Bahuda estuary, 27.8.80.

Diagnostic features : Body linear, rostrum minute. Antennule 7-segmented. Exopod of antenna one segmented. Mandible without exopod. Endopod of P. 1 prehensile. Middle segment of exopod of P. 1 without inner seta. Exopod of P. 5 with 5 setae and endopod with 3 setae. Caudal ramus longer than wide with one lateral and 2 developed terminal setae.

Measurements : Length 0.32-0.35 mm.

Remarks : The material examined corresponds well with the description of the type species with some variations in the smaller body size, position of aesthete on antennule, 1-segmented exopod of antenna and the exopod of P. 5 with five setae. In the absence of a comparison with type material, which is not available for study, it would be difficult to comment on this variation.

Habitat : Medium sand between low and high tide levels of the beach.

Distribution : Indian coast, Andaman Islands.

Genus **Paraleptomesochra** Wells, 1967

*113. **Paraleptomesochra wellsi** Rao

1972. *Paraleptomesochra wellsi* Rao, *Cah. Biol. Mar.*, 13 : 311.

Material examined : 1 ex., Konarak, 24.1.77 ; 2 ex., Puri, 23.1.77.

Diagnostic features : Body cylindrical. Anal operculum bare. Caudal ramus as long as broad. Antennule 8-segmented, with an aesthete on the fourth. Exopod of antenna 2-segmented. Mandible without exopod. P. 1 male with modified inner spine on basipodite. Exopod of P. 5 with 6 setae in female and 4 setae in male. P. 6 in male a plate with 2 setae.

Measurements : Length 0.30-0.32 mm.

Remarks : The specimens agree well with the original description of the species from Andhra coast.

Habitat : Medium sand with little detritus 5 cm below surface near mid water level, intertidal zone.

Distribution : East Coast of India.

Family **PARAMESOCHRIDAE**

Genus **Kliopsyllus**, Kunz, 1962

114. **Kliopsyllus wilsoni** (Krishnaswamy)

1957. *Paramesochra wilsoni* Krishnaswamy, *Studies on the Copepoda of Madras*, 114.

Material examined : 2 ex., Puri, 22.1.77 ; Konarak, 24.1.77 ; 1 ex., Bahuda estuary, 31.7.80.

Diagnostic features : Body depressed dorsoventrally and tapers posteriorly. Antennule 7-segmented with an aesthete on the fourth. Exopod of antenna single-segmented. Rami of P. 1 two segmented. Exopod of P. 5 with 3 setae. Caudal rami thrice longer than wide. P. 6 in male a transverse lappet with 3 short setae.

Measurements : Length 0.38-0.30 mm.

Remarks : The specimens correspond with the original description

of the female with a few variations. The antennule bears a terminal aesthete not reported for the type specimens. The terminal exopod segment of P.2-P.3 also bears a pectinate seta.

Habitat : Medium sand with little detritus, intertidal zone.

Distribution : Indian coast, Andaman Islands.

Genus *Apodopsyllus* Kunz, 1962

*115. *Apodopsyllus adaptatus* (Krishnaswamy)

1957. *Leptopsyllus adaptatus* Krishnaswamy, *Studies on the Copepoda of Madras*, 117.

Material examined : 3 ex., Puri, 23.1.77 ; 1 ex., Bahuda estuary, 27.8.80.

Diagnostic features : Body linear, cylindrical and vermiform. Antennule 7-segmented, with an aesthete on the fourth. Antenna single-segmented ending in a modified bifid seta. P.2-P.4 with exopod 3-segmented and endopod lacking. P. 5 is represented by a triangular lamina with 3 setae. Caudal ramus twice longer than wide with one lateral and 3 terminal setae. P.6 a triangular lamina with 3 setae.

Measurements : Length 0.52 mm.

Remarks : The specimens examined conform well with the original description of the species from Madras coast.

Habitat : Fine and medium sand 5 cm below surface near mid water level, intertidal zone.

Distribution : East coast of India.

Family CANTHOCAMPTIDAE

Genus *Mesochra* Boeck, 1864

116. *Mesochra pygmaea* (Claus)

1863. *Dactylopus pygmaea* Claus, *Die freilebenden Copepoden der Fauna Deutschlands*, 127.

Material examined : 1 ex., Puri, 14.7.80 ; 2 ex., Bahuda estuary, 27.8.80.

Diagnostic features : Antennule 6-segmented. Exopod of antenna 1-segmented. Endopod of P. 1 with 3 segments, the basis being longer than exopod. P. 5 with 2 segments, the basal segment bearing 5 setae. Anal operculum covered with fine setules. Caudal ramus wider than long with 2 developed terminal setae and a lateral spine.

Measurements : Length 0.42 mm.

Remarks : The specimens examined correspond well with the original description of the species.

Habitat : Algae and detritus sand, intertidal zone.

Distribution : Cosmopolitan.

Family CYLINDROPSYLLIDAE

Genus *Leptastacus* Scott, 1906

*117. *Leptastacus waltirensis* Rao and Ganapati

1969. *Leptastacus waltirensis* Rao and Ganapati, *Proc. Ind. Acad. Sci.*, 69 : 5.

Material examined : 2 ex., Gopalpur, 27.1.77.

Diagnostic features : Body cylindrical. Rostrum short and elliptical. Antennule 7-segmented, with an aesthete on the fourth. Exopod of antenna one-segmented. Third exopod segment of P. 3 and second and third exopod segments of P. 4 with a modified seta. P. 5 is a triangular lamina with 4 setae. Caudal ramus thrice longer than wide with 3 lateral setae and one stout terminal seta bearing lateral setules. P.6 in male with an inner spine and an outer seta.

Measurements : Length 0.36 mm.

Remarks : The specimens agree well with the original description of the species made from Andhra coast.

Habitat : Medium sand with little detritus between low and half-tide levels, intertidal zone.

Distribution : East coast of India.

Genus *Psammastacus* Nicholls, 1935

*118. *Psammastacus spinicaudatus* Rao and Ganapati

1969. *Psammastacus spinicaudatus* Rao and Ganapati, *Proc. Ind. Acad. Sci.*, 69 : 7.

Material examined : 1 ex., Puri, 22.1.77

Diagnostic features : Body cylindrical and vermiform. Anal operculum with two spinous outgrowths. Caudal rami conical with lateral spinules. Antennule 7-segmented, with an aesthete on the fourth. Exopod of antenna one-segmented. Third exopod segment of P. 3 and second and third exopod segments of P. 4 bear modified

setae. P. 5 reduced to a narrow plate with 4 setae. P. 6 in male with 2 setae. Dark anal gland seen in female absent in male.

Measurements : Length 0.6 mm.

Remarks : The specimens agree well with the original description of the species from the beach sands of Waltair coast.

Habitat : Coarse and medium sand with fine shell gravel and little detritus between low and half-tide levels, intertidal zone.

Distribution : India, Lakshadweep, Andaman Islands.

Genus *Arenopontia* Kunz, 1937

119. *Arenopontia subterranea* Kunz

1937. *Arenopontia subterranea* Kunz, *Kieler Meeresforsch.*, 2 : 104.

Material examined : 1 ex., Puri, 21.1.77 ; 2 ex., Puri, 23.1.77 ; 1 ex., Bahuda estuary, 31.7.80.

Diagnostic features : Body cylindrical and vermiform. Caudal rami twice longer than wide. Antennule 6-segmented with an aesthete on fourth. Exopod of antenna one-segmented. Second endopod segment of P. 2 and P. 4 with a modified seta. P. 5 is a triangular plate with 4 setae. Caudal ramus twice longer than wide, with 2 lateral and 3 terminal setae. P.6 with an inner spine and an outer seta.

Measurements : Length 0.30-0.32.

Remarks : The specimens agree in all essential features with the original description of the species. Minor variations, however, occurred in the armature of appendages, particularly the shape of modified setae on the terminal exopod segment of P. 1 and the terminal endopod segment of P. 2 and P. 4. As the species is widely distributed, these variations are to be considered local.

Habitat : Medium sand with little detritus near mid-water level.

Distribution : North Atlantic, Mediterranean, Lakshadweep, India, Andaman Islands.

120. *Arenopontia indica* Rao

1967. *Arenopontia indica* Rao, *Crustaceana*, 13 : 9.

Material examined : 2 ex., Puri, 22.1.77 ; 1 ex., 23.1.77 ; 3 ex., Bahuda estuary, 31.7.80 ; 2 ex., Gopalpur, 29.1.77.

Diagnostic features : Body cylindrical and worm-like. Anal operculum prominent without setae. Antennule 6-segmented, the fourth with an aesthete. Exopod of antenna one-segmented with two terminal setae. Second endopod segment of P. 2 and P. 4 and third exopod segment of P. 4 with modified setae. P. 5 is a triangular plate with 4 setae. P. 6 in male a semicircular lamina with an inner spine and an outer seta. Caudal ramus with 4 setae and a terminal claw.

Measurements : Length 0.52-0.56 mm.

Remarks : The specimens examined correspond well with the original description of the species except for the presence of the spur on the inner side of ramus. The spur was reported on the outer side of ramus for the type specimens occurring on the Waltair coast.

Habitat : Medium sand with little detritus, intertidal zone.

Distribution : India, Lakshadweep, Andaman Islands.

Genus *Sewellina* Krishnaswamy, 1957

121. *Sewellina reductus* Krishnaswamy

1957. *Sewellina reductus* Krishnaswamy, *Studies on the Copepoda of Madras*, 96.

Material examined : 1 ex., Gopalpur, 14.7.80 ; 2 ex., Bahuda estuary, 27.8.80 ; 2 ex., Bahuda estuary, 31.7.80.

Diagnostic features : Body cylindrical with reduced and filiform appendages. Antennule 6-segmented with an aesthete on the fourth. Exopod of antenna rudimentary with two apical setae. P.1 uniramous with 3 segments. P.2 biramous, each with a single segment and a modified seta. P.5 is a triangular lamina with 3 setae. Caudal ramus thrice longer than wide with a terminal claw and 6 setae of varying length, the terminal seta being quite long.

Measurements : Length 0.50-0.52 mm.

Remarks : The specimens exhibited a considerable variation compared to the original description of the species in the body size, structure of caudal ramus, antennule, antenna and the setation on P.2-P.4. They, however, correspond well with the variation described for the species by Rao and Ganapati (1969) on Waltair coast.

Habitat : Medium sand near mid water level, intertidal zone.

Distribution : East coast of India.

Family LAOPHONTIDAE

Genus **Laophonte** Philippi, 1840

122. Laophonte cornuta Philippi

1840. *Laophonte cornuta* Philippi, *Arch. Naturgesch.*, 5 : 195.

Material examined : 3 ex., Gopalpur, 29.1.77 ; 1 ex., Bahuda estuary, 31.7.80.

Diagnostic features : Body linear with maximum width behind cephalothorax. Antennule 4-segmented with an aesthete on the third. Exopod of antenna 1-segmented with 2 setae. Caudal ramus elongate, variable in size and bears 4 setae. Endopod of P.1 ends in a claw. Terminal segment of exopod of P.2 with 3 marginal spines. P.5 biramous with exopod bearing 6 and endopod 5 setae.

Measurements : Length 0.42 mm.

Remarks : The species has been described from different geographical regions with considerable morphological variation (Lang, 1965), particularly in the anal operculum and the somatic ornamentation. Although the present specimens conform with the important characters of the species, variation is, however, observed with the ornamentation, antennule and caudal ramus. Because of the ubiquitous nature of the species, these variations are to be considered local.

Habitat : Algae and detritus sand, intertidal zone.

Distribution : Cosmopolitan.

Genus : **Quinquelaophonte** Well, Hicks and Coull, 1982

123. Quinquelaophonte quinquespinosa (Sewell)

1924. *Laophonte quinquespinosa* Sewell, *Mem. Indian Mus.*, 5 : 832.

Material examined : 2 ex., Rambha Bay, 28.8.80 ; 2 ex., Bahuada estuary, 26.9.80.

Diagnostic features : Body linear. Anal operculum with small spinules. Caudal rami twice as long as broad. Antennule 6-segmented, with an aesthete on the fourth. Exopod of antenna one small segment with 2 setae. Endopod of P.1 with 2 segments, prehensile and ends in a claw. Exopod of P.5 with 5-6 setae. P.6 a short lamina with 3 terminal setae. Maxilliped robust with a terminal claw.

Measurements : Length 0.60-0.68 mm.

Remarks : The specimens conform well with the original description of the species except for minor variations in abdominal ornamentation and setation on appendages.

Habitat : Surface mud in estuarine, brackish and salt waters.

Distribution : Widely distributed on the coasts of Mediterranean, Atlantic, Pacific and Indian Oceans.

Order ISOPODA

Family MICROPARASELLIDAE

Genus *Angeliara* Chappuis and Delamare, 1954

124. *Angeliara phreaticola* Chappuis and Delamare

1954. *Angeliara phreaticola* Chappuis and Delamare, *Arch. Zool. exp. gen.* 91 : 105.

Material examined : 2 ex., Puri, 21.1.77 ; 1 ex., Puri, 23.1.77 ; 1 ex., Konarak, 24.1.77 ; 2 ex., Gopalpur, 29.1.77 ; 1 ex., Bahuda estuary, 31.7.80.

Diagnostic features : Body long and vermiform. Thorax 7-segmented and abdomen 2-segmented. Uropod long and biramous, with 6 terminal setae. Eyes absent. Antennule 7-segmented and carries 2 aesthetes. Antenna 5-segmented, with an aesthete on last segment. Epipodite of maxilliped large and bract-like. Pereiopods all alike, 6-segmented and carry a pair of terminal claws. Second pleopod of male 2-jointed and modified for copulation. Viviparous and brood pouch external, carrying a single embryo. Active and thigmotactic, clinging to sand grains.

Measurements : Length 1.2-1.6 mm.

Remarks : The specimens correspond well in all the essential features with the original description of the species. Minor variation of the local forms was, however, observed in the setation of appendages.

Habitat : Coarse and medium sand with little detritus between low and half-tide levels, intertidal zone.

Distribution : Mediterranean, Madagascar, Lakshadweep, India.

Family ANTHURIDAE

Genus *Microcerberus* Karaman, 1933

125. *Microcerberus predatoris* (Gnanamuthu)

1954. *Robustura predatoris* Gnanamuthu, *Ann. Mag. Nat. Hist.*, 12 : 264.

Material examined : 3 ex., Puri, 22.1.77 ; 1 ex., Puri, 23.1.77 ; 1 ex., Gopalpur, 29.1.77 ; 2 ex., Bahuda estuary, 10.9.80.

Diagnostic features : Body long and vermiform. Antenna 10-segmented with an aesthete on the fifth and the last. Antennule 5-segmented with a terminal aesthete. Pereiopods 6-segmented with 2 terminal claws. Second pleopod of male 2-segmented with a terminal finger-like papilla. Uropod 2-segmented with reduced exopod and 6 terminal setae. Moderately thigmotactic and sluggish in habits. Eyes absent. Carnivorous.

Measurements : Length 1.0-1.2 mm.

Remarks : The specimens agree well with the original description of the species from the beach sands of Madras coast.

Habitat : Coarse sand with fine shell gravel and little detritus between low and half-tide levels, intertidal zone.

Distribution : Indian coast, Lakshadweep.

Phylum TARDIGRADA

Order HETEROTARDIGRADA

Family STYGARCTIDAE

Genus *Stygarcus* Schulz, 1951

126. *Stygarcus bradypus* Schulz

1951. *Stygarcus bradypus* Schultz, *Kieler Meeresforsch.*, 8 : 92.

Material examined : 1 ex., Puri, 22.1.77.

Diagnostic features : Body dorsoventrally flattened, divided into head and trunk with 4 segments. Head with a median and 3 pairs of lateral cirri, a pair of papillae and clava. Second trunk segment with 2 dorsal hooks with bifurcated tips. Fourth segment with 2 lateral bristles and 2 terminal spikes. Four pairs of legs, each with 4 digits, the median 2 carrying slender sensory bristles. Thigmotactic.

Measurements : Length 0.12-0.14 mm.

Remarks : The material examined corresponds well with the original description of the species with minor variations of the body armature, particularly in the structure of the dorsal hooks on second trunk segment. But, because of the wide distribution of the species, these variations are to be considered local.

Habitat : Medium sand 10 cm below surface towards mid-water level, intertidal zone.

Distribution : Baltic, North Sea, Mediterranean, India, Andaman Islands.

Family DISCOPODIDAE

Genus **Batillipes** Richters, 1909

127. **Batillipes carnionensis** Fize

1957. *Batillipes carnionensis* Fize, *Bull. Soc. Zool. Fr.*, 32 : 430.

Material examined : 2 ex., Puri, 22.1.77 ; 1 ex., Konarak, 24.1.77 ; 1 ex., Gopalpur, 31.1.77.

Diagnostic features : Body dorsoventrally flattened and triangular. Head with a pair of clava, a median and 3 pairs of lateral cirri. Cuticle finely striated. Posterolateral corners of body are widest with a pair of slender bristles. A caudal spine occurs posteriorly. Each leg with 6 fingers of varying length ending in adhesive discs.

Measurements : Length 0.10-0.12 mm.

Remarks : The specimens agree well with the original description of the species except for a variation in body size and the position of external buccal cirri. The local forms are smaller in size, with external buccal cirri located on lateral head lobes, while the type specimens showed their presence at the base of these lobes. The legs also bear a small dorsal spine not reported for the type specimens from Mediterranean Sea.

Habitat : Fine and medium sand with little detritus 5-10 cm below surface, intertidal zone.

Distribution : Mediterranean, Bay of Bengal.

Phylum **ARTHROPODA**

Class **Arachnida**

Order **ACARINA**

Family **HALACARIDAE**

Genus **Halacarus** Gosse, 1855

128. **Halacarus anomalus** Trouessart

1946. *Halacarus anomalus* Trouessart, *Faune de France*, 46 : 152.

Material examined : 3 ex., Puri, 22.1.77 ; 1 ex., Puri, 23.1.77 ; 2 ex., Bahuda estuary, 26.9.80.

Diagnostic features : Body spindle-shaped, with 2 legs disposed anteriorly and 2 legs posteriorly. Ocular plates absent. Genital plate separate from anal plate. Legs I-IV have 6 segments with 2 terminal claws bearing an accessory tooth. Bacillum and parabacillum present. A narrow transverse sclerite separates genital and anal plates.

Measurements : Length 0.28-0.32 mm.

Remarks : The specimens correspond well with the original description of the species. The local forms are, however, considerably smaller in size, as the European specimens are known to reach upto 0.60 mm in length. The body is linear to suit life between sand grains.

Habitat : Coarse and medium sands with little detritus between low and half-tide levels, intertidal zone.

Distribution : Widely distributed along the coasts of Mediterranean, Atlantic and Indian Oceans.

Phylum MOLLUSCA

Class Gastropoda

Order NUDIBRANCHIATA

Family PSEUDOVERMIDAE

Genus *Pseudovermis* Pariaslavzewa, 1891

***129. *Pseudovermis indicus* Salvini-Plawen and Rao**

1973. *Pseudovermis indicus* Salvini-Palwen and Rao, *Z. Morph. Tiere*, 74 : 237.

Material examined : 2 ex., Puri, 12.1.77 ; 1 ex., Bahuda estury, 26.9.80.

Diagnostic features : Body elongate and vermiform with 10 large asymmetrically arranged cerata. Eyes absent. Foot-sole indistinct. Radula with 30 transverse rows of plates, middle plate with 9 denticles. Lateral teeth one-pointed. Jaws with 15 denticles. Numerous hypodermal glands present and body highly thigmotactic.

Measurements : Length 2.6-3.0 mm.

Remarks : The specimens agree well with the original description of the species.

Habitat : Coarse sand with fine shell gravel and little detritus 5-10 cm below surface near low-water level.

Distribution : India, Lakshadweep, Andaman Islands.

Order ACOCHLIDIACEA

Family MICROHEDYLIDAE

Genus *Microhedyle* Hertling, 1930

130. *Microhedyle* sp.

Material examined : 1 ex., Puri, 21.1.77 ; 2 ex., Bahuda estuary, 10.9.80.

Description : Body elongate, cylindrical, highly contractile and adhesive. Head bears 2 linear tentacles, 2 thick palps and 2 small dark eye spots. Anterior 2/5 of the body linear, while the rest comprises long and robust visceral mass. A ventral finger-like foot present. Radula apparatus consists of 26-30 transverse rows of plates, with serrated median and pointed lateral teeth. Sexes separate. Penis absent. Hypodermal glands present. Body highly contractile and thigmotactic.

Measurements : Length 2.5-2.8 mm.

Remarks : In the structure of external features, the specimens examined approach *Microhedyle gerlachi* Marcus and Marcus (1959) described from Maldives in Indian Ocean. Specific identification of the material, however, needs further study.

Habitat : Coarse, detritus sands with fine shell gravel near low water level.

REMARKS ON DISTRIBUTION

The Orissa coast is mostly sandy and muddy interspersed at some places with shingles of rocks and algae in the littoral region. The temperature of surface water varies from 20°C to 30°C. Estuarine, marine and brackish conditions of sea water prevails along the coast. The salinity of the open waters is highly fluctuating due to the influx of large quantities of river waters during monsoon months. The marked fluctuations in salinity of coastal waters clearly indicate that the littoral meiofauna is predominantly euryhaline. Bulk of the beach sands on the coast are silicious and fall under the category of medium

and fine sands rich in organic detritus. Coarse sands with fine shell gravel and little detritus occur largely near low water level on steep beaches at exposed areas. Extensive flats of mud and fine muddy sand occur on the coast along estuaries, bays and other sheltered areas.

Moderately dense populations of meiofauna occur in the intertidal habitats on Orissa coast. The faunal composition and its abundance varied considerably at different tidal levels, habitats and localities along the coast, depending on the nature of the substratum. The sheltered situations generally supported the richest populations. Samples collected from lower tidal levels which are less exposed to desiccation during low tide yielded larger numbers of these animals. The total population densities of meiofauna recorded in the littoral habitats varied from 210 individuals/10 cm² to 2840 individuals/10 cm². Maximum concentrations of the meiofauna, however, occurred between the low and mid water levels of the intertidal zone upto 20 cm below surface in sandy sediments and 2 cm below surface in muddy sediments. Some meiofaunal submergence always occurred towards the high water level of the beach due to decreasing amount of water content in the upper layers of the sandy sediments. Similarly, the algal thalli and fronds supporting rich detritus in the lower levels yielded more number of individuals than those occurring on the higher tidal levels.

Most of the meiofaunal groups characteristic of the intertidal sand, mud and algae are encountered on the Orissa coast. As common in the intertidal habitats, the free-living Nematoda and Copepoda constituted the major groups comprising 60-80% of the total, while the Protozoan Ciliata, Hydrozoa, Turbellaria, Gastrotricha, Kinorhyncha, Nemertina, Rotifera, Archiannelida, Polychaeta, Oligochaeta, Ostracoda, Isopoda, Amphipoda, Tardigrada, Halacarida, Gastropoda and Holothuroida comprised the minor groups. The results of a quantitative estimation of the percentage composition of the fauna made on the three habitats of the Orissa coast are presented in Table 1. The Protozoan ciliates could not be correctly estimated owing to their small size and the difficulty of their preservation and enumeration. Of these three intertidal habitats, the sandy sediments, however, yielded the greatest variety of meiofauna on the Orissa coast.

The intertidal meiofaunal populations are known to have varying degrees of adaptation, which largely determines their preference to colonize and thrive in particular types of habitat. Due to this the

TABLE 1. Percentage composition of the diverse groups of meiofauna recorded on the three intertidal habitats on Orissa coast.

<i>Group</i>	<i>Sand</i>	<i>Mud</i>	<i>Algae</i>
Hydrozoa	0.4	—	—
Turbellaria	6.4	2.2	2.2
Gnathostomulida	2.0	—	—
Nematoda	31.6	62.4	34.8
Nemertina	0.2	—	0.2
Gastrotricha	6.0	1.2	0.2
Kinorhyncha	0.2	0.8	—
Rotifera	0.1	0.2	0.5
Archannelida	5.0	—	0.2
Polychaeta	6.4	2.1	4.8
Oligochaeta	1.2	0.4	—
Ostracoda	2.1	6.0	3.3
Copepoda	28.1	16.4	24.8
Isopoda	2.2	1.0	3.2
Amphipoda	1.4	1.2	14.0
Tardigrada	0.8	—	0.3
Halacarida	2.0	0.5	3.0
Gastropoda	0.2	1.2	4.8
Cumacea	0.6	0.4	0.2
Insect larvae	0.4	2.2	1.2
Others	2.0	1.8	2.4

composition and density of these populations varied considerably from habitat to habitat and from locality to locality along the Orissa coast. As characteristic of the intertidal habitats, a few successful meiofaunal species always dominated in their quantitative abundance, while the majority of the remaining species occurred in considerably smaller numbers. Some widely distributed species, however, occurred in different kinds of habitats, while the others are restricted in their distribution. The finer sediments of the sand and mud generally supported the larger populations of the nematodes, while the coarser sandy sediments showed a predominance of the copepods. The other minor groups of animals showed a distinct preference for coarser sandy sediments with adequate interstices, but they occurred more sporadi-

cally in mud and algae. As in other areas, beaches with fine muddy sand yielded poor collections due to inhospitable conditions of life. The detritus sands with abundance of food and requiring little specialization of the fauna, always favoured the colonization of a large number of species.

The composition and abundance of genera and species recorded on Orissa coast are more or less in close agreement with other regions explored on the Indian coast. An analysis of the zoogeography of the meiofauna of this coast shows that the faunal element is mostly dominated by the eurytopic species, which are widely distributed in the Indian Ocean as well as those of the warm temperate and tropical beaches. There are only a very few endemic species recorded for the Orissa coast. None of the genera are, however, endemic. Of the total 130 species dealt in the present paper, 16(12.4%) are cosmopolites, 45 (34.6%) eurytopics occurring on warm temperate and tropical beaches, 64 (49.2%) Indian Ocean forms and 5 (3.8%) endemics (Table 2). Thus, the Indian Ocean forms and the eurytopics are well

TABLE 2. Zoogeographical relationships of the intertidal meiofauna of Orissa coast.

<i>Group</i>	<i>Total number of species</i>	<i>Cosmopolitan species</i>	<i>Eurytopic species</i>	<i>Indian Ocean forms</i>	<i>Endemic species</i>
Hydrozoa	2	—	1	1	—
Turbellaria	4	1	2	1	—
Nematoda	27	6	9	12	—
Gastrotricha	22	—	6	12	4
Kinorhyncha	2	—	—	2	—
Archiannelida	12	1	4	7	—
Polychaeta	18	3	7	7	1
Ostracoda	1	—	1	—	—
Copepoda	35	5	12	18	—
Isopoda	2	—	—	2	—
Tardigrada	2	—	2	—	—
Halacarida	1	—	1	—	—
Mollusca	2	—	—	2	—
Total	130	16	45	64	5

represented on the Orissa coast. But, as several global areas still remain unexplored or underexplored, the present zoogeographical ranges of the meiofauna species are likely to change as more and more areas are investigated in the future, extending their distribution to other remote regions on this earth.

SUMMARY

The paper gives a systematic account of 130 species of meiofauna of the diverse groups collected on the Orissa coast, of which 68 species are recorded for the first time from this area, while 10 species are new to the Indian coast. The study also supplements the increasing evidence that many species of marine meiofauna are widely distributed on beaches along the warm temperate and tropical seas.

ACKNOWLEDGEMENTS

The author is grateful to the Director, Zoological Survey of India, Calcutta, for providing necessary facilities to carry out the present work.

REFERENCES

- AX, P. 1971. Neue interstitielle Macrostomida (Turbellaria) der Gattungen *Acanthomarostomum* and *Haplopharynx*. *Microfauna Meeresboden*, 8 : 1-14.
- GAMO, S. 1969. Notes on three species of harpacticoid Copepoda from Tanabe Bay. *Publ. Seto. mar. biol. Lab.*, 16 : 345-361.
- GERLACH, S. A. 1961. Gastrotrichen aus dem Meeresand der Malediven. *Zool. Anz.*, 167 : 471-475.
- GERLACH, S. A. 1962. Freilebende Meeresnematoden von den Malediven I. *Kieler Meeresforsch.*, 18 : 81-108.
- GERLACH, S. A. 1963. Freilebende Meeresnematoden von den Malediven II. *Kieler Meeresforsch.*, 19 : 67-103.
- GRAFF, L. 1913. Turbellaria II. Rhabdocoelida. *Das Tierreich*, 24 : 1-34.

- HULINGS, N. C. AND GRAY, J. S. 1971. A manual for the study of meiofauna. *Smithson. Contrib. Zool.*, 78 : 1-84.
- JOVIN, C. 1971. Status of the knowledge of the systematics and ecology of Archiannelida. *Smithson. Contrib. Zool.*, 76 : 47-56.
- LANG, 1965. Copepoda Harpacticoidea from the Californian pacific coast. *K. sevenka. Vetensk. Akad. Handl.*, 4 : 1-560.
- MEIXNER, 1925. Beitrag zur Morphologie und zum system der Turbellaria Rhabdocoela. *Z. Morphol. Okol.*, 3 : 255-343.
- NAGABHUSHANAM, A. K. AND RAO, G. C. 1969. Preliminary observations on a collection of shore fauna of Orissa coast, India. *Proc. Zool. Soc. Calcutta*, 22 : 67-82.
- NOODT, W. 1958. Die Copepoda Harpacticoidea der Brandeungsstrandes von Teneriffa. *Mathem. Naturv. Kl. Akad. Wiss. Lit. Mainz.*, 2 : 53-116.
- PATNAIK, S. 1971. Seasonal abundance and distribution of bottom fauna of the Chilka Lake. *J. Mar. Biol. Assoc. India*, 13 : 106-125.
- RAO, G. C. 1969. The marine interstitial fauna inhabiting the beach sands of Orissa coast. *J. Zool. Soc. India*, 21 : 19-104.
- RAO, G. C. 1975. *Halammohydra chauhani* n. sp. (Hydrozoa) from Andamans, India. *Dr. B. S. Chauhan Comm. Vol.*, 1 : 299-303.
- RAO, G. C. 1978. On a new species of *Hesionides* from Orissa coast, India. *Bull. Zool. Surv. India.*, 1 : 171-274.
- RAO, G. C. 1981. Three new species of gastrotrichs from Orissa coast, India. *Bull. Zool. Surv. India*, 3 : 137-143.
- RAO, G. C. AND GANAPATI, P. N. 1975. Report on the occurrence of an aberrant cnidarian *Halammohydra octopodides* in Indian waters. *Curr. Sci.*, 35 : 129-130.
- RAO, G. C. AND GANAPATI, P. N. 1968. On some archiannelids from the beach sands of Waltair coast. *Proc. Ind. Acad. Sci.*, 68 : 24-30.
- RAO, G. C. AND GANAPATI, P. N. 1969. On some interstitial copepods from the beach sands of Waltair coast. *Proc. Ind. Acad. Sci.*, 70 : 262-286.
- REMANE, A. 1928. *Nerillidium mediterraneum* und seine tiergeographische Bedeutung. *Zool. Anz.* 77 : 57-60.

- SARMA, A. L. N. AND RAO, D. G. 1980. The meiofauna of Chilka Lake (Brackish water lagoon). *Curr. Sci.*, **49** : 870-872.
- SARMA, A. L. N., SAIPATHY, S. AND RAO, D. G. 1981. Phytal macro and meiofauna of Chilka Lake. *Indian J. Mar. Sci.*, **10** : 61-65.
- SEWELL, R. B. S. 1940. Copepoda Harpacticoida. *Scient. Rep. John Murray Exped.*, **7** : 117-382.
- TIMM, R. W. 1961. Marine nematodes of the Bay of Bengal. *Proc. Pak. Acad. Sci.*, **1** : 25-88.
- WELLS, J. B. J. 1980. A revision of the genus *Longipedia* Claus (Crustacea : Copepoda : Harpacticoida). *Zool. J. Linn. Soc. Lond.*, **70** : 103-189.
- WIESER, W. 1959. Free-living nematodes and other small invertebrates of Puget Sound Beaches. *Wash. Publ. Biol.*, **19** : 1-179.

OLIGOCHAETA—A CHECKLIST

J. M. JULKA, B. K. SENAPATI* AND R. PALIWAL

*High Altitude Zoology Field Station,
Zoological Survey of India,
Solan—173 212, H. P., India.*

INTRODUCTION

The oligochaete fauna of Orissa is fairly well known. This article gives a comprehensive systematic list and a key for the identification of the Oligochaeta so far recorded from the area. For a detailed description, distribution and synonymy of the species the works of Brinkhurst and Jamieson (1971), Dash and Thambi (1978) and Dash (1983) for the microdrile Oligochaeta, and Gates (1972), Julka (1976, 1978) and Julka and Senapati (1987) for the megadrile Oligochaeta may be referred. In this work the classification of Oligochaeta into orders and suborders as proposed by Brinkhurst and Jamieson (1971) and the division of the suborder Lumbricina into superfamilies and families as given by Sims (1980) are followed.

KEY TO THE IDENTIFICATION OF OLIGOCHAETA OF ORISSA

1. Setae in four bundles per segment, usually numerous in each bundle (absent in <i>Achaeta</i>); small worms	...	2 (Microdrili)
Setae single, numerous arranged in rings or four pairs per segment; large worms	...	15 (Megadrili)
2. Spermathecal pores anterior to the segments bearing male pores, separated by a gap of five segments	...	3 (Fam. Enchytraeidae)
Spermathecal pores at least immediately in front or behind those bearing male pores	...	11

*School of Life Sciences, Sambalpur Univ., Burla 768017, Orissa.

3. Setae absent	...	<i>Achaeta nurmineni</i>	
Setae present	...	...	4
4. Setae forked at distal end	...	<i>Propappus</i> sp.	
Setae simple	...	...	5
5. Salivary glands present	...	...	6
Salivary glands absent	...	...	9
6. Salivary gland unpaired, dorsal	...	<i>Hemienchytraeus khallikotosus</i>	
Salivary glands paired	...	...	7
7. Dorsal pores present from vii ; medianmost pair of setae within the bundle shorter than the outer ones	...	...	8
Dorsal pores absent ; setae of equal length within the bundle	...	<i>Enchytraeus berhampurosus</i>	
8. Spermathecae communicating with oesophagus ; salivary glands simple or feebly ramified tubes	...	<i>Distichopus bulbosus</i>	
Spermathecae free ; salivary glands long and much coiled	...	<i>Distichopus k..linga</i>	
9. Setae straight or bent, 3 in each of dorsal and ventral bundles in preclitellar segments	...	<i>Stephensoniella barkudensis</i>	
Setae sigmoid, less than 3 in each of dorsal and ventral bundles in preclitellar segments	...	...	10
10. Setae 2 in each of dorsal and ventral bundles in all segments	...	<i>Marionina indica</i>	
Setae 1 or 2 in each of dorsal and ventral bundles in preclitellar segments, and 1 seta in all post-clitellar segments	...	<i>Marionina macfadyeni</i>	
11. Male pores on vi ; pectinate dorsal setae rarely present	...	<i>Allonais paraguayensis</i> (Fam. Naididae)	
Male pores on xi, pectinate dorsal setae frequently present	...	12 (Fam. Tubificidae)	
12. Dorsal and ventral unpaired gills present	...	<i>Branchiura sowerbyi</i>	
Gills absent	...	...	13
13. Prostates diffused ; male and spermathecal pores in median inversions of body wall ; coelomocytes abundant	...	<i>Monopylephorus parvus</i>	
Prostates solid with stalk-like attachment to atria or male ducts ; paired male and spermathecal pores not included in median inversions of body wall ; coelomocytes absent	...	...	14

14. Hair setae absent in dorsal bundles ; all dorsal needles bifid ; penis sheath cylindrical, much longer than broad, surrounded by spiral muscles	<i>Limnodrilus hoffmeisteri</i>	
Hair setae present ; anterior dorsal needles pectinate ; penis sheath often indistinct, tub-shaped	<i>Tubifex tubifex</i>	
15. Testes and male funnels intraseptal, male pores in 10/11, clitellum x-xiii	...	16 (Fam. Moniligastridae)
Testes and male funnels interseptal, male pores posterior to 10/11, clitellum in xiii and posteriad segments	...	18
16. Genital markings with central pores, internally with digitiform, prostate-like glands	...	17
Genital markings without central pores, internally with spheroidal to oval glands beneath longitudinal muscle layer	<i>Drawida calebi</i>	
17. Genital markings in 9/10, with glands shorter than prostates	<i>Drawida willsi</i>	
Genital markings usually close to spermathecal pores, rarely on ix and x, with glands longer than prostates	<i>Drawida limella</i>	
18. Male and spermathecal pores inconspicuous, prostates absent, body wall protuberant at maturity as paired longitudinal lamellar ridges ("wings") through clitellar segments	<i>Glyphidrilus tuberosus</i> (Fam. Almidae)	
Male and spermathecal pores distinct, prostates present, body wall not so modified	...	19
19. Prostates tubular	...	20
Prostates racemose	...	39 (Fam. Megascolecidae)
20. Last pair of hearts in ix, dorsal pores usually absent	...	21 (Fam. Ocnerodrilidae)
Last pair of hearts behind ix, dorsal pores usually present	...	27
21. Extramural calciferous glands paired in ix, gizzard absent	<i>Ocnerodrilus occidentalis</i>	
Extramural calciferous glands absent, gizzard present	...	22
22. One gizzard, in vii	...	23
Two gizzards, in vi-vii	<i>Deccania alba</i>	

23.	Male pores on xvii, spermathecal pores in 8/9, prostates one pair	...	...	24
	Male pores on xviii, spermathecal pores in 7/8/9, prostates 2 pairs	...	...	25
24.	Holandric, seminal grooves absent	...	<i>Malabaria biprostata</i>	
	Metandric, male pores at anterior ends and prostatic pores at posterior ends of diagonally placed short seminal grooves	...	<i>Malabaria sulcata</i>	
25.	Genital markings present	...	...	26
	Genital markings absent	...	<i>Thatonia gracilis</i>	
26.	Genital markings on viii-x, 15/16-16/17, 19/20-21/22, internally with spheroidal glands	...	<i>Thatonia sambalpurenensis</i>	
	Genital markings on xxii, internally with prostate-like tubular glands	...	<i>Thatonia bolangirensis</i>	
27.	Holonephric, nephridia absent in preclitellar segments	...	<i>Pontodrilus bermudensis</i> (Fam. Acanthodrilidae)	
	Meronephric, nephridia present in preclitellar segments	...	28 (Fam. Octochaetidae)	
28.	One gizzard present	...	...	29
	Two gizzards present	...	...	35
29.	Discrete calciferous glands absent	..	...	30
	Discrete calciferous glands present	...	...	31
30.	Spermathecal pores at viii and ix, intestine begins in xiv, typhlosole in the form of a low ridge	...	<i>Ramiella bishambari</i>	
	Spermathecal pores in 7/8 and on ix, intestine begins in xv, typhlosole lamelliform	...	<i>Ramiella sundargarhensis</i>	
31.	Prostates one pair, male and prostatic pores on xvii, calciferous glands intramural, one pair in xii	...	...	32
	Prostates 2 pairs discharging on xvii and xix, male pores on xviii, calciferous glands extramural, one pair, usually asymmetrical, opening into gut at or close to the insertion of septum 15/16	...	...	33
32.	Holandric, male pores discharging directly onto the body surface on circular poropores, spermathecal pores in <i>bc</i>	...	<i>Eutyphoeus incommodus</i>	
	Metandric, male pores discharging within a vestibulum on posterior walls of conical penes, spermathecal pores in <i>ab</i>	...	<i>Eutyphoeus kherai</i>	

33. Holandric	...	...	34
Metandric	...	<i>Octochaetona beatrix</i>	
34. Last pair of hearts in xii, testes and male funnels free	...	<i>Octochaetona barkudensis</i>	
Last pair of hearts in xiii, testes and male funnels contained in cylindrical sacs	...	<i>Octochaetona surensis</i>	
35. Calciferous glands one pair, each gland trilobed with one vertical lobe in each of segments xv, xvi and xvii	...	...	36
Calciferous glands more than one pair, anterior to segment xiv	...	...	38
36. Female pore single, median ; genital markings absent	...	<i>Dichogaster bolau</i>	
Female pores paired	...	...	37
37. Median genital markings present	...	<i>Dichogaster affinis</i>	
Genital markings absent	...	<i>Dichogaster modiglianii</i>	
38. Calciferous glands 4 pairs in x-xiii, holandric, spermathecal pores on viii and ix	...	<i>Pellogaster bengalensis</i>	
Calciferous glands 3 pairs in x-xii, proandric, spermathecal pores on viii	...	<i>Lenogaster pusillus</i>	
39. Holonephric	...	...	40
Meronephric	...	...	42
40. Spermathecal pores 2 pairs in 7/8/9, nephridia aversiculate, nephridiopores in one rather irregular rank on each side	...	...	41
Spermathecal pores 3 pairs in 6/7/8/9, nephridia vesiculate, nephridiopores alternating in position in successive segments on each side	...	<i>Perionyx sansibaricus</i>	
41. Last pair of hearts in xii	...	<i>Perionyx excavatus</i>	
Last pair of hearts in xiii	...	<i>Perionyx millardi</i>	
42. Gizzard in v, spermathecae bidiverticulate, male pores discharging directly on to the body surface, penial setae present	...	<i>Lampito mauritii</i>	
Gizzard posterior to septum 7/8, spermathecae unidiverticulate, male pores discharging within copulatory pouches, penial setae absent	...	...	43
43. Lateral intestinal caeca absent ; spermathecal pores in batteries (polythecal)	...	<i>Polypheretima elongata</i>	
Lateral intestinal caeca present ; spermathecal pores not in batteries	...	...	44

44. Septum 8/9 present and muscularized, spermathecal pores 4 pairs opening slightly anterior to 5/6-8/9, genital markings paired usually on xvii and xix, slightly median to male pore lines ... *Metaphire posthuma*
- Septum 8/9 absent, spermathecal pores 2 pairs opening on vii and viii close to 6/7/8, genital markings 1-4 slightly median to each spermathecal pore on vii-viii, 8-13 on roof and walls of each copulatory pouch ... *Metaphire planata*

SYSTEMATIC LIST OF OLIGOCHAETA OF ORISSA

Order : **Moniligastrida**
Family : **MONILIGASTRIDAE**

1. **Drawida calebi** Gates

1945. *Drawida calebi* Gates, *Proc. Indian Acad. Sci.*, 21(B) : 211.

Distribution : INDIA : Orissa : Wide-spread ; Madhya Pradesh ; Uttar Pradesh ; Karnataka.

2. **Drawida limella** Gates

1934. *Drawida limella* Gates, *Rec. Indian Mus.*, 36 : 241.

Distribution : INDIA : Orissa : Wide-spread ; Assam ; Andhra Pradesh.

3. **Drawida willsi** Michaelsen

1907. *Drawida willsi* Michaelsen, *Mitt. naturh. Mus. Hamb.*, 24 : 145.

Distribution : INDIA : Orissa : Wide-spread ; Madhya Pradesh ; Andhra Pradesh ; Uttar Pradesh.

Order : **Haplotaxida**
Suborder : **TUBIFICINA**
Superfamily : **ENCHYTRAEOIDEA**
Family : **ENCHYTRAEIDAE**

4. **Achaeta nurmineni** Dash and Thambi

1978. *Achaeta nurmineni* Dash and Thambi, *Rev. Ecol. Biol. Sol.*, 15 : 133.

Distribution : INDIA : Orissa : Ganjam District.

5. **Distichopus bulbosus** (Rosa)

1887. *Neoenchytraeus bulbosus* Rosa, *Boll. Mus. Zool. Anat. comp. Univ. Torino*, 2, No. 29.

Distribution : INDIA : Orissa : Puri and Konarak Coasts. Elsewhere : Pakistan.

6. **Distichopus kalinga** (Dash, Nanda and Thambi)

1978. *Fridericia kalinga* Dash, Nanda and Thambi, *Indian Biol.*, 10 (2) : 35.

Distribution : INDIA : Orissa : Phulbani, Jharsuguda.

7. **Enchytraeus berhampurosus** Dash and Thambi

1978. *Enchytraeus berhampurosus* Dash and Thambi, *Rev. Ecol. Biol. Sol.*, 15 : 132.

Distribution : INDIA : Orissa : Ganjam District.

8. **Hemienchytraeus khallikotosus** Dash and Thambi

1978. *Hemienchytraeus khallikotosus* Dash and Thambi, *Rev. Ecol. Biol. Sol.*, 15 : 131.

Distribution : INDIA : Orissa : Ganjam District.

9. **Marionina indica** Dash and Thambi

1978. *Marionina indica* Dash and Thambi, *Rev. Ecol. Biol. Sol.*, 15 : 130.

Distribution : INDIA : Orissa : Ganjam District.

10. **Marionina macfadyeni** Dash and Thambi

1978. *Marionina macfadyeni* Dash and Thambi, *Rev. Ecol. Biol. Sol.*, 15 : 130.

Distribution : INDIA : Orissa : Ganjam District.

11. **Propappus** sp.

1969. *Propappus* sp., Rao, *J. zool. Soc. India*, 21 : 98.

Distribution : INDIA : Orissa : Puri and Konarak Coasts.

12. **Stephensoniella barkudensis** (Stephenson)

1915. *Enchytraeus barkudensis* Stephenson, *Mem. Indian Mus.*, 5 : 142.

Distribution : INDIA : Orissa : Barkuda Island, Chilka Lake, Puri and Konarak Coasts ; Tamil Nadu.

Superfamily : TUBIFICOIDEA

Family : TUBIFICIDAE

13. *Branchiura sowerbyi* Beddard

1892. *Branchiura sowerbyi* Beddard, *Q. Jl. microsc. Sci.*, 33 : 325.

Distribution : INDIA : Orissa : Present new record from Ladukhai in marshy habitat rich in organic matter, Cuttack, Sambalpur, Burla (several ex., coll. B. K. Senapati) ; West Bengal ; Tamil Nadu ; Uttar Pradesh ; Manipur ; Assam. Elsewhere : Cosmopolitan.

14. *Limnodrilus hoffmeisteri* Claparede

1862. *Limnodrilus hoffmeisteri* Claparede, *Mem. Soc. Phys. Hist. nat. Geneve.*, 16 : 217.

Distribution : INDIA : Orissa : Cuttack fish ponds ; West Bengal ; Jammu & Kashmir ; S. India. Elsewhere : Cosmopolitan.

15. *Monopylephorus parvus* Ditlevsen

1904. *Monopylephorus parvus* Ditlevsen, *Z. wiss. Zool.*, 77 : 427.

Distribution : INDIA : Orissa : Barkuda Island, Chilka Lake. Elsewhere : Cosmopolitan, brackish water.

16. *Tubifex tubifex* (Muller)

1774. *Lumbricus tubifex* Muller, *Vermium terrestrium et fluviatilium* : 27.

Distribution : INDIA : Orissa : Bargarh, Cuttack, Ladukhai, Sambalpur (First record from Orissa several examples collected from ditches and drains with organic matter by B. K. Senapati) ; Tamil Nadu : Nilgiri Hills. Elsewhere : Cosmopolitan.

Family : NAIDIDAE

17. *Allonais paraguayensis* (Michaelsen)

1905. *Nais paraguayensis* Michaelsen, *Zoologica Stuttg.*, (18) 44 : 354.

Distribution : INDIA : Orissa : Barkuda Island, Chilka Lake ; West Bengal ; Bihar ; Madhya Pradesh ; South India. Elsewhere : Cosmopolitan.

Suborder : LUMBRICINA

Superfamily : GLOSSOSCOLECOIDEA

Family : ALMIDAE

18. *Glyphidrilus tuberosus* Stephenson

1916. *Glyphidrilus tuberosus* Stephenson, *Rec. Indian Mus.*, 12 : 349.

Distribution : INDIA : Orissa : Cuttack, Burla, Godbhaga, Ladukhai, Sundargarh, Surda ; West Bengal ; Tamil Nadu.

Superfamily : MEGASCOLCOIDEA

Family : OCNERODRILIDAE

19. *Deccania alba* Gates

1949. *Deccania alba* Gates, *Proc. Indian Acad. Sci.*, 30 (B) : 279.

Distribution : INDIA : Orissa ; Sambalpur, Bolangir ; Madhya Pradesh.

20. *Malabaria biprostata* Aiyer

1929. *Malabaria biprostata* Aiyer, *Rec. Indian Mus.*, 31 : 73.

Distribution : INDIA : Orissa : Burla, Godbhaga, Ladukhai ; Kerala.

21. *Malabaria sulcata* Gates

1945. *Malabaria sulcata* Gates, *Proc. Indian Acad. Sci.*, 21(B) : 218.

Distribution : INDIA : Orissa : Sundargarh, Jharsuguda, Sambalpur, Bolangir, Titlagarh ; Uttar Pradesh ; Madhya Pradesh.

22. *Ocnerodrilus occidentalis* Eisen

1878. *Ocnerodrilus occidentalis* Eisen, *Nova Acta R. Soc. Sci. Upsaliensis*, 3, 10(4) : 218.

Distribution : INDIA : Orissa : Wide-spread ; Uttar Pradesh ; Rajasthan ; Maharashtra ; Kerala ; Andaman Islands. Elsewhere : Cosmopolitan.

23. *Thatonia bolangirensis* Julka

1976. *Thatonia bolangirensis* Julka, *Mitt. zool. Mus. Berlin*, 52 : 326.

Distribution : INDIA : Orissa : Bolangir, Sundargarh.

24. *Thatonia gracilis* Gates

1942. *Thatonia gracilis* Gates, *Bull. Mus. comp. Zool. Harvard*, 89 : 101.

Distribution : INDIA : Orissa : Sambalpur, Bolangir ; Andaman Islands. Elsewhere : Burma.

25. *Thatonia sambalpurensis* Julka

1976. *Thatonia sambalpurensis* Julka, *Mitt. zool. Mus. Berlin*, 52 : 328.

Distribution : INDIA : Orissa : Sambalpur.

Family : ACANTHODRILIDAE

26. *Pontodrilus bermudensis* Beddard

1891. *Pontodrilus bermudensis* Beddard, *Ann. Mag. nat. Hist., ser. 6*, 7 : 96.

Distribution : INDIA : Orissa : Chilka Lake ; Andhra Pradesh ; Tamil Nadu ; Kerala ; Maharashtra ; Goa ; Andaman and Nicobar Islands ; Laccadives & Maldives. Elsewhere : Cosmopolitan in the coastal areas.

Family : OCTOCHAETIDAE

27. *Dichogaster affinis* (Michaelsen)

1890. *Benhamia affinis* Michaelsen, *Jb. hamb. wiss. Anst.*, 7 : 29.

Distribution : INDIA : Orissa : Antrakyari nr. Balugaon ; Arunachal Pradesh ; Meghalaya ; Madhya Pradesh ; Gujarat ; Maharashtra ; Karnataka ; Kerala. Elsewhere : Southern Hemisphere.

28. *Dichogaster bolavi* (Michaelsen)

1891. *Benhamia bolavi* Michaelsen, *Jb. hamb. wiss. Anst.*, 8 : 9.

Distribution : INDIA : Orissa : Wide-spread ; all over the country. Elsewhere : Cosmopolitan.

29. *Dichogaster modiglianii* (Rosa)

1896. *Benhamia modiglianii* Rosa, *Ann. Mus. Sto. Nat. Genova*, 36 : 510.

Distribution : INDIA : Orissa : Sundargarh ; West Bengal ; Meghalaya ; Andaman & Nicobar Islands. Elsewhere : Southern Hemisphere.

30. Eutyphoeus incommodus (Beddard)

1910. *Typhoeus incommodus* Beddard, *Proc. zool. Soc. Lond.*, 1901 : 200.

Distribution : INDIA : Orissa : Deogarh and Padhanpat Water Fall in Sambalpur district ; Indo-Gangetic Plains.

31. Eutyphoeus kherai Julka

1978. *Eutyphoeus kherai* Julka, *Mitt. zool. Mus. Berlin*, 54 : 191.

Distribution : INDIA : Orissa : Bisoi, range extended to Bhadrak in Balasore district (4 clitellate specimens collected by B. K. Senapati, Sept 1985).

32. Lennogaster pusillus (Stephenson)

1920. *Eudichogaster pusillus* Stephenson, *Mem. Indian Mus.*, 7 : 253.

Distribution : INDIA : Orissa : Wide-spread ; Uttar Pradesh ; Madhya Pradesh ; Himachal Pradesh ; Karnataka.

33. Octochaetona barkudensis (Stephenson)

1916. *Octochaetus barkudensis* Stephenson, *Rec. Indian Mus.*, 12 : 340.

Distribution : INDIA : Orissa : Wide-spread.

34. Octochaetona beatrix (Beddard)

1902. *Octochaetus beatrix* Beddard, *Ann. Mag. nat. Hist.*, ser. 7, 9 : 456.

Distribution : INDIA : Orissa : Wide-spread ; all over the country. Elsewhere : Burma, Nepal, Pakistan, Malay Peninsula, Philippine Islands.

35. Octochaetona surensis (Michaelson)

1910. *Octochaetus surensis* Michaelson, *Abh. Geb. Naturw. Hamburg*, 19 (5) : 88.

Distribution : INDIA : Orissa : Wide-spread ; Uttar Pradesh ; Madhya Pradesh ; Assam. Elsewhere : Burma.

36. Pellogaster bengalensis (Michaelson)

1910. *Eudichogaster bengalensis* Michaelson, *Abh. Geb. Naturw. Hamburg*, 19 (5) : 96.

Distribution : INDIA : Orissa : Wide-spread ; West Bengal ; Madhya Pradesh.

37. *Ramiella bishambari* (Stephenson)

1914. *Octochaetus bishambari* Stephenson, *Rec. Indian Mus.*, 10 : 347.

Distribution : INDIA : Orissa : Balugaon, Sundargarh, Titlagarh, Ushakothi ; Uttar Pradesh ; Madhya Pradesh ; Andaman & Nicobar Islands. Elsewhere : Pakistan, Burma, Christmas Island, Philippines, ? China.

38. *Ramiella sundargarhensis* Julka

1978. *Ramiella sundargarhensis* Julka, *Mitt. zool. Mus. Berlin*, 54 : 190.

Distribution : INDIA : Orissa : Sundargarh, Burla, Godbhaga, Jyoti Vihar, Ushakothi.

Family : MEGASCOLECIDAE

39. *Lampito mauritii* Kinberg

1866. *Lampito mauritii* Kinberg, *Ofvers. K. Vetens. Akad. Forhandl. Stockholm*, 23 : 103.

Distribution : INDIA : Orissa : Wide-spread ; all over the country. Elsewhere : S. E. Asia, China, Hongkong, Pacific Islands.

40. *Metaphire planata* (Gates)

1926. *Pheretima planata* Gates, *Ann. Mag. nat. Hist., Ser. 9*, 17 : 411.

Distribution : INDIA : Orissa : Jharsuguda ; Assam ; West Bengal ; Andaman Islands. Elsewhere : Burma, Bangla Desh, Thailand, Malaysia.

41. *Metaphire posthuma* (Vaillant)

1868. *Pheretima posthuma* Vaillant, *Annls. Sci. nat. (ser. 5)*, 10 : 228.

Distribution : INDIA : Orissa : Baleswar, Sundargarh ; Indo-Gang-etic Plains ; Maharashtra ; Andaman & Nicobar Islands. Elsewhere : Pakistan, S. E. Asia, Philippines, U. S. A.

42. *Perionyx excavatus* Perrier

1872. *Perionyx excavatus* Perrier, *Nouv. Archs Mus. Hist. nat. Paris*, 8 : 126.

Distribution : INDIA : Orissa : Sambalpur, Burla, Bargarh, Jyoti Vihar, Rajgangpur, Sundargarh ; Assam ; Arunachal Pradesh ; West Bengal ; Uttar Pradesh ; Himachal Pradesh ; Maharashtra ; Andaman & Nicobar Islands. Elsewhere : Widely transported successful colonization restricted to tropical lowlands from Madagascar east to Hawaiian Islands.

43. *Perionyx millardi* Stephenson

1915. *Perionyx millardi* Stephenson, *Mem. Indian Mus.*, 6 : 74.

Distribution : INDIA : Orissa : Brajarajpur, Chilka, Sambalpur, Jagatsinghpur, Burla, Jyoti Vihar ; Maharashtra ; Madhya Pradesh.

44. *Perionyx sansibaricus* Michaelsen

1891. *Perionyx sansibaricus* Michaelsen, *Mitt. naturh. Mus. Hamb.*, 9 : 4.

Distribution : INDIA : Orissa : Jharsuguda ; Maharashtra ; Gujarat ; Madhya Pradesh ; Uttar Pradesh ; Tamil Nadu ; Kerala. Elsewhere : Zanzibar.

45. *Polypheretima elongata* (Perrier)

1872. *Perichaeta elongata* Perrier, *Nouv. Archs Mus. Hist. nat. Paris*, 8 : 124.

Distribution : INDIA : Orissa : Sambalpur ; Maharashtra ; West Bengal ; Andhra Pradesh ; Karnataka ; Andaman Islands. Elsewhere : S. E. Asia, transported to other regions also.

ACKNOWLEDGEMENTS

The authors are grateful to the Director, Zoological Survey of India, Calcutta for providing necessary facilities for this work. One of the authors (B.K.S.) is thankful to Prof. M. C. Dash, School of Life Sciences, Sambalpur University for his constant encouragement.

REFERENCES

- BRINKHURST, R. O. AND JAMIESON, B. G. M. 1971. *Aquatic Oligochaeta of the world*. University of Toronto Press, Toronto and Buffalo : 1-860.
- DASH, M. C. 1983. *Biology of Enchytraeidae*. International Book Distributors, Dehra Dun : 1-171.
- DASH, M. C. AND THAMBI, A. V. 1978. Taxonomic Study of Enchytraeidae (Oligochaeta) from grassland soils of southern Orissa, India. *Rev. Ecol. Biol. Sol.*, 15 : 129-134.

- GATES, G. E. 1972. Burmese earthworms. An introduction to the systematics and biology of megadrile oligochaetes with special reference to Southeast Asia. *Trans. Am. phil. Soc.*, **62** : 1-326.
- JULKA, J. M. 1976. Studies on the earthworm fauna of Orissa (India). 1. Moniligastridae and Ocnerodrilidae. *Mitt. zool. Mus. Berlin*, **52** : 321-329.
- JULKA, J. M. 1978. Studies on the earthworm fauna of Orissa (India). 2. Megascolecidae, Octochaetidae and Microchaetidae. *Mitt. zool. Mus. Berlin*, **54** : 185-197.
- JULKA, J. M. AND SENAPATI, B. K. 1987. Earthworms (Oligochaeta : Annelida) of Orissa, India. *Rec. zool. Surv. India, Occ. Paper*, No. 92 : 1-49.
- SIMS, R. W. 1980. Classification and the distribution of earthworms suborder Lumbricina (Haplotaxida ; Oligochaeta). *Bull. Br. Mus. nat. Hist. (Zool.)*, **39**(2) : 103-124.

INSECTA : ORTHOPTERA : ACRIDOIDEA

S. K. TANDON and M. S. SHISHODIA

Zoological Survey of India, Calcutta

INTRODUCTION

Kirby (1914), in his volume on Acrididae under "Fauna of British India" series, has recorded a few species from the area now constituting the state Orissa. Recently Bhowmik (1983) has recorded some species of Acridids from Chilka lake area of Orissa. Besides this work no serious effort has been made to study this group of insects from this State. The present work was initiated to make a systematic study of the Acridoidea fauna with special reference to its detailed distribution, chiefly based on the large collections made by various survey parties of the Zoological Survey of India from 1971-1975, under a scheme of the Department for intensive faunistic survey of Orissa. We have also examined the earlier collections present in the National Zoological collections. For general topography and list of collecting localities reference may be made to introductory part of this volume.

The present paper deals with 55 species distributed over 43 genera and 4 families of which 31 species marked with asterisk are recorded for the first time from Orissa. Besides this, Bhowmik (supracit) has recorded *Acridella nasuta* (Linn.)*, *Choroedocus illustris* (Walker) and *Pachyacris violascens* (Walker) from Orissa. The above species were not found in the material which we have studied. Thus the total number of species known from Orissa so far is 58. This is the first comprehensive report on the Acridoidea fauna of Orissa in which key to genera from Orissa is given. We have also given notes for identification of individual species. The detailed distribution of each species is traced within Orissa and is supported by maps. The arrangement of families and subfamilies is after Dirsh, 1975.

* *Truxalis nasuta* (Linn.), Dirsh, 1951 : 206.

SYSTEMATIC ACCOUNT

Key to the Genera

1. Head acutely conical, with incurved frons ; fastigial furrow present ; external apical spine of hind tibiae absent ; lower basal lobe of hind femur usually longer than upper. ...	...	2
— Head variable in shape ; fastigial furrow absent ; external apical spine of hind tibiae present or absent ; lower basal lobe of hind femur usually shorter than or equal to upper one. ...	...	6
2. Anterior margin of prosternum strongly reflexed and dilated ; body short and stout ; pronotum heavily rugosed and much widened behind ; posterior femora stout. ...	<i>Chrotogonus</i> Serville	
— Anterior margin of prosternum neither reflexed nor dilated ; body moderately slender ; pronotum may or may not rugose and not much widened behind ; posterior femora not so stout. ...	...	3
3. Body medium and slender ; antennae remote from the eyes, placed in front of the ocelli. ...	<i>Atractomorpha</i> Saussure	
— Body medium to large ; antennae placed near the eyes and inserted below the ocelli. ...	...	4
4. Body large ; outer apical spine of posterior tibiae very distinct. ...	...	5
— Body medium ; outer apical spine of posterior tibiae absent. ...	<i>Pyrgomorpha</i> Serville	
5. Fastigium of vertex less extended in front of the eyes ; pronotum strongly tuberculated or rugosed. ...	<i>Aularches</i> Stal	
— Fastigium of vertex a little more extended in front of the eyes ; pronotum neither tuberculated nor rugosed. ...	<i>Poecilocerus</i> Serville	
6. Prosternal tubercle absent. ...	...	7
— Prosternal tubercle present. ...	...	23
7. Face more or less oblique, usually meeting the vertex at an acute angle. ...	...	8
— Face nearly or quite vertical, forming with the vertex a rounded arch. ...	...	14
8. Stridulatory serration on internal side of hind femur distinctly present. ...	...	9
— Stridulatory serration on internal side of hind femur not distinct or absent. ...	...	11

9. Size large ; head conically ascending ; fastigium broad, laminate and truncate at apex ; antennae ensiform	...	<i>Truxalis</i> Fabricius	
— Size small to medium ; head not ascending ; fastigium narrow, not truncate at apex ; antennae filiform	...	...	10
10. Fastigial foveolae of vertex not visible from above, apex more or less angular	...	<i>Leva</i> Bolivar	
— Fastigial foveolae visible from above, apex not pointed	...	<i>Aulacobothrus</i> Bolivar	
11. Size large ; head long, conically ascending ; fastigium of vertex extended much in front of the eyes, broad and truncated at apex ; antennae ensiform	...	<i>Acrida</i> Linnaeus	
— Size medium ; head not ascending ; fastigium broad or narrow, more or less rounded at the apex ; antennae may or may not ensiform.	...	...	12
12. Antennae always ensiform ; lateral carinae of pronotum straight and parallel.	...	<i>Phlaeoba</i> Stål	
— Antennae filiform ; lateral carinae of pronotum not straight and parallel.	...	...	13
13. Pronotum constricted in prozona ; lateral carinae of pronotum not parallel in prozona ; foveolae of fastigium long, linear, visible from above.	...	<i>Aiolopus</i> Fieber	
14. Median carina of pronotum cut by one transverse groove.	...	...	15
— Median carina of pronotum cut by two transverse grooves.	...	...	22
15. Thorax Short.	...	...	16
— Thorax long.	...	...	21
16. Basal half of tegmina opaque.	...	...	17
— Basal and apical portion of tegmina subhyaline.		<i>Locusta</i> Linn.	
17. Transverse veins in apical part of tegmina erect, the cells square or oblong.	...	...	18
— Transverse veins of apical part of tegmina oblique, arranged zig-zag.	...	<i>Pternoscirta</i> Saussure	
18. Posterior pair of wings without well marked fascia.	...	...	19
— Posterior pair of wings with well marked fascia.	...	...	29

19. Internal calcaria of posterior tibiae not greatly unequal, normal. ...	<i>Dittopternis</i> Saussure	
— Internal calcaria of posterior tibiae unequal, the lower one much longer than the upper, apex acute and abruptly hooked. ...	<i>Heteropternis</i> Stål ^o	
20. Pronotum with pale marks arranged so as to form 'X' mark. ...	<i>Oedaleus</i> Fieber	
— Pronotum without 'X' mark. ...	...	21
21. Pronotum with well marked median carina, and with numerous longitudinal rugae. ...	<i>Morphacris</i> Walker	
— Pronotum with strong crest or acutely tectiform, without rugae ; wings without black colour at apex. ...	<i>Gastrimargus</i> Saussure	
22. Pronotum without very distinct crest, short, broadly rounded behind or very little angular. ...	<i>Acrotylus</i> Fieber	
— Pronotum with well marked crest, strongly bilobed in front when viewed side way. ...	<i>Trilophidia</i> Stål ^o	
23. Lower basal lobe of hind femur as long as upper one or only a little shorter or longer ; pronotum with a very high crest, compressed, covering a part of abdomen. ...	<i>Teratodes</i> Brulle	
— Lower basal lobe of hind femur distinctly shorter than the upper one ; pronotum normal. ...	...	24
24. Radial area of tegmen with a series of regular, parallel stridulatory veinlets. ...	...	25
— Stridulatory veinlets of radial area of tegmen absent. ...	...	28
25. Prosternal process spatulate ; head conical ; fastigium of vertex obtusely angular ; antennae shorter than head and pronotum ; tegmina with a patch of densely placed transverse nervures at the parting of the radial veins. ...	<i>Spathosternum</i> Karsch	
— Prosternal process not spatulate ; head not conical ; fastigium of vertex not angular ; tegmina without a patch of nervures at the parting of the radial veins. ...	...	26
26. Size medium ; head small ; fastigium longer at apex, obtusely triangular. ...	<i>Gesonula</i> Uvarov	
— Size medium ; head small or big ; fastigium of vertex not triangular at apex. ...	...	27

27. Head short and very broad ; face broader than long ; pronotum constricted in prozona ; tegmina and wings fully developed. ...	<i>Clonacris</i> Uvarov	
— Head normal ; face not broader than long ; pronotum not constricted in prozona ; tegmina and wings fully developed or brachypterus. ...	<i>Hieroglyphus</i> Krauss	
28. Lower external lobe of hind knee with spine like apex. ...	<i>Oxya</i> Serville	
— Lower external lobe of hind knee with apex rounded, angular or subacute, but spine like. ...	...	29
29. Last abdominal tergite in male (in majority of genera) with well developed furcula ; supra-anal plate mostly with attenuate or trilobate apex ; subgenital plate with transverse fold. ...	...	30
— Last abdominal tergite in male without well developed furcula ; supra-anal 1 plate variable ; subgenital plate without transverse fold. ...	...	31
30. Frontal ridge scarcely or only moderately narrowed at apex ; median carina of pronotum low, linear, interrupted by all the three transverse sulci. ...	<i>Eucoptacra</i> Bolivar	
— Frontal ridge at apex narrowed almost to a point ; median carina of pronotum well raised, interrupted by posterior transverse sulcus only ...	<i>Epistaurus</i> Bolivar	
31. Mesosternal interspace closed. ...	...	32
— Mesosternal interspace open. ...	...	33
32. Size large and slender ; prosternal process compressed laterally, apex slightly bent backwards, not quite reaching the anterior margin of mesosternum, conical or subtruncate. ...	<i>Oxyrrhepes</i> Stål	
— Size medium ; prosternal process broad, strongly widened towards apex, with square, flat or slightly concave apical surface, curved backwards, almost touching the anterior margin of mesosternum. ...	<i>Tristria</i> Stål	
33. Mesosternal lobes rounded or obtusangular. ...	...	34
— Mesosternal lobes rectangular. ...	...	41
34. Male cerci pincers-like, strong, regularly incurved ; hind femur short and widened. ...	<i>Brachyxenla</i> Kirby	
— Male cerci variable, but not pincers like hind femur normal. ...	...	35

35. Dorsum of pronotum flat or weakly tectiform, with median and lateral carinae linear, lateral carinae sometimes obliterated ; male cercus with strongly compressed, lobiform or subacute, downcurved apex. ... 36
- Dorsum of pronotum of variable shape ; lateral carinae, if present, not linear ; male cercus variable, but not with strongly compressed, lobiform or subacute, downcurved apex. ... 38
36. Hind femur comparatively slender, much narrowed towards knees ; prosternal tubercle bilobed at apex. ... *Tylotropidius* Stål
- Hind femur normal and not much narrowed towards knees ; prosternal tubercle not bilobed at apex. ... 37
37. Size medium ; cerci large, wide, compressed, incurved and downcurved with rounded or subacute apex ; subgenital plate with wide, sometimes bilobate apex. ... *Heteracris* Walker
- Size large ; cerci very, large, flattened, compressed, slightly incurved, upper margin rather thick and rounded ; lower and hind margin thin, inner surface with an oval impression in the apical half ; subgenital plate conical, slightly recurved, truncate, subtruncate or rounded at top. ... *Choroedocus* Bolivar
38. Pronotum not constricted in the middle. ... 39
- Pronotum at least slightly constricted in the middle. ... 40
39. Prosternal tubercle not compressed laterally, or if slightly compressed, then narrow, triangular in profile ; body and hind femur not slender. ... *Catantops* Schaum
- Prosternal tubercle compressed laterally, in profile broad and curved backwards ; body and hind femur slender. ... *Stenocatantops* Dirsh
40. Frons in profile straight ; male cercus scarcely upcurved, almost straight. ... *Xenocatantops* Dirsh
- Frons in profile incurved ; male cercus slightly downcurved. ... *Pirithoicus* Uvarov
41. Prosternal tubercle straight, vertical or slightly inclined backwards in the direction of mesosternum, far from reaching the latter, conical, or compressed. ... 42

- Prosternal tubercle strongly curved backwards, touching or almost touching mesosternum, inflated in middle, with acutely or subacutely apex ... 44
- 42. Frontal ridge in both sexes slightly expanded above the median ocellus ; subgenital plate in male trilobate. ... *Anacridium* Uvarov
- Frontal ridge in both sexes not expanded above median ocellus, its margins almost parallel to each other ; subgenital plate in male conical, pointed without apical incisions. ... 43
- 43. Tegmina with oblique venation in apical part, transverse veins situated obliquely to principal veins ; prosternal process conical, male cercus elongate conical ; male subgenital plate acuminate, apex pointed. ... *Pachyacris* Uvarov
- Tegmina with straight venation in apical part, transverse veins forming almost right angle with principal veins ; prosternal process almost cylindrical, with rounded apex. ... *Patanga* Uvarov
- 44. Pronotum strongly tectiform ; integument strongly rugose ; median carina of pronotum sharp ; male cercus incurved at base, about half as wide as its length. ... *Chondracris* Uvarov
- Pronotum moderately tectiform, slightly constricted ; integument fairly rugose, almost smooth ; male cercus with subacute apex. ... *Cyrtacanthacris* Walker

Family I. PYRGOMORPHIDAE

1. *Chrotogonus* (*Chrotogonus*) *trachypterus trachypterus* (Blanchard)

1836. *Ommexecha trachypterus* Blanchard, *Annls. Soc. ent. Fr.*, 5 : 618.
 1914. *Chrotogonus trachypterus* : Kirby, *Faun. Brit. India Orth.* (Acrididae) : 165.
 1959. *Chrotogonus* (Ch.) *trachypterus trachypterus* : Kevan, *Publcoes cult. Co. Diam. Angola*, no. 43 : 147.

Material examined : *Mayurbhanj Dist.*—Bisoi, 13, 16 and 17.viii. 1972, 2 ♀ ♀, 2 ♂ ♂, Bangriposi, 13.ix.1972, 27 ♂ ♂ and 9 ♀ ♀, 14.ix. 1972, 3 ♂ ♂ and 2 ♀ ♀, 15.ix.1972, 14 ♂ ♂ and 13 ♀ ♀, 16.ix.1972, 11 ♂ ♂ and 12 ♀ ♀, 17.ix.1972, 19 ♂ ♂ and 17 ♀ ♀ ; Baripada, 5.iv. 1973, 2 ♂ ♂ and 2 ♀ ♀. *Keonjhar Dist.*—Padampur, 21.ix.1972, 4 ♂ ♂ and 3 ♀ ♀, Keonjhargarh, 23.ix.1972, 4 ♂ ♂ and 8 ♀ ♀ ; Tangerpada, 24.ix.1972, 6 ♀ ♀ ; Bharabhadarpur, 26.ix.1972, 15 ♂ ♂ and 18 ♀ ♀ ;

Soras, 26.ix.1972, 1 ♀ *Sundargarh Dist.*—Raurkela, 10.xii.1971, 1 ♂ ; Bonaigarh, 14.xii.1971, 1 ♀ ; Bhawani hill, 15.xii.1971, 6 ♂ ♂ and 6 ♀ ♀ ; Bonaigarh, 16.xii.1971, 5 ♂ ♂ and 7 ♀ ♀ , 17.xii.1971, 3 ♂ ♂ and 2 ♀ ♀ ; Bishalvari reserve forest, 9.i.1972, 1 ♂ ; Sundargarh town, 10.i.1972, 1 ♀ , 12.i.1972, 9 ♂ ♂ and 11 ♀ ♀ ; Bonaigarh, 19.vi.1972, 1 ♂ ; Sundargarh, 25.x.1972, 1 ♀ ; *Dhenkanal Dist.*—Angul, 30.ix.1972, 1 ♀ , 3.x.1972, 1 ♀ ; Shankarpur, 7.x.1972, 37 ♂ ♂ and 47 ♀ ♀ . *Sambalpur Dist.*—Dhanupali, 22.xii.1971, 3 ♂ ♂ and 2 ♀ ♀ ; Sonapali, 23.xii.1971, 4 ♂ ♂ ; Rairakhol, 26.xii.1971, 1 ♂ , 27.xii.1971, 1 ♂ and 1 ♀ ; Jharsuguda, 5.i.1972, 21 ♂ ♂ and 21 ♀ ♀ , 6.i.1972, 2 ♀ ♀ , 7.i.1972, 1 ♂ , and 4 ♀ ♀ , 1.ix.1972, 1 ♀ . *Bolangir Dist.*—Hathisalpara, 30.xii.1971, 1 ♂ and 2 ♀ ♀ ; Salapali, 1.i.1972, 4 ♂ ♂ and 5 ♀ ♀ ; Bolangir town, 2.i.1972, 4 ♂ ♂ and 18 ♀ ♀ , 3.i.1972, 1 ♂ , 10-12.ix.1972, 3 ♀ ♀ ; Titlagarh, 15-16.ix.1972, 15 ♂ ♂ and 1 ♀ . *Ganjam District.*—Barkuda Island, Chilka Lake, 3-19.viii.1919, 1 ♀ ; Nawrangapur, 14.ii.1972, 3 ♂ ♂ and 8 ♀ ♀ ; Gopalpur, 11.x.1972, 3 ♀ ♀ . *Kalahandi District*—Kundamal, 30.i.1972, 1 ♀ ; Asha sagar, Bhawanipatna, 31.i.1972, 2 ♂ ♂ ; Gutuma, 8.ii.1972, 1 ♀ . *Koraput District*—Semiliguda, 22.ii.1972, 2 ♀ ♀ ; Koraput, 25.ii.1972, 1 ♀ .

Remarks : This species can easily be identified in having hind wings hyaline or occasionally faintly tinged yellowish brown but never infumated or infuscated, apparently always fairly well developed and always at least two third as long as tegmina.

It is fairly well distributed in Orissa (Map, 1). In general it is widely distributed in the northern part of India and in south to about 16°N extending into Andhra Pradesh, often occurring at very considerable altitude in the north grading into subspecies *robertsi* in eastern Baluchistan. This species also occurs in Pakistan, Bangladesh and southern Nepal.

2. *Chrotogonus (Chrotogonus) oxypterus* (Blanchard)

1798. *Gryllus scaber* Fabricius, *Suppl. Ent. Syst.* : 196, no, 62-3 (nec Gmelin, 1788).
 1836. *Ommexecha oxypterus* Blanchard, *Annls Soc. ent. Fr.*, 5 : 622.
 1914. *Chrotogonus oxypterus* : Kirby, *Faun. Brit. India Orth.*, : 166.
 1959. *Chrotogonus (Chrotogonus) oxypterus* : Kevan, *Publ. cult. Comp. Diam. Angola*, no. 43 : 48.

Material examined : *Mayurbhanj Dist.*—Bangriposi, 13.ix.1973, 13.ix.1972, 1 ♂ and 1 ♀ , 15.ix.1972, 2 ♂ ♂ ; Mayurbhanj, 17.x.1972, 2 ♂ ♂ ,

and 2 ♀ ♀ ; Silwan, 25.ix.1972, 3 ♂ ♂ ; Ghatgaon, 29.iii. and 21.iv. 1973, 1 ♂ , 1 ♀ . *Sundargarh Dist.*—Raurkela, 25.x.1972, 1 ♀ . *Dhenkanal Dist.*—Angul, 10.iv.1973, 1 ♂ . *Koraput Dist.*—Jeypore, 24.xi.1973, 1 ♀ . *Cuttack Dist.*—Nandan Kanan, 27.iii.1974, 2 ♂ ♂ and 3 ♀ ♀ . *Ganjam Dist.*—Barkuda Island (Chilka lake), 3-19.viii.1914, 1 ♂ , 16.ix.1919, 2 ♀ ♀ .

Remarks : This species can easily be recognised in having hind wings always infumated to dark fuscous, never clear hyaline. Head large and broad.

It is fairly well distributed in Orissa and is more dominant in the northern region with only one record from southern district of Koraput (Map, 1). In general it is mainly confined to southern and central India to Bombay and Gujarat and to west and northeast to West Bengal and Bangladesh. It is also widely distributed in Sri Lanka.

3. *Poecilocus pictus* (Fabricius)

1775. *Gryllus pictus* Fabricius, *Syst. Ent.*, : 289.

1914. *Poecilocus pictus* : Kirby, *Faun. Brit. India, Orth.*, 1 : 172.

1966. *Poecilocus pictus* : Akbar, *Sind. Univ. Sci. Res. Journal.*, : 1.

Material examined : *Keonjhar Dist.*—Barahal, 25.ix.1972, 1 ♂ . *Sundargarh Dist.*—Sudargarh, 22.ix.1972, 1 ♀ . *Cuttack Dist.*—Bhubaneswar, 21.viii.1911, 1 ♂ , 18.i.1974, 1 ♂ and 4 ♀ ♀ . *Sambalpur Dist.*—Jharsuguda, 17.ix.1972, 5 ♂ ♂ and 3 ♀ ♀ ; Dhutra village, 10.ix.1972, 17 ♂ ♂ and 15 ♀ ♀ ; Brundamal Rly. Stn., 19.ix.1972, 4 ♂ ♂ and 4 ♀ ♀ ; Jharsuguda, 1.xi.1972, 6 ♂ ♂ and 3 ♀ ♀ ; *Puri Dist.*—Balighai, 18-20.viii.1911, 1 ♂ . *Bolangir Dist.*—Sahubagicha, 30.ix.1972, 2 ♂ ♂ , and 4 ♀ ♀ ; Titlagarh, 4.x.1972, 1 ♂ , and 3 ♀ ♀ , 15.xi.1972, 2 ♂ ♂ 2 ♀ ♀ .

Remarks : *P. pictus* is of large size with finely rugose integument. Body fusiform. Head and pronotum with faint median carina. Antennae blue black ringed with yellow beyond the basal third of their length. Pronotum with lateral carinae absent.

This species is rather limited in distribution in Orissa and we have found it only in few districts of Orissa (Map, 2). In general it is mainly confined to northern part of India but there are also

scattered records from Andhra Pradesh, Karnataka, Tamil Nadu in south while Maharashtra in Western part of India and West Bengal in eastern region. It is also recorded from Pakistan. It is generally found on AK plants (*Calotropis gigantea*) but it also feeds on various crops, vegetables and fruit plants and occasionally causes considerable damage by feeding on young plants.

4. *Aularches miliaris* (Linnaeus)

1758. *Gryllus* (*Locusta*) *miliaris* Linnaeus, *Syst. Nat.* (ed. x) 1 : 432.
 1873. *Aularches miliaris* : Stål, *Recens. Orth.*, 1 : 18.
 1914. *Aularches miliaris* : Kirby, *Faun. Brir. India Orth.*, (Acrididae) : 168.

Material examined : Mayurbhanj Dist.—Bisoi, 13.viii.1972, 1 ♀ .
 Keonjhar Dist.—Ghatgaon, 19.viii.1972, 4 ♀ ♀ ; Atei Reserve Forest, 20.viii.1972, 3 ♀ ♀ ; 21.viii.1972, 1 ♂ and 1 ♀ , 22.viii.1972, 4 ♀ ♀ , 23.viii.1972, 9 ♀ ♀ . Sundargarh Dist.—Ranibania Reserve Forest, 28.viii.1972, 1 ♂ . Puri Dist.—Barkul Hill, 11-13.xii.1972, 1 ♀ . Ganjam Dist.—Chilka Lake (Barkuda Island), 7-15.viii.1907, 1 ♂ .

Remarks : *A. miliaris* is of large size ; body stout. Head large, smooth, brownish with yellowish tinge or black. Pronotum strongly tuberculate with two large contiguous elevations in front.

This species is confined to few districts of north eastern region of Orissa (Map, 2). In India this grasshopper is distributed in parts of northern and southern regions especially in Uttar Pradesh, Jammu and Kashmir, Sikkim and Tamil Nadu. It is also known from Nepal, Sri Lanka and Indonesia (Java). We have also examined specimens of the species from Himachal Pradesh and Meghalaya. We have found this species in large numbers in small swarms at Shillong.

5. **Pyrgomorpha bispinosa bispinosa* (Walker)

1870. *Pyrgomorpha bispinosa* Walker, *Cat. Derm. Salt. Brit. Mus.*, 3 : 499.
 1914. *Pyrgomorpha bispinosa* : Kirby, *Fauna Brit. India Orth.*, (Acrididae), : 176.
 1975. *Pyrgomorpha bispinosa bispinosa* : Kevan, *Acrida*, 4 : 58.

Material examined : Sundargarh Dist.—Raurkela, 11.xii.1971, 1 ♀ ; Bonaigarh, 16.xii.1971, 1 ♂ and 1 ♀ ; 17.xii.1971, 1 ♂ and 5 ♀ ♀ ; Bishalvari Reserve Forest, 10.i.1972, 2 ♂ ♂ and 1 ♀ ; Subulia Khasra Forest, 10.i.1972, 1 ♂ and 1 ♀ ; Balijuri, 11.i.1972, 1 ♀ ; Sundargarh, 24.x.1972, 1 ♂ and 1 ♀ ; Cuttack Dist.—Nandankanan, 23.iii.1972,

1 ♂. *Dhenkanal Dist.*—Angul, 29.ix.1972, 1 ♀ ; Lingarajori (Angal) 3.x.1972, 2 ♂ ♂. *Sambalpur Dist.*—Sambalpur, 22.xii.1971, 2 ♂ ♂ and 2 ♀ ♀ ; Haldinallah, 27.xii.1971, 1 ♂. *Puri Dist.*—Puri, 1-5.xii.1910, 1 ♀. *Bolangir Dist.*—Hathisalpara, 30.xii.1971, 1 ♂ ; Salapali, 1.i.1972, 1 ♂ and 1 ♀ ; Gaundrial Village, 2.i.1972, 2 ♀ ♀ ; Bolangir, 3.i.1972, 1 ♂ and 1 ♀ ; Titlagarh, 24.x.1972, 1 ♂.

Remarks : *P. bispinosa bispinosa* is of medium size with lateral carinae of pronotum broken ; tegmina in some cases even in female, extend beyond the abdomen, postventral point of lateral pronotal lobe distinct but generally short.

It is well distributed in the northern region of Orissa as far as Panposh in the Sundargarh District while southern limit is in Titlagarh in central Bolangir Dist. (Map 2). In general the species is known from peninsular India and its extension into north east is of significance.

6. **Atractomorpha crenulata* (Fabricius)

1793. *Truxalis crenulata* Fabricius, *Ent. Syst.*, 2 : 28.

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

1969. *Atractomorpha crenulata* : Kevan and Chen, *Zool. J. Linn. Soc.*, 48 : 187.

Material examined ; Mayurbhanj Dist.—Baripada, 13.xi.1955, 1 ♂, 9.viii.1972, 1 ♀, 5.iv.1973, 1 ♂ ; Bangripasi, 13.ix.1972, 2 ♀ ♀, 14.ix.1972, 2 ♀ ♀, 17.ix.1972, 1 ♀. *Keonjhar Dist.*—Keonjhar, 20-23.ix.1972, 3 ♂ ♂, 2 ♀ ♀, 29.ix.1972, 3 ♂ ♂ ; Anandpur, 3.iv.1973, 2 ♂ ♂, 14.iv.1973, 2 ♂ ♂ ; Ghatgaon, 21.xii.1975, 1 ♂. *Sundargarh Dist.*—Raurkela, 9.xii.1971, 1 ♀, 10.xiii.1971, 1 ♀, 11.xii.1971, 2 ♂ ♂, 2 ♀ ♀ ; Bonaigarh, 13.xii.1971, 4 ♂ ♂, 5 ♀ ♀ ; Bhawani Hill Forest, 15.xii.1971, 1 ♀ ; Bonaigarh, 15.xii.1971, 1 ♂, 16.xii.1971, 3 ♂ ♂, 1 ♀, 17.xii.1971, 1 ♂ ; Balijuri village, 11.i.1972, 2 ♂ ♂ ; Sundargarh, 12.i.1972, 1 ♂, 1 ♀, 20.ix.1972, 1 ♀, 25.x.1972, 1 ♀, 26.x.1972, 1 ♂, 1 ♀, 28.x.1972, 2 ♂ ♂, 2 ♀ ♀ ; Panposh, 25.iii.1972, 2 ♀ ♀ ; Banki Camp Compound, 29.iii.1972, 5 ♂ ♂ and 6 ♀ ♀. *Cuttack Dist.*—C. R. R. I. Compound, 14.iv.1972, 2 ♂ ♂. *Dhenkanal Dist.*—Angul, 29.ix.1972, 1 ♀, 30.ix.1972, 2 ♀ ♀ ; Lingarajori, 3.x.1972, 2 ♀ ♀ ; Dhenkanal, 7.x.1972, 1 ♂, 3 ♀ ♀ ; Angul, 7.vi.1972, 1 ♂, 10.iv.1973, 2 ♂ ♂. *Sambalpur Dist.*—Sambalpur (near Mahanadi river bed), 19.xii.1971, 3 ♂ ♂ and 1 ♀ ; Dhanupali, 22.xii.1971, 8 ♂ ♂ & 6 ♀ ♀ ; Sonapali Village, 23.xii.

1971, 4♂♂, 2♀♀; Haldinallah and vicinity, 27.xi.1971, 3♂♂; Sundimunda village, 28.xii.1971, 1♀; Burapara village, (Jharsuguda), 5.i.1972, 12♂♂, 3♀♀; Jharsuguda, 7.i.1972, 2♂♂, 2♀♀; Sambalpur, 3, 4, 6.xi.1972, 2♂♂, 14♀♀; Deogarh, 23.iv.1973, 7♂♂, 7♀♀. *Puri Dist.*—Balighai, 16-20.viii.1911, 1♀; Bhubaneswar, 4-6.xii.1912, 1♂; Balugaon, 27-30.vii.1913, 1♂ and 2♀♀; Konark, 1♂ & 1♀; Balugaon, 17.iii.1974, 1♀; Nandankanan, 22, 27, 28.iii.1974, 5♀♀. *Bolangir Dist.*—Hathisalpara, 30.xii.1971, 7♂♂; Bolangir, 1.i.1972, 1♂, 1♀; Gaundrial village, 2.i.1972, 3♂♂ and 1♀; Mahakhand, 31.v.1972, 1♂; Bolangir, 11.xi.1972, 2♂♂ and 3♀♀; Titlagarh, 14.xi.1972, 2♂♂ and 2♀♀. *Ganjam Dist.*—Barkuda Island, 15-22.vii.1916, 1♀. *Kalahandi Dist.*—Ashasagar, 31.i.1972, 1♀; Bhawani Patna, 7.iii.1972, 2♀♀; Gutuma village, 8.iii.1972, 1♀. *Koraput Dist.*—Balliguda, 22.i.1972, 1♂; Koraput, 2.ii.1972, 1♂; Badchindri village, 21.ii.1972, 2♂♂.

Remarks: The size and colour of *Atractomorpha crenulata* is extremely variable. Specimens from Orissa are similar in shape and colour when compared to the examples from eastern region of India. Body generally slender, fastigium of vertex short, tegmina large and in having a well developed membranous area near the posterior margin of lateral lobes of pronotum. It feeds upon variety of host plants.

This species is fairly well distributed in Orissa (Map, 1) and is more dominant in the northern region with few records in the southern region in Koraput district and patch in central region. It is widely distributed in India and in the neighbouring Indo-Malayan sub-region.

Family II. ACRIDIDAE

Subfamily ACRIDINAE

7. *Acrida exaltata* (Walker)

1859. *Truxalis exaltata* Walker, *Ann. Mag. nat. Hist.*, (3) 4 : 222.

1914. *Acrida exaltata* : Kirby, *Faun. Brit. India Orth. (Acrididae)* : 99.

1954. *Acrida exaltata* : Dirsh, *Bull. Soc. Fouad. Ent.*, 38 : 49.

Material examined: *Mayurbhanj Dist.*—Bahadurpur, 13.ix.1972, 1♂; Bangriposi, 15.ix.1972, 1♀; Katra, 16.ix.1972, 1♂; Chandanpur, 16.ix.1972, 1♂; Simlipal hills, 13.xi.1972, 4♀♀; Bastapur, 15.xi.1972, 1♀; Joshipur, 16.xi.1972, 2♀♀; Lulong, 11.xii.1975, 1♀. *Keonjhar Dist.*—Ghatgaon, 23.viii.1972, 1♀; Kashipur, 19.ix.1972, 1♂;

Keonjhar, 20.ix.1972, 3 ♂♂ and 4 ♀♀, 21.ix.1972, 1 ♂, 3 ♀♀ ; Bankapatuli, 23.ix.1972, 9 ♂♂, 3 ♀♀ ; Barpachhi, 23.ix.1972, 5 ♂♂, 1 ♀ ; Tanagerpada, 24.ix.1972, 1 ♂, 1 ♀ ; Barahal, 25.ix.1972, 2 ♂♂ ; Silwan, 25.ix.1972, 1 ♂ ; Ghatgaon, 9.xi.1972, 2 ♀♀, 23.xii.1975, 1 ♀ ; Ashanput, 11.viii.1983, 1 ♂ ; Guptaganga, 13.viii.1983, 1 ♂. *Sundargarh Dist.*—Raurkela, 9.xii.1971, 1 ♀, 11.xii.1971 2 ♂♂ ; Bonaigarh, 13 & 14.xii.1971, 3 ♂♂ and 2 ♀♀, 15.xii.1971, 1 ♂ and 2 ♀♀, 16.xii.1971, 2 ♂♂, 17.xii.1971, 5 ♂♂ ; Barswan, 12.ix.1972, 1 ♂, 1 ♀ ; Sundargarh, 22.ix.1972, 3 ♂♂, 27.ix.1972, 1 ♂, 25.x.1972, 2 ♂♂, 26.x.1972, 4 ♂♂, 3 ♀♀ ; Panposh, 25.iii.1973, 1 ♀ ; Banki Camp Compound, 29.iii.1973, 1 ♂. *Cuttack Dist.*—Paradip, 30.i.1972, 1 ♂ ; Nandankanan Park, 23.iii.1974, 1 ♂ ; Raghunathpur, 25.ii.1974, 1 ♂ ; Cuttack, 14.iv.1973, 1 ♀. *Dhenkanal Dist.*—Dhenkanal, 5.i.1972, 1 ♂ ; Purnagarh, 29.ix.1972, 1 ♂ ; Angul, 1, 2, 3.x.1972, 5 ♂♂ and 5 ♀♀ ; Lingarajori, 3.x.1972, 10 ♂♂, 2 ♀♀ ; Dhenkanal, 7.x.1972, 2 ♂♂ ; Angul, 8.iv.1973, 1 ♂. *Sambalpur Dist.*—Sambalpur, 20.xii.1971, 1 ♂ and 1 ♀, 22.xii.1971, 8 ♂♂, 8 ♀♀, 23.xii.1971, 8 ♂♂ ; Jharsuguda, 5.i.1972, 2 ♂♂, 7.i.1972, 4 ♂♂, 31.x.1972 & 1.xi.1972, 4 ♂♂ and 3 ♀♀ ; Hirakud dam, 25.ix.1972, 2 ♂♂, 1 ♀, 5.xi.1972, 3 ♂♂, 1 ♀ ; Sambalpur, 3.xi.1972, 3 ♂♂, 2 ♀♀, 6.xi.1972, 1 ♂, 1 ♀ ; Deogarh, 23.iv.1973, 2 ♀♀ ; Rairakhol, 25.xii.1971, 1 ♂. *Puri Dist.*—Balighai, 20-26.viii.1911, 1 ♀ ; Barkul, 13.xi.1972, 1 ♀ ; Konark, 19.ix.1972, 1 ♂ ; Balugaon, 17.iii.1974, 1 ♀. *Bolangir Dist.*—Hathisalpara, 30.xii.1971, 5 ♂♂ ; Bolangir, 1.i.1972, 1 ♀, 2.i.1972, 1 ♀ ; F.R.H. Lathore, 24.v.1972, 1 ♀ ; Chinnivati (Bolangir), 2.x.1972, 1 ♀ ; Bolangir, 3.x.1972, 1 ♀, 9-12.xi.1972, 5 ♂♂, 6 ♀♀, 11.xi.1972, 1 ♀, 14.xi.1972, 1 ♂, 1 ♀. *Ganjam Dist.*—Gopalpur, 8.xi.1972, 2 ♀♀ ; Taptapani, 14.iii.1974, 1 ♂ ; *Kalahandi Dist.*—Kesinga, 28.i.1972, 1 ♀ ; Bhawanipatna, 1.ii.1972, 1 ♀ ; Komna, 7.ii.1972, 1 ♂. *Koraput Dist.*—Malkangiri, 18.ii.1972, 2 ♀♀, 2.xii.1973, 1 ♀ ; Koraput, 21.ii.1972, 1 ♂, 1 ♀ ; Semiliguda, 22.ii.1972, 1 ♂ ; Jeypore, 23.xi.1972, 1 ♀, 3.xii.1973, 2 ♀♀, 24.xi.1973, 1 ♀ ; Malkangiri, 23.xi.1972, 1 ♀.

Remarks : *Acrida exaltata* varies in size and general colouration from uniformly green to ochraceous and brownish. Head less robust and elongated. Pronotum slender ; pronotal disc relatively narrow ; male subgenital plate in profile short.

It occurs almost throughout Orissa (Map, 5) and it may well be

present in many areas from which it has not yet been recorded. This species is widely distributed throughout plains and hilly regions of Indian subcontinent. It has also been reported from south east Tibet, Afghanistan, south east Iran and middle east countries.

8. **Ceracris striata* Uvarov.

1925. *Ceracris striata* Uvarov, *Ent. Mitt.*, 14 : 16.

Material examined : *Mayurbhanj Dist.*—Dayarsoni, 15.viii.1972, 1 ♂ ; *Keonjhar Dist.*—Ghatgaon, 21.viii.1972, 1 ♂ . *Cuttack Dist.*—Athgarh, 29.viii.1972, 1 ♀ .

Remarks : *Ceracris striata* is of medium size, slightly compressed. Tegmina with only a sharp defined narrow sulfurous stripe in the scapular area ; anal area greenish or only slightly paler than the rest of tegmina. Metazona heavily punctured.

This species occurs only in three districts of Orissa from single localities (Map, 3) in India and also known from Pakistan.

9. **Ceracris deflorata* (Brunner)

1893. *Duronia deflorata* Brunner, *Annali Mus. civ. Stor. nat. Giacomo Doria*, 33 : 126.

1914. *Ceracris deflorata* : Kirby, *Faun. Brit. India Orth. (Acriedidae)* : 112.

Material examined : *Sundargarh Dist.* Barsuan, 13.ix.1972, 1 ♂ and 1 ♀ .

Remarks : *C. deflorata* is of large size, very slender. Tegmina without a pale pre-radial stripe, anal area pale. Face and pronotum smooth ; metazona minutely punctured.

Two specimens of this species were collected from single locality in Sundargarh District of Orissa (Map 3). Recorded earlier from Bihar in India.

10. *Phlaeoba infumata* Brunner

1893. *Phlaeoba infumata* Brunner, *Annali Mus. civ. stor. nat. Giacomo Doria*, 33 : 124.

1914. *Phlaeoba infumata* : Kirby, *Faun. Brit. India Orth.*, (Acriedidae) : 103.

Material examined : *Mayurbhanj Dist.*—Bisoi, 23.iii.1973, 1 ♂ . *Keonjhar Dist.*—Keonjharhargh 3.iv.1973, 3 ♂ ♂ and 1 ♀ . *Cuttack Dist.*—Nandankanan, 24.iii.1974, 1 ♂ , 26.iii.1974, 1 ♂ . *Dhenkanal Dist.*—Angul, 29.ix.1972, 2 ♀ ♀ , 30.ix.1972, 1 ♂ ; Lingarajori (Angul), 3.x.

1972, 1 ♂. *Ganjam Dist.*—Taptapani, 15.iii.1972, 2 ♂ ♂ and 2 ♀ ♀. *Korapur Dist.*—Jeypore, 13.ii.1972, 1 ♀ ; Teliguda (Jeypore), 19.ii.1972, 1 ♀ ; Pottandi, 24.ii.1972, 1 ♀. *Baudhkhandmals Dist.*—Phulbani, 19.i.1972, 1 ♀.

Remarks : *P. infumata* is of medium size. Body more slender. Antennae unicolorous, ensiform in the male, more distinct in female. Pronotum with the median and lateral carinae distinct, though fine, surface finely punctured. Wings hyaline, apex not or only slightly infumated. Hind femur yellowish brown, knee often dark coloured.

This species is well distributed in Orissa and we have found it as far as Bisoi in the north east and in south upto Jeypore in Koraput district (Map, 4). It is a very common species in India and is known to occur both in plains and hilly regions. There are records of its occurrence in Nepal, Burma, Bangladesh, Malacca and South China. It is a minor pest of paddy and maize.

11. **Zygophlaeoba sinuaticollis* Bolivar

1902. *Zygophlaeoba sinuaticollis* Bolivar, *Annls Soc. ent. Fr.*, 70 : 591.

Material examined : *Keonjhar Dist.*—Atei Reserve Forest (Keonjhar-garh) 29.iii.1973, 1 ♂.

Remarks : *Zygophlaeoba sinuaticollis* can easily be identified in having forntal ridge in profile sinuated between the median ocellus and the antennae.

We have found this species in collection from a single locality in Keonjhar District of Orissa (Map, 8). The occurrence of this species in Orissa is very interesting as it extends the distribution of this relatively unkown species from Tamil Nadu to further north east of India.

Subfamily TRUXALINAE

12. *Truxalis indica* (I. Bolivar)

1902. *Acrida (Acridella) uugiculata* Rambur, Var *indica* I Bolivar, *Annls Soc. ent. Fr.*, 70 : 589.

1951. *Truxalis indica* : Dirsh, *Eos. Madr.*, Tomo extraord (1950) : 178.

Material examined : *Sundargarh Dist.*—Sundargarh, 10.i.1972, 1 ♂, 1 ♀.

Remarks : *Truxalis indica* is of medium size and moderately slender. Pronotum broader and rather saddle shaped ; metazona longer than prozona. Basal disc of wing in the female brightly deep pink.

We have found this species in collection from a single locality in Sundargarh District (Map, 3). There are few records of its occurrence in Bihar, Madhya Pradesh, Andhra Pradesh and Tamil Nadu. Beside India this species also occurs in Burma and Sri Lanka.

Subfamily GOMPHOCERINAE

13. **Dnopherula (Aulacobothrus) socius* (I. Bolivar)

1902. *Aulacobothrus socius* Bolivar, *Annls Soc. ent. Fr.*, 70 : 599.
 1914. *Aulacobothrus socius* : Kirby, *Faun. Brit. India Orth.*, (Acrididae) : 124.
 1971. *Dnopherula (Aulacobothrus) socius* : Jago, *Proc. Acad. nat. sci. Philad.*, 123 (8) : 243.

Material examined : Bolangir Dist.—Salapali, 1.i.1972, 1 ♀.

Remarks : This species is of medium size. Hind femora with three oblique dark brown bands and the knee dark brown ; lateral carinae of pronotum wavy, median carinae straight. Hind tibiae red.

It seems to be rare in Orissa, as we have found only one example in Bolangir District of Orissa (Map, 3). There are also records of its occurrence in Tamil Nadu and Maharashtra. We have also examined specimens of this species from Himachal Pradesh and Haryana.

14. *Dnopherula (Aulacobothrus) luteipes* (Walker)

1871. *Stenobothrus luteipes* Walker, *Cat. Derm. Salt. Brit. Mus.*, 5 Suppl., : 82.
 1914. *Stenobothrus (?) luteipes* : Kirby, *Faun. Brit. India Orth.*, (Acrididae) : 121.
 1921. *Aulacobothrus luteipes* : Uvarov, *Ann. Mag. nat. Hist.* (9) 7 : 382.
 1971. *Dnopherula (Aulacobothrus) luteipes* : Jago, *Proc. Acad. nat. Sci. Philad.*, 123(8) : 243.

Material examined : Bolangir Dist.—Salapali, 1.i.1972, 1 ♀.

Remarks : This species is of small size. Hind femur with three black bands on the dorsal surface and with a black distal end. Pronotum subcylindrical with nearly parallel lateral carinae which are weakly concave in the middle part ; posterior part of pronotum nearly smooth and posterior margin obtusely angulate. Median carina distinct. Hind tibiae reddish in the apical part.

There is only one record of its occurrence in Orissa and is confined

to Bolangir District only. *Dnopherula (Aulacobothrus) luteipes* is widely distributed in Maharashtra, Madhya Pradesh, Bihar, West Bengal, Assam, Tamil Nadu and Karnataka. It is also known from Sri Lanka, Burma, China, Japan, Europe and North America.

15. **Bababuddinia bizonata* Bolivar

1917. *Bababuddinia bizonata* Bolivar, *Rev. Acad. Cienc. Madr.*, 16 : 382.

Material examined : *Keonjhar Dist.*—Keonjhargarh (Atei Reserve Forest), 29.iii.1973, 1 ♂. *Ganjam Dist.*—Ganjam (Taptapani), 13.iii.1974, 1 ♂.

Remarks : It is of medium size. General colouration pale-brown. Pronotum dorsally with two black transverse marking anteriorly otherwise unicolours. Anterior side of pronotum rugose.

Only two examples of this species have been found in collection from Orissa (Map, 4). *B. bizonata* was described by Bolivar from Bababuddin Hills of Karnataka. The occurrence of this grasshopper from Orissa is very interesting from the point of view of its distributional range.

16. **Leva indica* (Bolivar)

1902. *Gymnobothrus indica* Bolivar, *Annls Soc. ent. Fr.*, 70 : 596.

1914. *Leva indica* : Bolivar, *Trab. Mus. nac. Cienc. nat. Madr.*, (Ser. Zool.) no. 20 : 64.

Material examined : *Mayurbhanj Dist.*—Bangripasi, 13-16.ix.1972, 4 ♂ ♂. *Keonjhar Dist.*—Keonjhargarh, 21-26.ix.1972, 1 ♂ and 13 ♀ ♀ ; Anandapur, 2.iv.1973, 1 ♂ and 1 ♀. *Sundargarh Dist.*—Raurkela, 8.iii.1971, 8 ♂ ♂ and 9 ♀ ♀ ; Bonaigarh, 9.i.1972, 1 ♂ ; Subulia Khasra Forest, 10.i.1972, 1 ♂ and 1 ♀ ; Sundargarh, 21-23.ix.1972, 1 ♀ ; 25.x.1972, 1 ♀. *Cuttack Dist.*—Cuttack, 14.iv.1973, 1 ♀ ; Nandankanan, 22.iii.1974, 1 ♂. *Dhenkanal Dist.*—Angul, 13.iv.1973, 1 ♂, 29-30.ix.1973, 4 ♂ ♂ and 8 ♀ ♀. *Sambalpur Dist.*—Sambalpur, 22-23.xii.1971, 1 ♂ and 1 ♀, 27.xii.1973, 12 ♂ ♂ and 3 ♀ ♀ ; Rairakhol, 25.xii.1971, 1 ♂ and 1 ♀ ; Jharsuguda, 5-7.i.1972, 1 ♂ and 2 ♀ ♀, 30.x.1972, 1 ♂. *Bolangir Dist.*—Hathisalpara (Bolangir), 30.xii.1971, 1 ♀ ; Matkai Reserve Forest, 31.xii.1971, 1 ♂ and 1 ♀ ; Bolangir, 1-3.i.1972, 11 ♂ ♂ and 12 ♀ ♀, 9.xi.1972, 1 ♂ and 1 ♀. *Ganjam Dist.*—Gopalpara, 7.x.1972, 1 ♀.

Remarks : *Leva indica* is of small size. Lateral carinae of pronotum parallel in prozona and strongly divergent in metazona.

It is well distributed in Orissa and occurs in association with *Leva cruciata* (Map, 3). Beside Orissa it occurs also in Bihar, Tamil Nadu, West Bengal and Delhi.

17. **Leva cruciata* Bolivar

1914. *Leva cruciata* Bolivar, *Trab., Mus. Cienc. nat. Madr.*, 20 : 65.

Material examined : *Mayurbhanj Dist.*—Bangriposi, 16.ix.1972, 1 ♂ ; Baripada, 7.viii.1983, 1 ♂ and 1 ♀ ; *Keonjhar Dist.*—Keonjhargarh, 23-26.ix.1972, 1 ♂ and 6 ♀ ♀ ; Ghatgaon, 1.iv.1973, 2 ♂ ♂ ; Rankie, 12.viii.1983, 1 ♂ . *Sundargarh Dist.*—Raurkela, 8.xii.1971, 2 ♀ ♀ ; Bonaigarh, 15 & 17.xii.1971, 2 ♂ ♂ and 5 ♀ ♀ ; Bishalbari Reserve Forest (Sundargarh), 9.i.1972, 2 ♂ ♂ and 5 ♀ ♀ ; Sundargarh, 2.ix.1972, 1 ♀ ; Mahantipara (Sundargarh), 23.ix.1972, 1 ♂ . *Dhenkanal Dist.*—Angul, 3.x.1972 2 ♂ ♂ and 4 ♀ ♀ ; *Sambalpur Dist.*—Sambalpur, 27.xii.1971, 5 ♂ ♂ and 9 ♀ ♀ ; Jharsuguda, 5-7.i.1972, 2 ♀ ♀ ; Rangali, 21.viii.1983, 1 ♂ . *Bolangir Dist.*—2-3.i.1972, 3 ♀ ♀

Remarks : *L. cruciata* is of small size. Pronotum with cruciform mark dorsally, lateral carinae of pronotum in median prozona drawing anteriorly and divergent posteriorly. Frontal ridge sulcated between antennae.

In Orissa the species is fairly well distributed in the northern part of the state. There are few records from eastern and western parts also (Map, 3). It has also been recorded from Bihar, Tamil Nadu and Karnataka earlier. We have also examined some specimens of this species from West Bengal.

Subfamily OEDIPODINAE

18. *Acrotylus humbertianus* Saussure

1884. *Acrotylus humbertianus* Saussure, *Mem. Soc. Phys., Hist. nat. Geneve*, 28(9) : 189.

1914. *Acrotylus humbertianus* : Kirby, *Faun. Brit. Indi Orth., (Acrididae)* : 153.

Material examined : *Mayurbhanj Dist.*—Bangriposi, 15-17.ix.1972, 2 ♂ ♂ and 1 ♀ ; Joshipur, 18.xii.1975, 1 ♂ . *Keonjhar Dist.*—Keonjhargarh, 28.ix.1972, 14 ♂ ♂ and 32 ♀ ♀ ; Upardhia (Keonjhargarh), 31.ii.1973, 2 ♂ ♂ ; Ghatgaon, 1.iv.1973 1 ♀ ; Ashaniput, (Keonjhargarh),

31.ii.1983, 2 ♂♂. *Sundargarh Dist.*—Raurkela, 8.xii.1971, 1 ♀ ; Bonaigarh, 17.xii.1971, 1 ♂ and 5 ♀♀ ; Bishalvari Reserve Forest (Sundargarh), 9.i.1972, 1 ♂ and 5 ♀♀ ; Sundargarh, 10-12.i.1972, 3 ♂♂ and 12 ♀♀. *Cuttack Dist.*—Paradip, 30.i.1972, 1 ♂. *Dhenkanal Dist.*—Angul, 29.ix.1972, 6 ♂♂ and 8 ♀♀, 10.iv.1973, 1 ♂. *Sambalpur Dist.*—Sambalpur, 22-23, 27.xii.1971, 5 ♂♂ and 12 ♀♀, 24.viii.1983, 1 ♀ ; Rairakhol, 26.xii.1971, 1 ♂ and 1 ♀ ; Jharsuguda, 5-7.i.1972, 7 ♂♂ and 5 ♀♀ ; *Bolangir Dist.*—Bolangir, 1-3.i.1972, 7 ♂♂ and 6 ♀♀ ; Titlagarh, 16.xi.1972, 2 ♀♀. *Ganjam Dist.*—Gopalpur, 7.x.1972, 1 ♂ and 1 ♀. *Koraput Dist.*—Koraput, 23.ii.1972, 1 ♂.

Remarks : *A. humbertianus* is of medium size. Wings yellow at the base, with a wide incomplete dark band, entirely or nearly reaching the anal veins ; One to three small black speckles at the apex of first lobe of the wing. Tegmina long and extending beyond the middle of hind tibiae.

This species is fairly well distributed in the northern region of the State (Map, 6). There are few records of its occurrence in the central and southern regions. It is widely distributed throughout in India.

19. *Aiolopus thalassinus tamulus* (Fabricius)

1798. *Gryllus tamulus* Fabricius, *Ent. Syst. Suppl.*, : 195.

1914. *Aiolopus tamulus* : Kirby, *Faun. Brit. India, Orth. (Acrididae)* : 122.

1968. *Aiolopns thalassinus tamulus* : Hollis, *Bull. Br. Mus. nat. Hist. (Ent.)*, 22(7) : 347.

Material examined : *Mayurbhanj Dist.*—Baripada, 7 & 9.viii.1972, 2 ♂♂ ; Bangripasi, 14-16.ix.1972, 9 ♂♂ and 7 ♀♀ ; Manbhanj (Bangripasi) 17.ix.1972, 1 ♀ ; Simlipal hills, 13.xi.1972, 2 ♂♂. *Keonjhar Dist.*—Atei Reserve Forest, Ghatgaon, 23.viii.1972, 1 ♀ ; Keonjhar-garh, 19-26.ix.1972, 10 ♂♂ and 24 ♀♀ ; Upardhia, 31.iii.1973, 1 ♀. *Sundargarh Dist.*—Raurkela, 11.xii.1971, 1 ♂ ; Bonaigarh, 13.16.xii.1971, 2 ♂♂ and 2 ♀♀ ; Sundargarh, 11.ii.1972, 3 ♂♂, 25.x.1972, 1 ♀ ; Banki, 29.iii.1973, 1 ♂. *Cuttack Dist.*—Paradip, 9.ix.1972, 1 ♀. *Dhenkanal Dist.*—Angul, 29-30.ix. and 2-3.x.1972, 4 ♂♂ and 10 ♀♀ ; Dhenkanal, 7.x.1972, 1 ♀ ; Angul, 22.x.1972, 1 ♂. *Sambalpur Dist.*—Sambalpur, 19.xii.1972, 1 ♀ ; Jharsuguda Sambalpur, 1-3.xi.1972, 1 ♀, 2 ♀♀. *Puri Dist.*—Balugaon, 18.iii.1984, 1 ♂. *Ganjam Dist.*—Gopalpur, 7 & 11.ix.1972, 1 ♂ and 2 ♀♀.

Remarks : It is of medium size. Fastigium of head with forward

angle more acute, frontal ridge flat and continuously narrowing upwards. Pronotum with very weak lateral carinae in prozona, posterior margin more rounded.

Aiolopus thalassinus tamulus is well distributed in the northern region of Orissa and the southern limit is in Gopalpur in Ganjam District (Map, 5). In general this species is well distributed in India with records from central, north-western and eastern regions. It is also fairly well distributed in Oriental and Australian regions.

20. *Dittopternis venusta* (Walker)

1870. *Oedipoda venusta* Walker, *Cat. Derm. salt. Br. Mus.* 4 : 740.

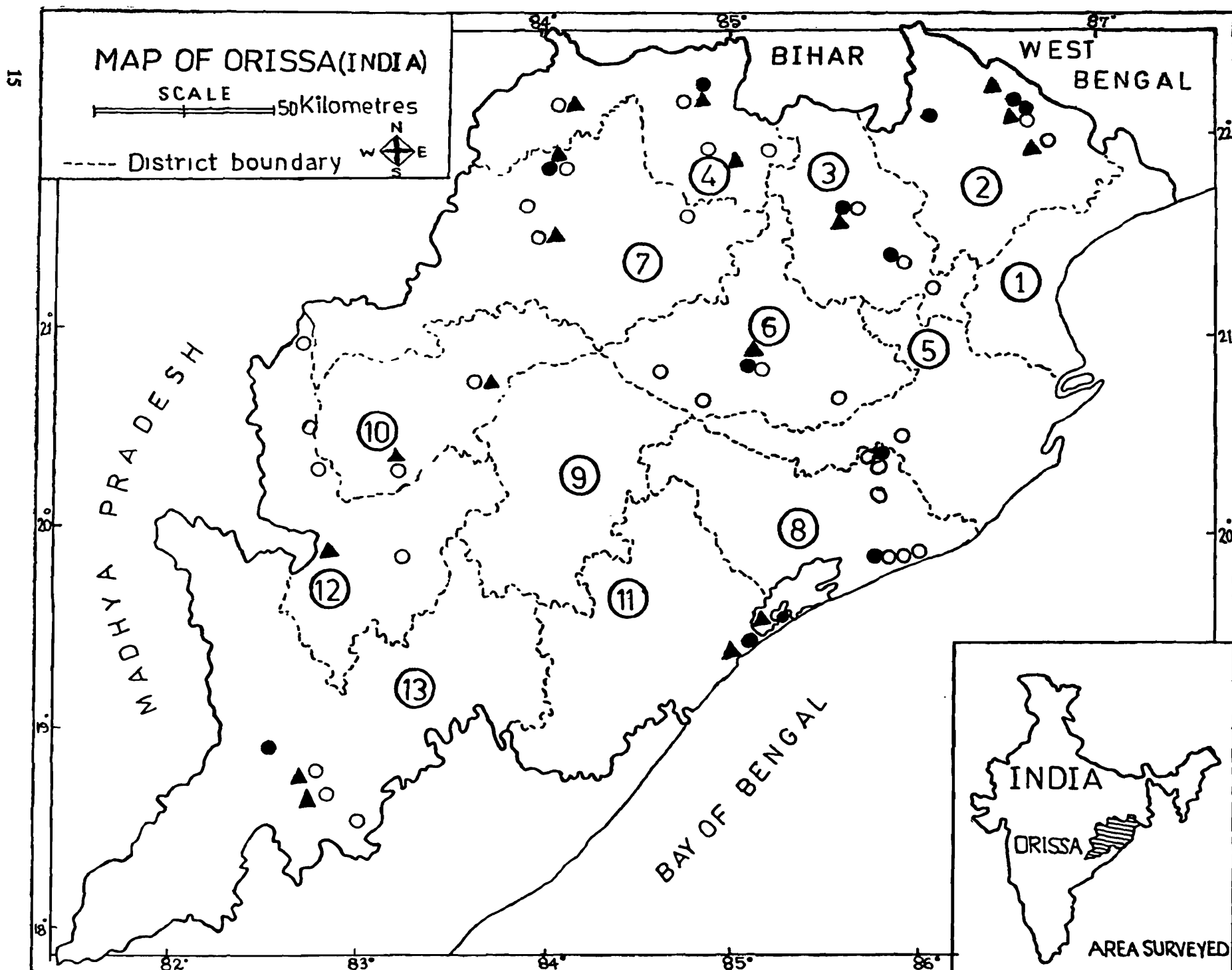
1888. *Dittopternis venusta* : Saussure, *Mem. Soc. Phys. Hist. nat. Geneve*, 30(1) : 40.

1914. *Dittopternis venusta* : Kirby, *Faun. Brit. India Orth. (Acrididae)* : 140.

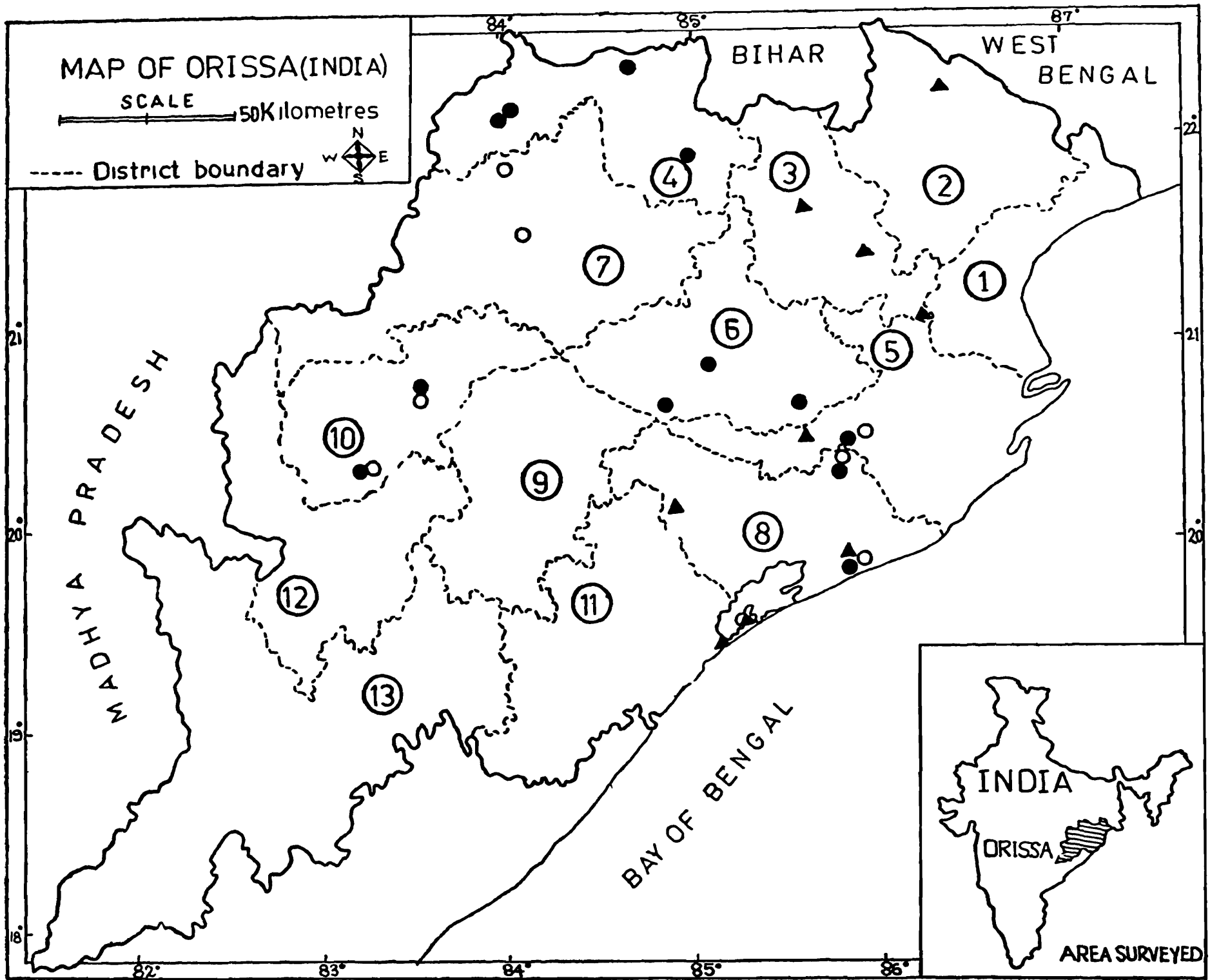
Material examined : *Mayurbhanj Dist.*—Bisoi, 14.viii.1972, 1 ♂ and 1 ♀, 23-26.iii.1973, 4 ♂ ♂ and 1 ♀. *Keonjhar Dist.*—Atei Reserve Forest, 20-22.viii.1972, 4 ♂ ♂ ; Keonjhargarh, 21-23.ix.1972, 2 ♂ ♂ and 8 ♀ ♀. *Sundargarh Dist.*—Bhawani Hill (Sundargarh), 15.xii.1971, 1 ♂ ; Bonairgarh, 17.xii.1971, 1 ♂ ; Bisahlvari Reserve Forest (Sundargarh), 9.i.1971, 2 ♂ ♂ and 1 ♀. *Cuttack Dist.*—Athgarh, 29.viii.1972, 1 ♂ ; Nandankanan, 23.iii.1974, 1 ♀, 13.xii.1977, 2 ♂ ♂. *Dhenkanal Dist.*—Angul, 30.ix.1972 and 2.x.1972, 5 ♂ ♂ and 5 ♀ ♀. *Sambalpur Dist.*—Khasra Forest, Rampur, 26.xii.1971, 1 ♀ ; Sambalpur, 27.xii.1971, 1 ♀ ; Rairakhol, 28.xii.1971, 2 ♂ ♂. *Puri Dist.*—Konark, 20.ix.1972, 2 ♀ ♀. *Bolangir Dist.*—Matkai Reserve Forest, 31.xii.1971, 4 ♂ ♂ and 2 ♀ ♀ ; Bolangir, 1.i.1972, 1 ♂. *Ganjam Dist.*—Barkuda Island (Chilka lake), 20.vii.1914, 1 ♀. *Kalahandi Dist.*—Madanpur-Rampur, 6.x.1973, 2 ♀ ♀.

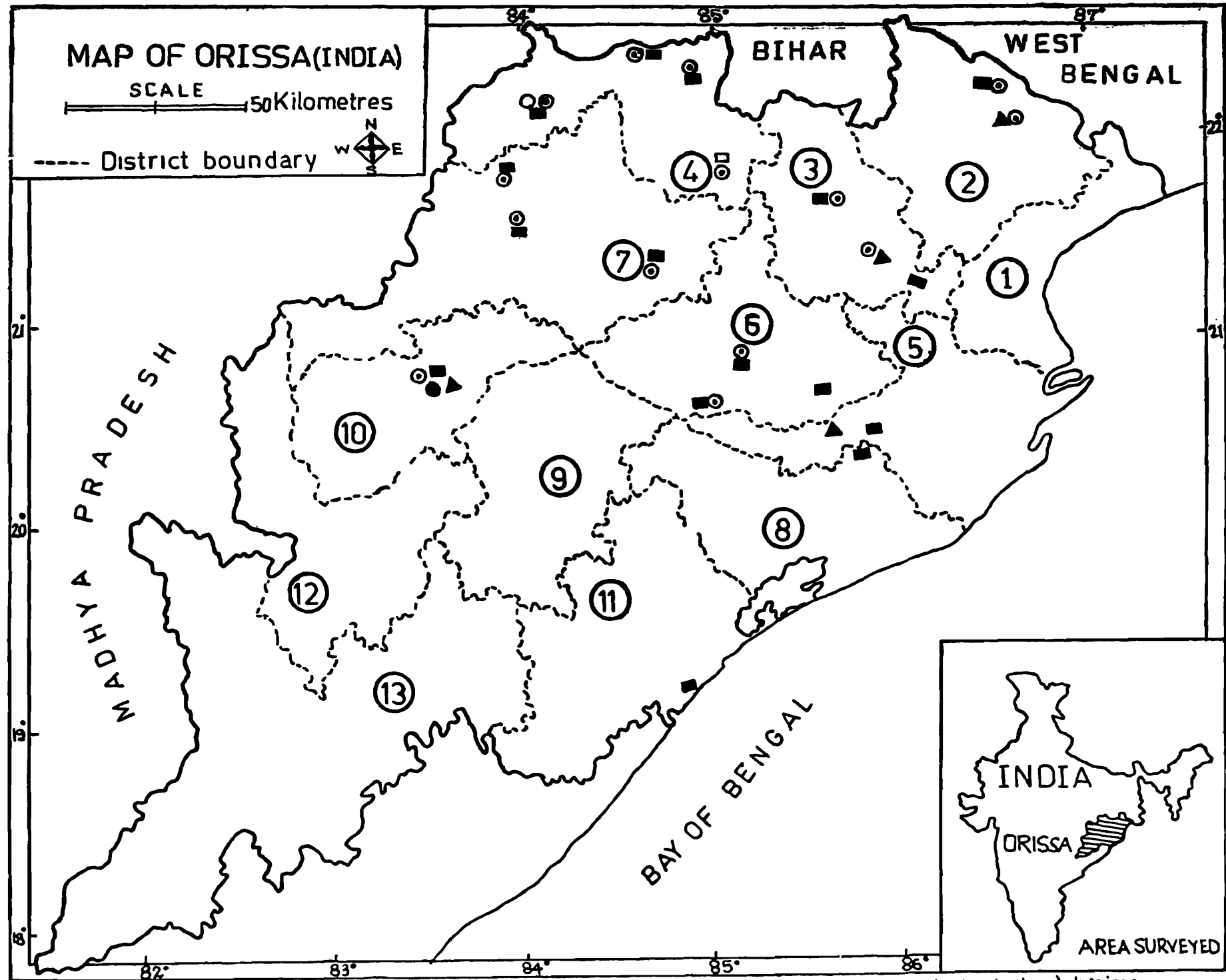
Remarks : It is of medium size. Head and pronotum strongly granular ; pronotum rugose, granulated with strong median carina ; lateral lobes of pronotum rectangular behind.

D. venusta is fairly well distributed in the northern and eastern region of the State. There are few records from western and southern regions also (Map, 6). In India this species is known from Tamil Nadu, Madhya Pradesh and West Bengal. Also recorded from Sri Lanka.

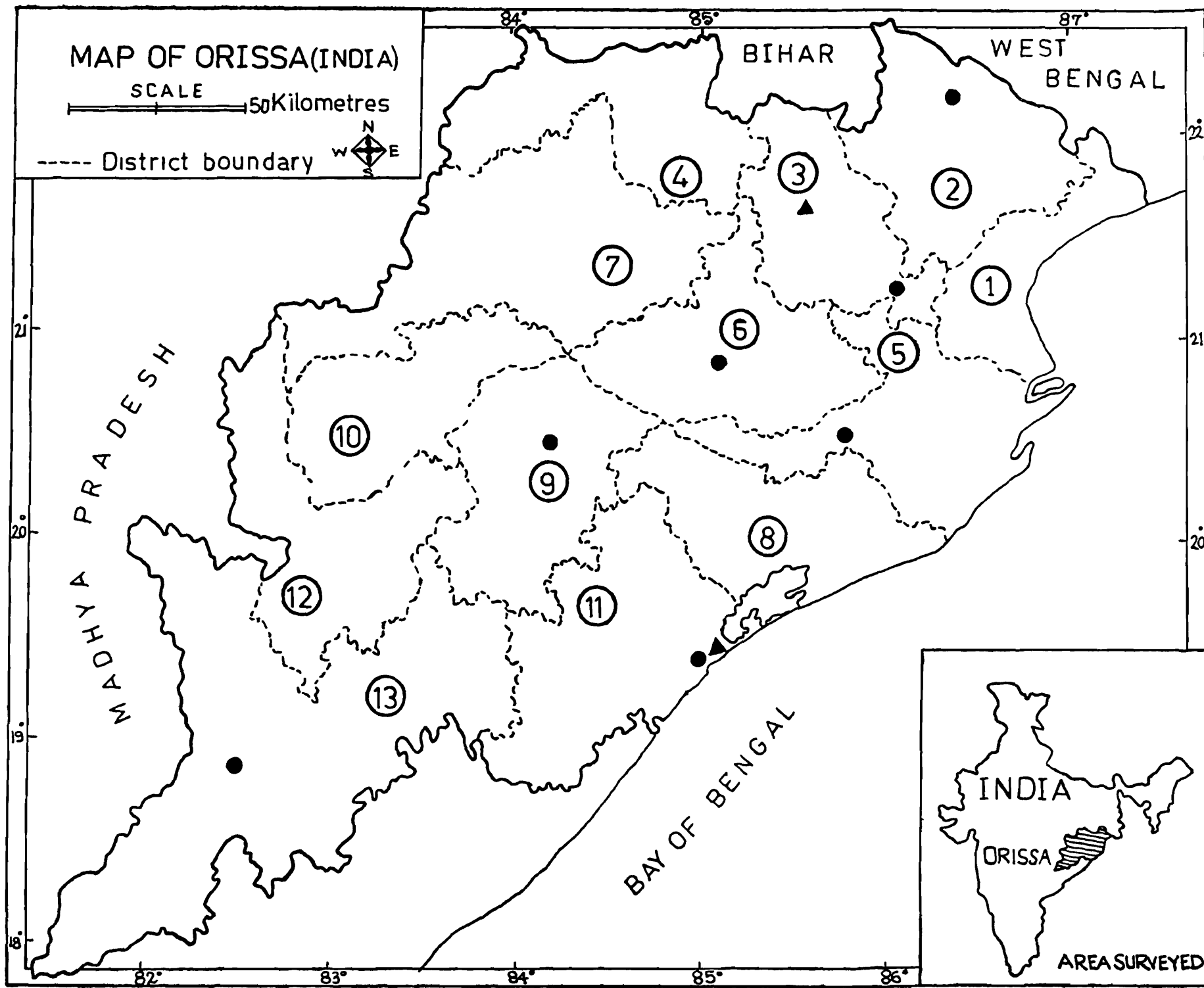


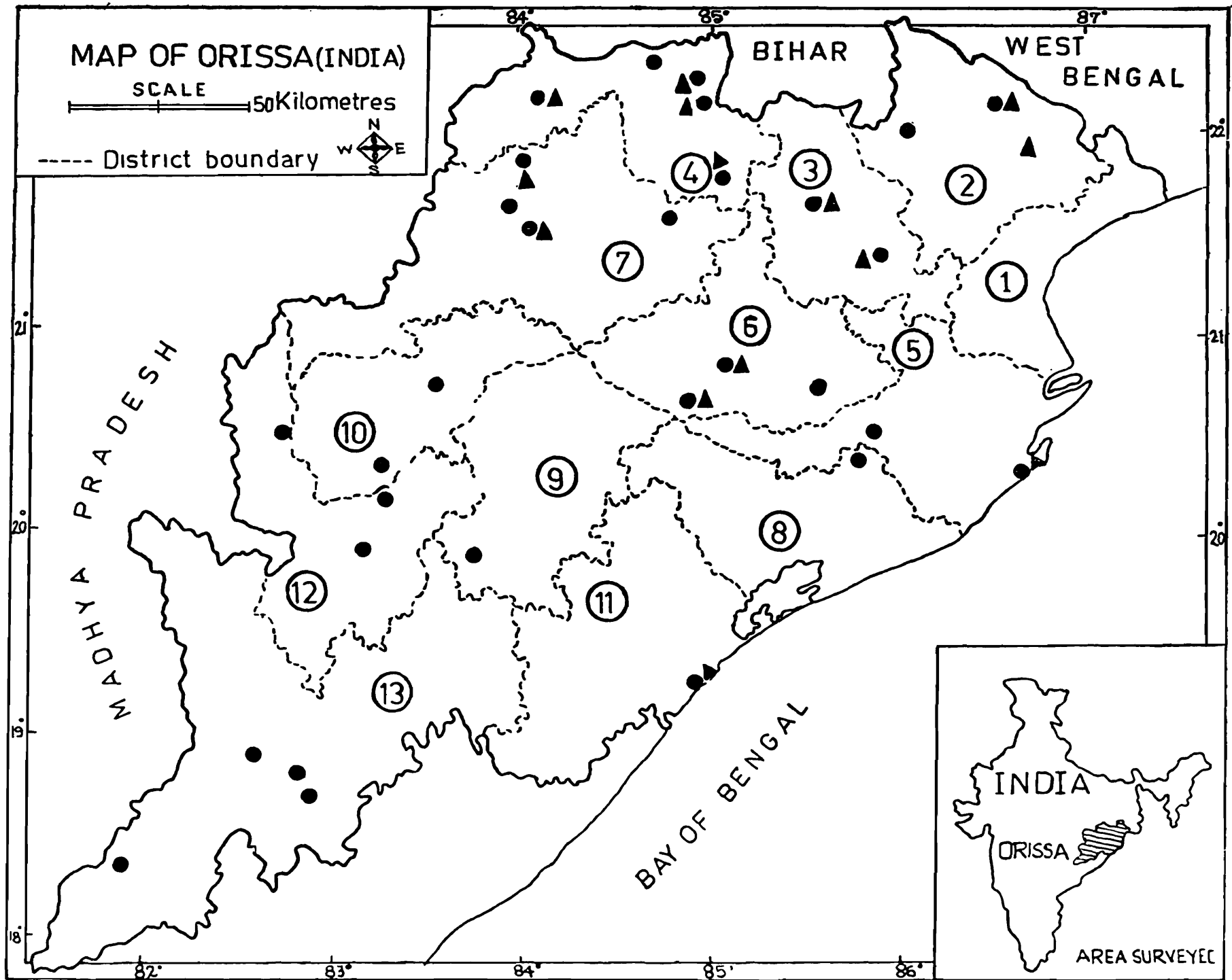
Map I. Distribution of ▲ Chrotogonus (Ch.) trachypterus trachypterus, ● - Chrotogonus (Ch.) oxypterus,
○ - Atractomorpha crenulata.



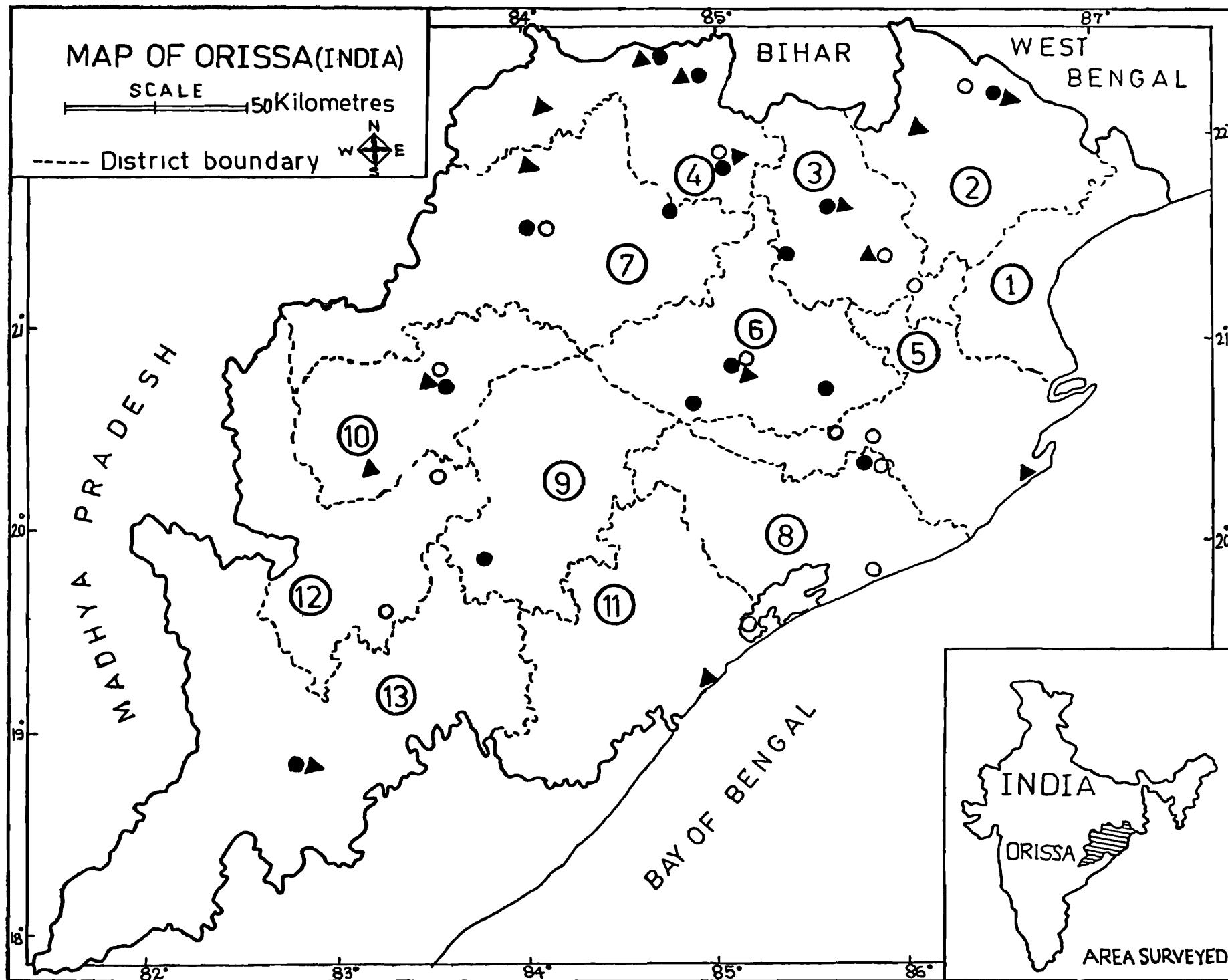


Map 3. Distribution of ○ - *Truxalis indica*, ● - *Dnopherula (Aulacobothrus) socius*, ▲ - *Dnopherula (Aulacobothrus) luteipes*,
 ▲ - *Ceracris striata*, □ - *Ceracris deflorata*, ■ - *Leva indica*, ⊙ - *Leava cruciata*.

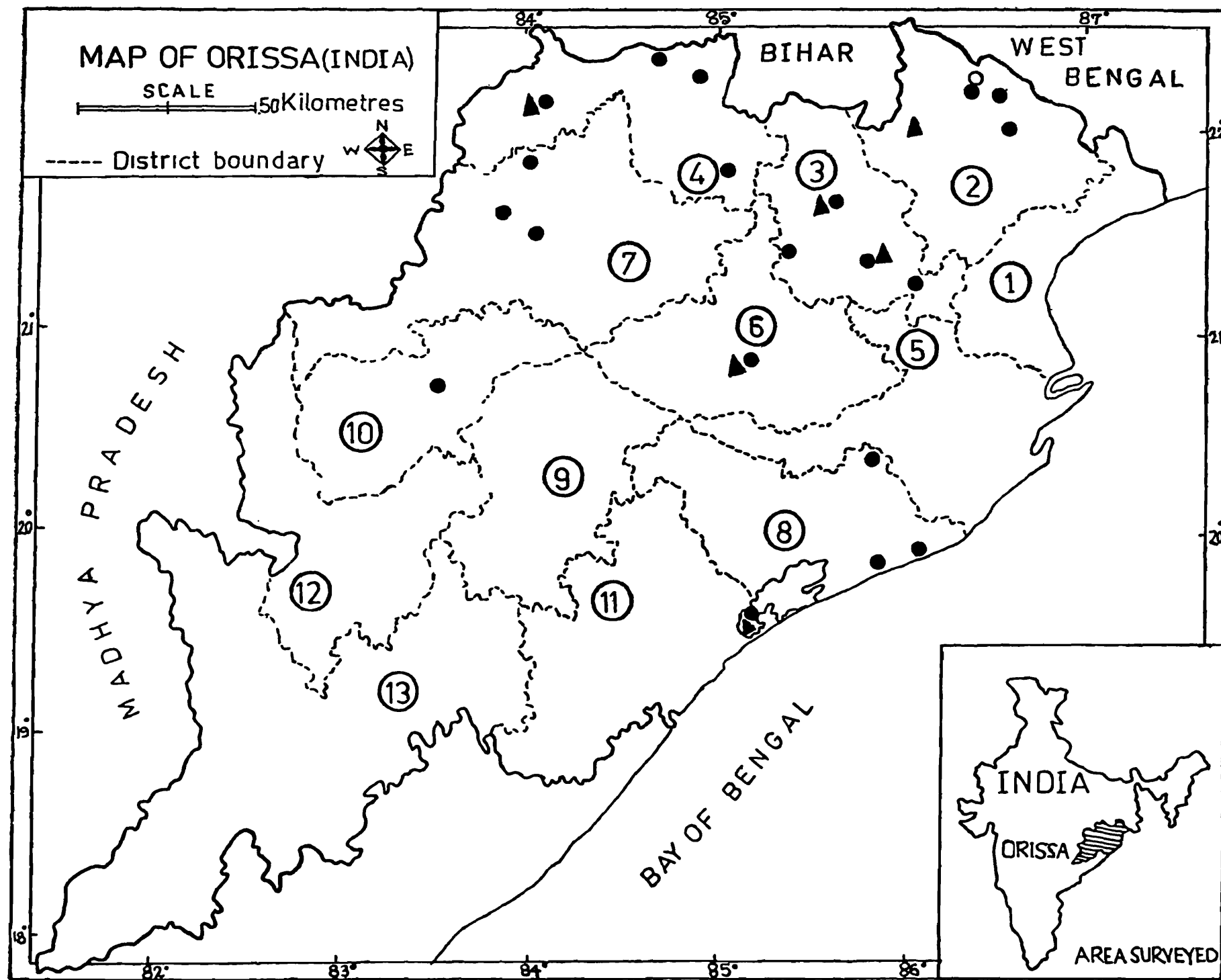




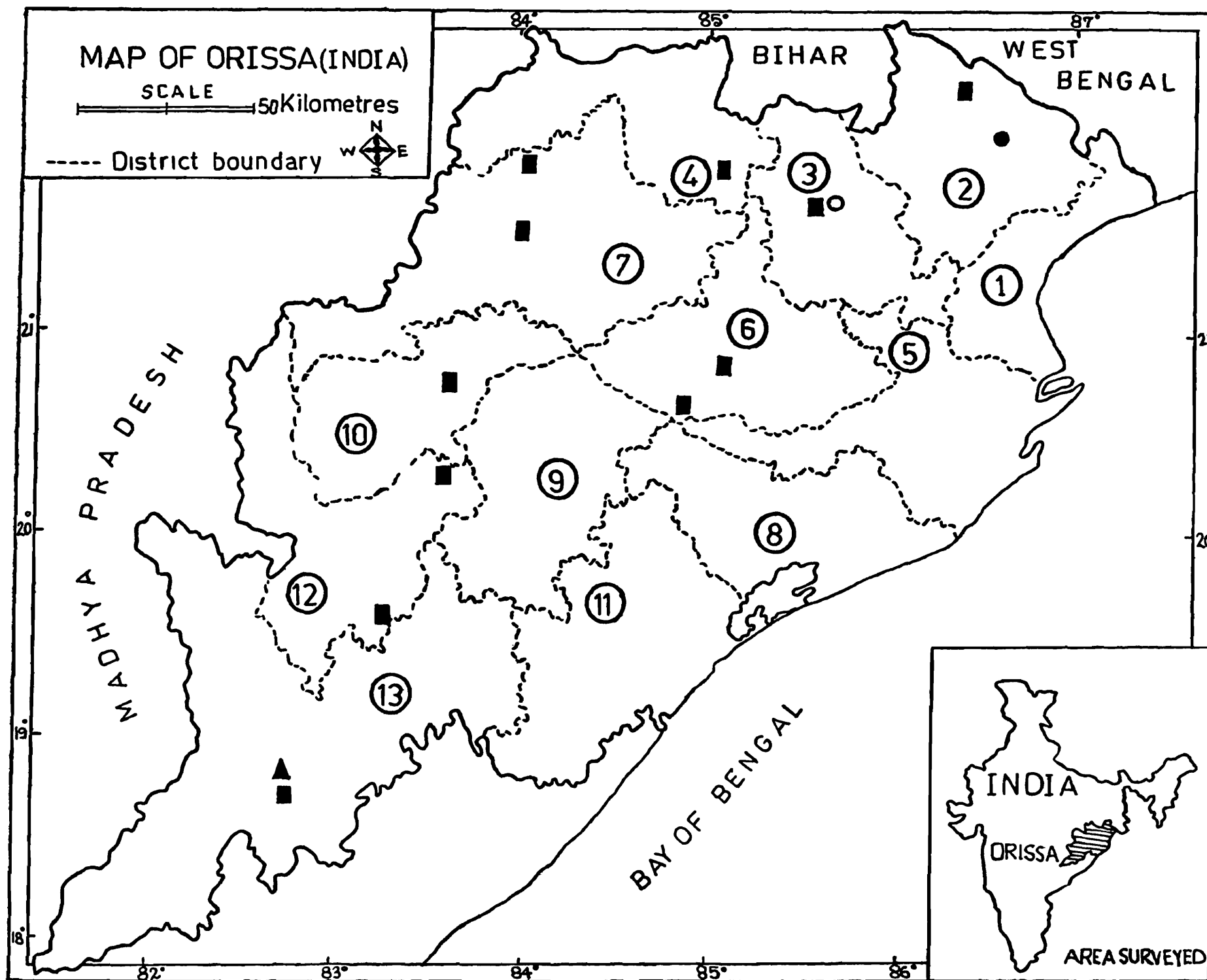
Map 5. Distribution of ▲ - *Aiolopus thalassinus tamulus*, ● - *Acrida exaltata*.



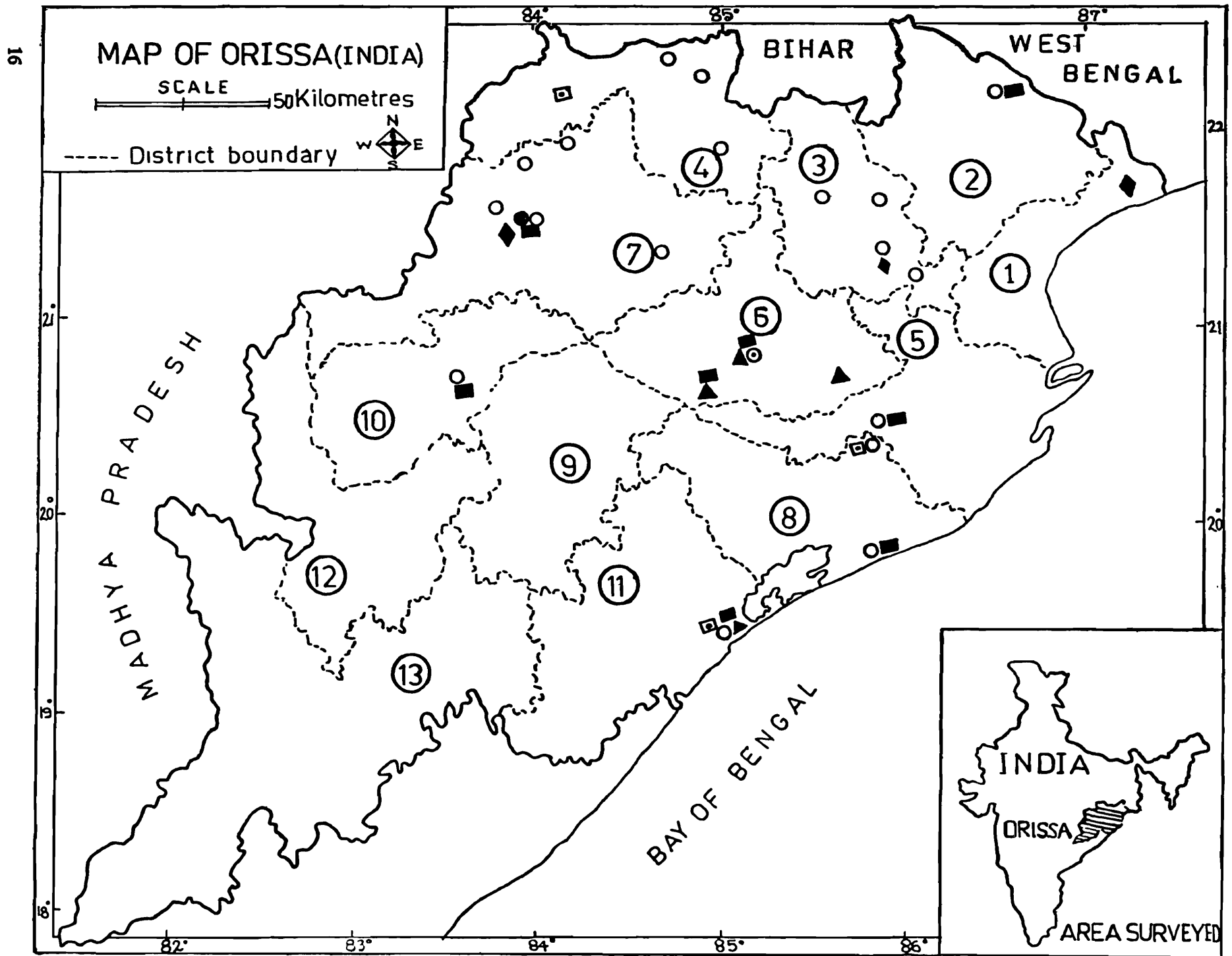
Map 6. Distribution of ● - Oedaleus abruptus ▲ - Acrotylus humberianus, ○ - Dittopernis venusta.



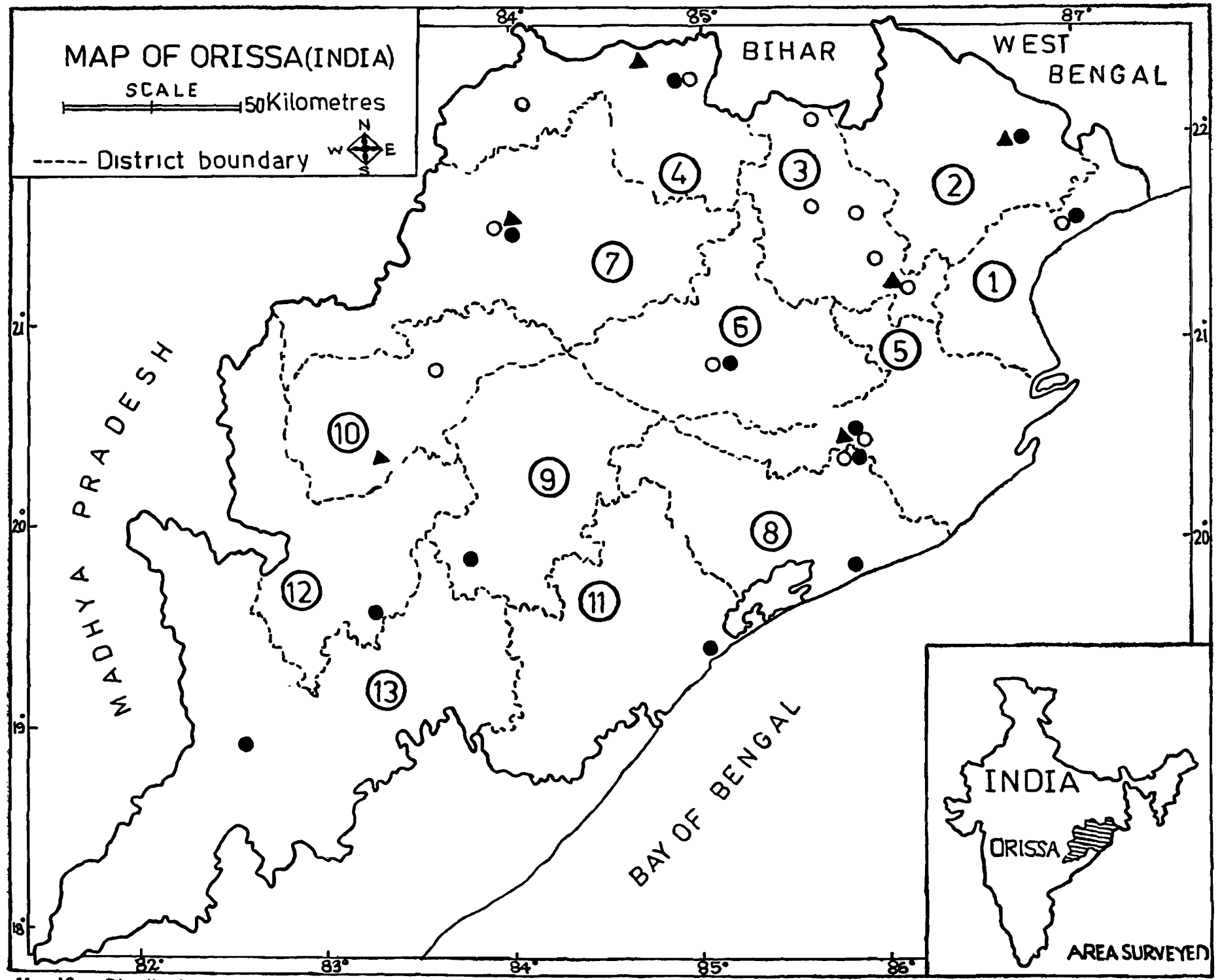
Map 7. Distribution of ▲ - *Morphacris fasciata sulcata*, ● - *Trilophidia annulata*, ○ - *Pternoscirta cinctifemur*.



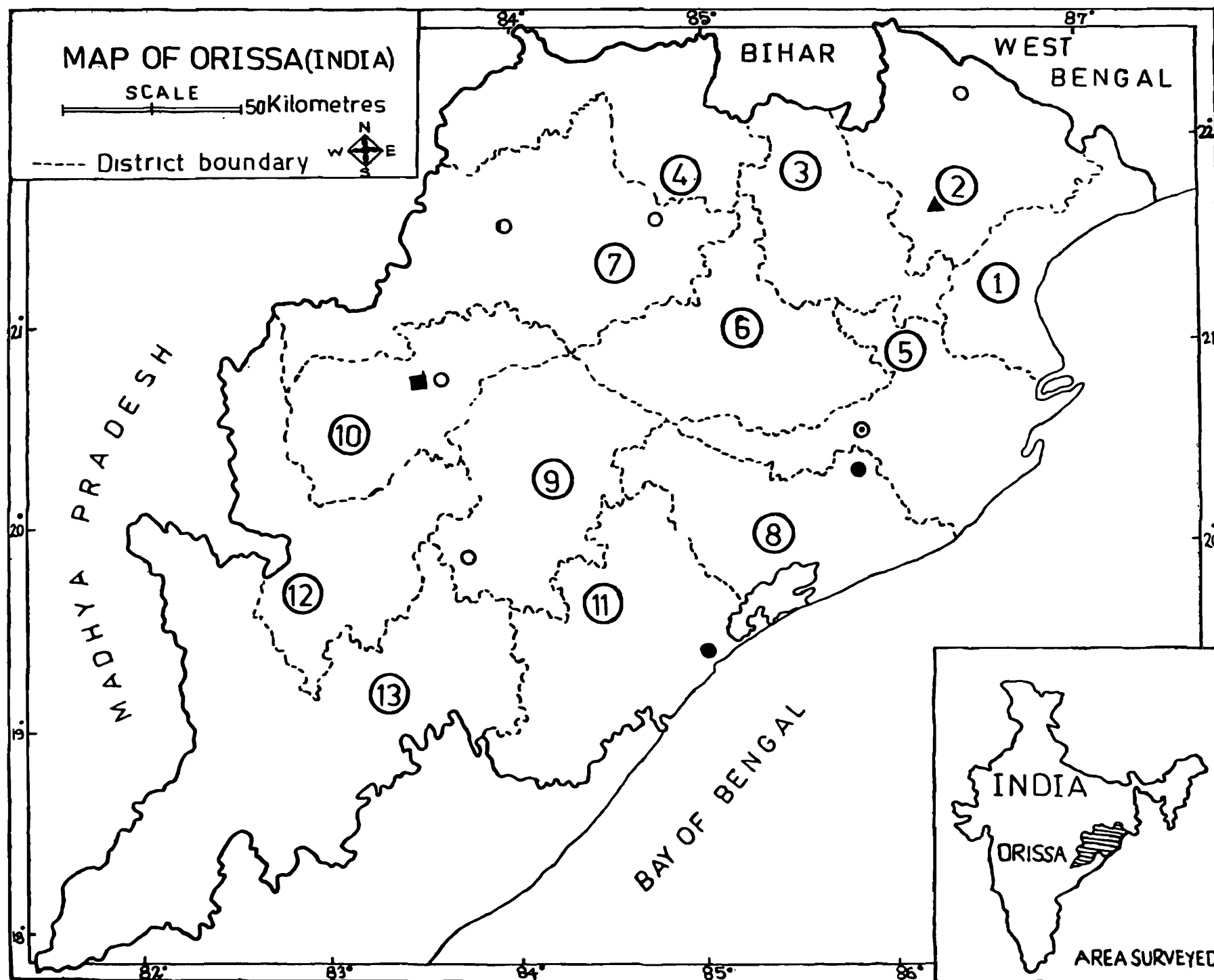
Map 8. Distribution of ■ - Gastrimargns africanus africanus, ● - Heteropternis respondens, ▲ - Locusta migratoria migratoriodes, ○ - Zygophlaeoba sinuaticollis.



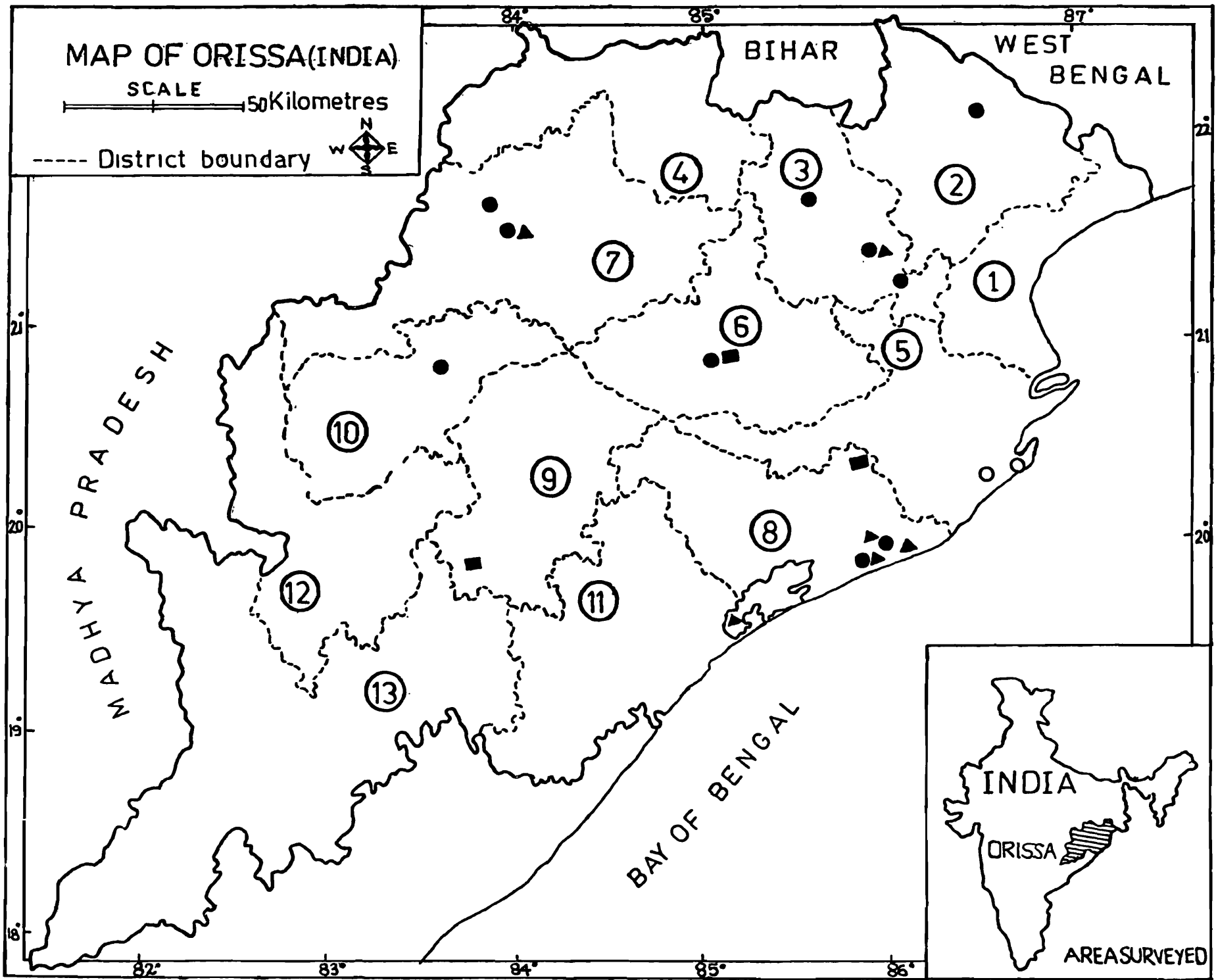
Map 9. Distribution of $\square$ - *Teratodes monticollis*, $\blacklozenge$ - *Clonacris kirbyi*, $\bullet$ - *Gesonula punctifrons*, $\blacksquare$ - *Hieroglyphus banian*, $\blacktriangle$ - *Hieroglyphus nigrorepletus*, $\odot$ - *Hieroglyphus oryzivorus*, $\circ$ - *Spathosternum prasiniferum prasiniferum*.

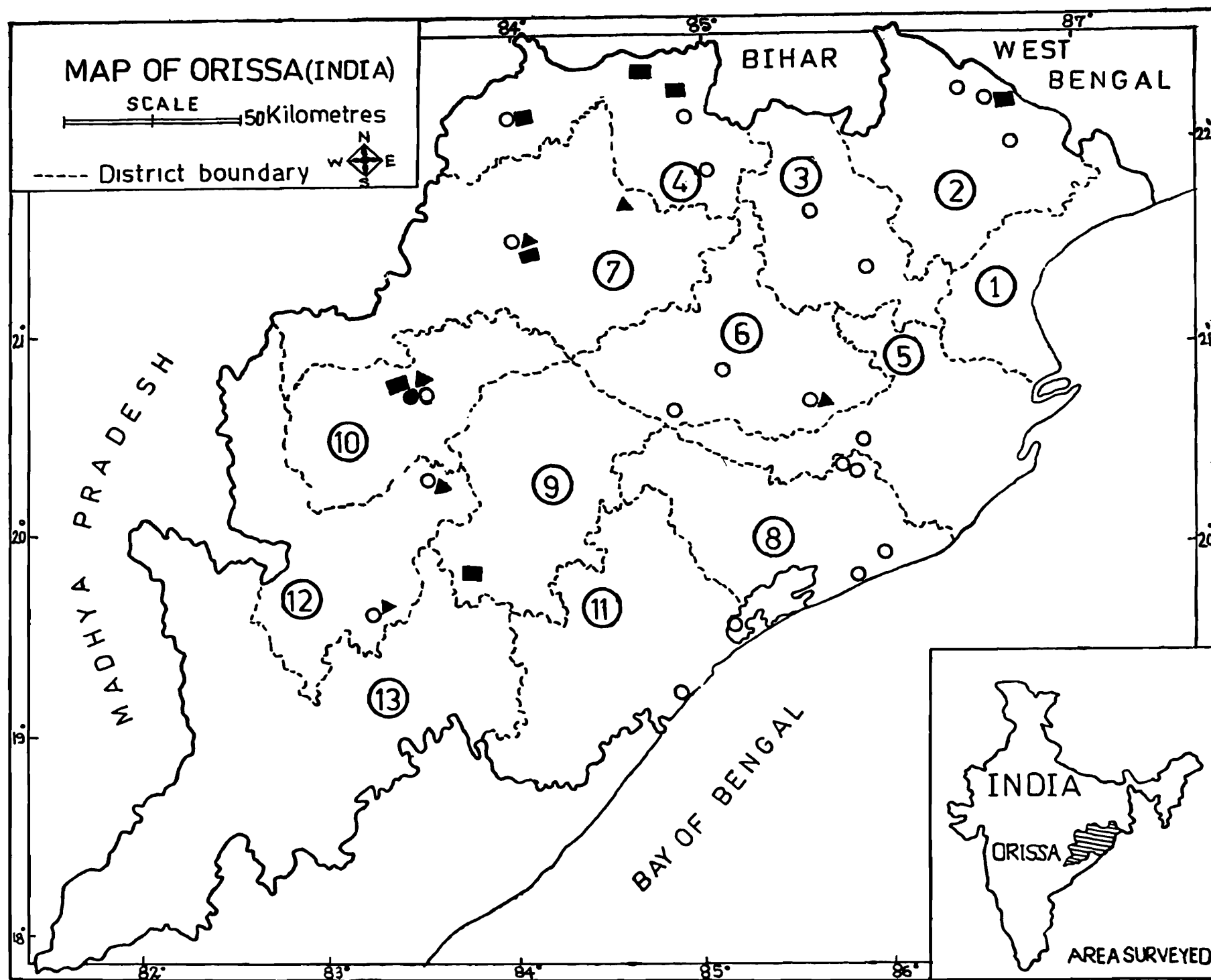


Map 10. Distribution of ● - *Oxya fuscovittata*, ○ - *Oxya hyla hyla*, ▲ - *Oxya nitidula*.

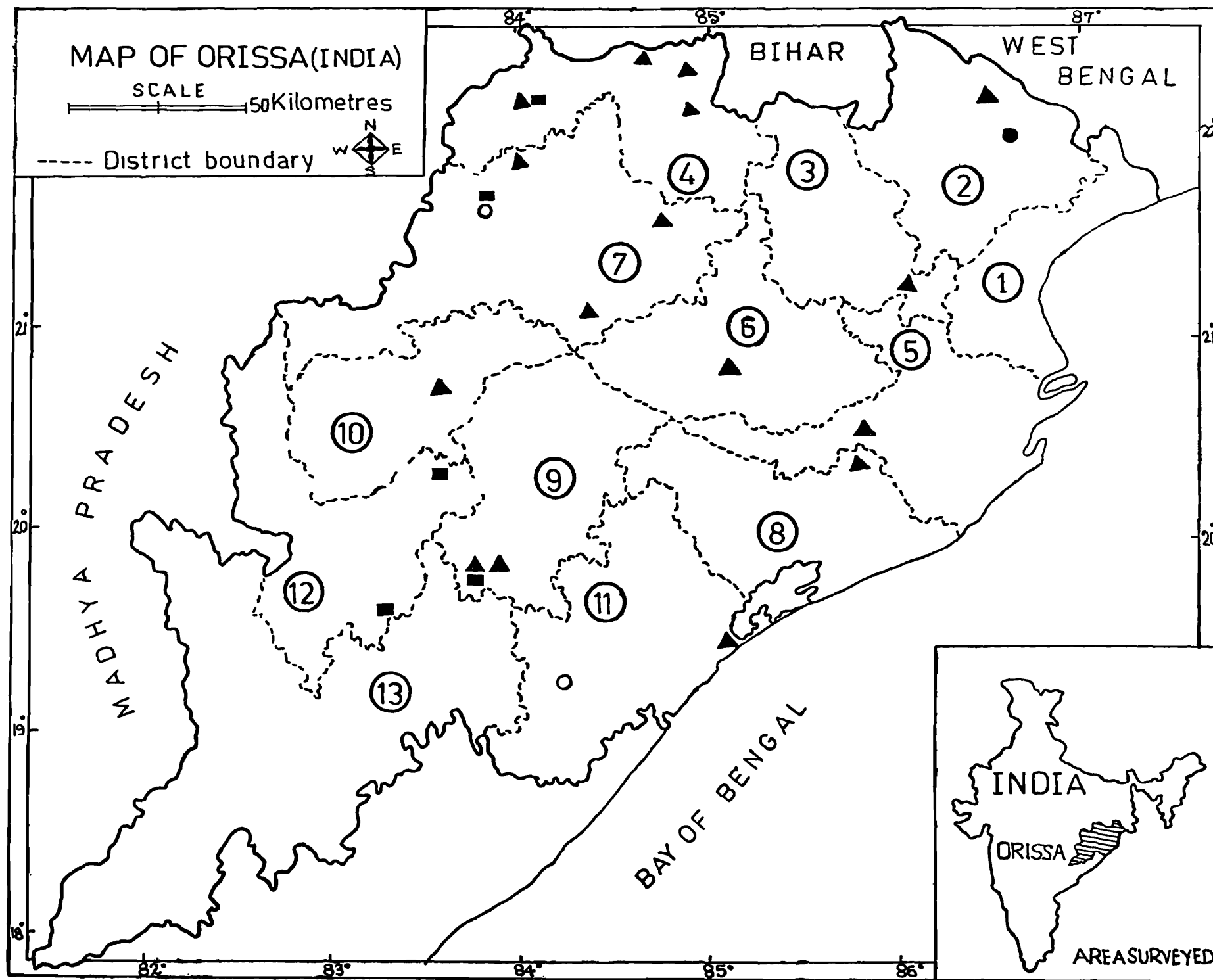


Map 11. Distribution of ● *Epistaurus sinetyi*, ○ - *Eucoptacra saturata*, ▲ - *Oxyrrhepes obtusa*, ⊙ *Tristria pulvinata*, ■ - *Brachyxenia scutifera*.





Map 13. Distribution of ○ - Catantops pinguis innotabilis, ▲ - Stenocatantops splendens, ■ - Xenocatantops karnyi, ● - Perithoicus ophthalmicus,



21. *Gastrimargus africanus africanus* (Saussure)

1888. *Oedaleus* (*Gastrimargus*) *marmoratus* var. *africana* Saussure, *Mem. Soc. Phys. Hist. nat. Geneve*, 30(1) : 39.
 1910. *Gastrimargus africanus* : Kirby, *Syst. Cat. Orth.*, 3 : 227.
 1982. *Gastrimargus africanus africanus* : Ritchie, *Bull. Br. Mus. nat. Hist. (Ent.)*, 44(4) : 248.

Material examined : Mayurbhanj Dist.—Bisoi, 17.viii.1972, 1 ♂ ; Gurguria Forest Rest House (Simlipal hills), 13.xi.1972, 1 ♀ . Keonjhar Dist.—Keonjhar, 21, 23-28.ix.1972, 2 ♂ ♂ and 2 ♀ ♀ . Sundargarh Dist.—Bonaigarh, 15.xii.1971, 1 ♂ ; Bishalvari Reserve Forest (Sundargarh), 9.i.1972, 1 ♀ ; Dhenkanal Dist.—Angul, 29.ix. & 2.x.1972, 4 ♂ ♂ . Sambalpur Dist.—Sambalpur, 29.xii.1971, 1 ♀ , 6.xi.1972, 1 ♀ ; Jharsuguda, 5.i.1972, 1 ♀ ; Bolangir Dist.—Bolangir, 1.i.1972, 1 ♂ and 1 ♀ , 9.xi.1972, 1 ♂ . Kalahandi Dist.—Madanpur-Rampur, 6.xii.1973, 1 ♀ ; Koraput Dist.—Chandili, 28-29.xi.1983, 1 ♂ and 1 ♀ .

Remarks : It is of large size. Antennae as long as head and pronotum together or slightly larger. Pronotum tectiform with high sharp median carina. Wing with dark brown or black fasciae. Hind femora brown or blackish.

G. africanus africanus occurs almost throughout the state from Koraput in south to Bisoi in the north eastern region (Map, 8).

In general it occurs all over from peninsular India to the north of Himalayas ; Sri Lanka, Pakistan, Nepal, Southern Tibet, Burma, Thailand, Middle east and Africa.

22. *Heteropternis respondens* (Walker)

1859. *Acrydium respondens* Walker, *Ann. Mag. nat. Hist.*, (3) 4 : 223.
 1914. *Heteropternis respondens* : Kirby, *Faun. Brit. India, Orth.*, (Acrididae) : 141.

Material examined : Mayurbhanj Dist.—Jenabil forest, 20.iii.1973, 1 ♀ .

Remarks : It is of medium size ; antennae slender, longer than head and pronotum together ; lateral lobe of pronotum in lateral half sloping but straight, making a well marked right angle with the posterior margin. Wings yellowish near the base.

Only one female of *H. respondens* has been collected in Orissa so far from Mayurbhanj District (Map, 8). In India outside Orissa it is

widely distributed in Uttar Pradesh, Bihar, West Bengal, Tamil Nadu and Arunachal Pradesh. This species also occurs in China, Burma, Sri Lanka and south east Asia.

23. **Locusta migratoria migratorioides* (Reiche & Fairmaire)

1859. *Oedipoda migratorioides* Reiche & Fairmaire Voy., *Abyssini*, 3 : 430.
 1902. *Locusta migratorioides* : Kirby, *The Uganda Protectorate* 1 : 468.
 1914. *Locusta migratorioides* : Kirby, *Faun. Brit. India Orth.*, (Acrididae) : 146.
 1951. *Locusta migratoria migratorioides* : Uvarov, *Bull. off. nat. anti-Acrid. Paris* no. 1 : 1-4.

Material examined : Koraput Dist.—Chandili, 28.xi.1983, 1 ♂ and 1 ♀.

Remarks : This species is of large size. General colouration green, or brown. Head sometimes slightly inflated. Pronotum tectiform or saddle shaped ; lateral lobes of pronotum higher than its length ; metazona rounded or angular posteriorly. *Locusta migratoria migratorioides* occurs in two forms (form *solitaria* and form *gregaria*). The two forms are very sharply different, but all intermediate forms exist.

We have found the example of *solitaria* phase of *Locusta migratoria migratorioides* in southern Koraput district of Orissa (Map 8). It occurs in the whole of Ethiopian region and whole of eastern hemisphere except Arctic and northern region.

24. *Morphacris fasciata sulcata* (Thunberg)

1815. *Gryllus fasciatus* Thunberg, *Mem. Acad. Sci. St. Petersburg*, 5 : 230.
 1910. *Morphacris citrina* : Kirby, *Syst. Cat. Orth.*, 3 : 219.
 1921. *Morphacris fasciata sulcata* : Uvarov, *Ann. Mag. nat. Hist.*, (9) 7 : 488-89.

Material examined : Mayurbhanj Dist.—Joshipur, 11.xii.1975, 1 ♀. Keonjhar Dist.—Keonjhargarh, 23.ix.1972, 1 ♀ ; Ghatgaon, 1.iv.1973, 1 ♂. Sundargarh Dist.—Subulia Khasra Forest (Sundargarh), 10.i.1972, 2 ♂ ♂. Dhenkanal Dist.—Angul, 29.ix.1972, 1 ♂ and 2 ♀ ♀. Sambalpur Dist.—Sambalpur, 22.xii.1971, 1 ♂. Ganjam Dist.—Barkuda Island (Chilka Lake), 7.ix.1920, 1 ♂ and 1 ♀ ; Kalijogeshwar (Chilka Lake), 19.iii.1974, 1 ♀.

Remarks : This species is of medium size. Antennae filiform, longer than head and pronotum together. Pronotum tectiform, without lateral carinae ; median carina sharp and high ; dorsum covered with

parallel sharp longitudinal ridges. Wings with base light yellow with dark transverse fascia.

M. fasciata sulcata is sparsely distributed in Orissa and we have found it mostly in north eastern region of the State with isolated record from east coast in Ganjam District (Map 7). It is widely distributed in India and has been recorded from Tamil Nadu, Bihar, Madhya Pradesh, Maharashtra, Andhra Pradesh, Kerala and Goa.

25. *Oedaleus abruptus* (Thunberg)

1815. *Gryllus abruptus* Thunberg, *Mem. Acad. Sci. St. Petersb.*, 5 : 233.

1884. *Oedaleus abruptus* : Saussure, *Mem. Soc. Phys. Hist. Geneve*, 28 : 117.

1914. *Oedaleus abruptus* : Kirby, *Faun. Brit. India Orth. (Acrididae)* : 144.

Material examined : *Mayurbhanj Dist.*—Bangriposi, 13.ix.1972, 2 ♂♂. *Keonjhar Dist.*—Keonjhargarh, 19-26.ix.1972, 18 ♂♂ and 44 ♀♀ ; Upardhia, 31.iii.1973, 3 ♂♂ ; Keonjhargarh, 11.viii.1983, 1 ♀. *Sundargarh Dist.*—Raurkela, 8-9.xii.1971, 4 ♂♂ and 7 ♀♀, 25.ii.1973, 2 ♂♂ ; Bonaigarh, 13-17.xii.1971, 54 ♂♂ and 90 ♀♀ ; Bishalvari Reserve Forest (Sundargarh), 9.1.1972, 1 ♂ ; Subulia Khasra Forest (Sundargarh), 10.i.1972, 4 ♂♂, 11-12.x.1972 3 ♂♂, 14.x.1972, 2 ♂♂ and 1 ♀, 25.x.1972, 1 ♀, 20.iii.1973, 2 ♀♀. *Cuttack Dist.*—Nandanakanan, 23.iii.1974, 1 ♀. *Dhenkanal Dist.*—Angul, 29-30.ix.1972 and 2-3.x.1972, 7 ♂♂ and 10 ♀♀, 13.iv.1973, 1 ♂ ; Dhenkanal, 7.x.1972, 1 ♂, 28.viii.1983, 1 ♀. *Sambalpur Dist.*—Sambalpur, 19-27.xii.1971, 32 ♂♂ and 30 ♀♀ ; Burapara (Sambalpur), 5.i.1972, 2 ♀♀ ; Jharsuguda, 1.xi.1972, 12 ♀♀ ; Deogarh, 23.iv.1973, 1 ♀. *Bolangir Dist.*—Hathisalpara (Bolangir), 30.xii.1971, 2 ♂♂ ; Bolangir, 1-3.i.1972, 10 ♂♂, 9.xi.1972, 2 ♀♀. *Ganjam Dist.*—Chilka Lake, 24.ix.1972, 1 ♀. *Koraput Dist.*—Koraput, 21.iii.1972, 1 ♂. *Baudhkhondmals Dist.*—Kotgarh, 12.xii.1973, 1 ♀.

Remarks : It is of small size. Fastigium of head almost flat. Pronotum with distinct shaped markings situated on slightly raised ridges. Wings with incomplete dark bands.

The species is fairly well distributed in Orissa and we have found it in 8 districts of the State mainly in the northern region in sufficient numbers (Map, 6). This is a typical species of the genus with a wide distribution in Indian sub-continent from Himalayas to Kanyakumari. It has also been known from southern and central China.

26. **Pternoscirta cinctifemur* (Walker)

1859. *Acridium cinctifemur* Walker, *Ann. Mag. Nat. Hist.*, (3) 4 : 223.

1914. *Pternoscirta cinctifemur* : Kirby, *Faun. Brit. India Orth.*, (Acridiade) : 134.

Material examined : Mayurbhanj Dist.—Bisoi, 23.iii.1973, 2 ♂ ♂.

Remarks : It is of medium size. Head and pronotum granular with small sparse tubercles. Pronotum with sharp median carina ; wing red at base ; tegmina narrow with transverse veins in apical part oblique and arranged in zig-zag pattern. Hind femora buff or bluish grey outside and with black spots ; hind tibiae black, banded with yellow at the base and blue beyond.

The single record of this species is from Bisoi (Mayurbhanj District) in north east Orissa (Map 7). *P. cinctifemur* has been recorded from Assam, West Bengal, Tamil Nadu and Goa. It has also been found in Sri Lanka and Eastern Nepal.

27. **Trilophidia annulata* (Thunberg)

1815. *Gryllus annulatus* Thunberg, *Mem. Acad. Sci. St. Petersb.*, 5 : 234.

1873. *Trilophidia annulata* : Stal, *Recensio Orthopterorum*, 1 : 132.

1914. *Trilophidia annulata* : Kirby, *Faun. Brit. India Orth.* (Acrididae) : 149.

1965. *Trilophidia annulata* : Hollis, *Trans. R. ent. Soc. Lond.*, 117 (8) : 251.

Material examined : Mayurbhanj Dist.—Bisoi, 14.viii.1972, 1 ♀ ; Aasua, 16.vii.1972, 1 ♂ ; Katra, 13.ix.1972, 3 ♂ ♂ and 8 ♀ ♀, 14.ix.1972, 5 ♂ ♂ and 4 ♀ ♀, 15.ix.1972, 12 ♀ ♀ and 11 ♀ ♀, 16.ix.1972, 5 ♂ ♂ and 1 ♀ ; 17.ix.1972, 1 ♂ and 1 ♀ ; Baripada, 7-8.viii.1983, 2 ♂ ♂. Keonjhar Dist.—Kashipur, 19.ix.1972, 1 ♂ ; Bhatsai, 20.ix.1972, 2 ♀ ♀ ; Keonjharagarh, 20-23.ix.1972, 1 ♂ and 2 ♀ ♀ ; Jaganathpur, 2 ♂ ♂ and 22.ix.1972, 1 ♂ and 3 ♀ ♀ ; Badand, 20.ix.1972, 1 ♀ ; Padampur, 21.ix.1973, 1 ♂ ; Govindpur, 21.ix.1972, 1 ♂ ; Bankapatuli, 23.ix.1973, 1 ♂ and 3 ♀ ♀ ; Silwan, 25.ix.1972, 7 ♂ ♂ and 3 ♀ ♀, 26.ix.1972, 3 ♂ ♂, 2 ♀ ♀ ; Ghatgaon, 29.iii.1973, & 1.iv.1973, 3 ♂ ♂, 5 ♀ ♀ ; Patua, 30.iii.1973, 1 ♂, 2 ♀ ♀ ; Anandapur, 3.iv.1973, 1 ♀ ; Rankie, 12.viii.1983, 1 ♀ ; Ghatgaon, 21.xii.1973, 1 ♂, 2 ♀ ♀. Sundargarh Dist.—Raurkela, 8.xii.1971, 2 ♂ ♂, 9.xii.1971, 1 ♀, 11.xii.1971, 3 ♀ ♀ ; Bonaigarh, 13.xii.1971, 2 ♂ ♂, 15.xii.1971, 2 ♂ ♂, 16.xii.1971, 2 ♂ ♂, 1 ♀, 17.xii.1971, 1 ♂ ; Sundargarh, 9.i.1972, 1 ♂, 10-11.i.1972, 2 ♀ ♀ ; Sankara, 26.x.1972, 1 ♂. Cuttack Dist.—Nandankanan, 22-23.iii.1974, 2 ♂ ♂ ; Bhagwanpur,

24.iii.1974, 2 ♂♂, 2 ♂♂ ; Barang, 30.i.1974, 2 ♂♂. *Dhenkanal Dist.*—Angul, 29.ix.1972, 3 ♂♂, 7 ♀♀, 30.ix.1972, 2 ♂♂, 1 ♀ ; Lingarajori, 3.x.1972, 2 ♂♂, 6 ♀♀ ; Angul, 9.iv.1973, 1 ♀, 10.iv.1973, 1 ♂, 13.iv.1973, 1 ♂, 1 ♀. *Sambalpur Dist.*—Sambalpur, 19.xii.1971, 1 ♂, 1 ♀, 3-6.xi.1972, 3 ♂♂, 3 ♀♀, 18.xi.1972, 1 ♀ ; Dhanupali, 22.xii.1971, 2 ♀♀ ; Rampur Khasra Forest, 26.xii.1971, 1 ♂, 1 ♀ ; Jharsuguda, 31.x. & 1.xii.1971, 2 ♂♂ and 2 ♀♀ ; 5.i.1972, 2 ♂♂, 1 ♀ ; Hirakud dam, 5.xi.1972, 2 ♀♀. *Puri Dist.*—Konark, 20.i.1972, 1 ♂ ; Puri, 27.iii.1974, 3 ♀♀. *Bolangir Dist.*—Bolangir (Matkai Reserve Forest), 31.xii.1971, 2 ♀♀, 11.xi.1972, 2 ♂♂, 1 ♀ ; Salapali, 1.i.1972, 2 ♀♀ ; Gaundrail Village, 2.i.1972, 1 ♀ ; *Ganjam Dist.*—Barkuda Island, 17.viii.1919, 1 ♀, 17.viii.1920, 1 ♂ ; Taptapani, 13-15.iii.1974, 1 ♂, 2 ♀♀. *Koraput Dist.*—Koraput, 2.ii.1972, 1 ♂, 26.ii.1972, 2 ♀♀. Badchindri, 21.ii.1972, 1 ♂, 1 ♀ ; Semiliguda, 22.ii.1974, 1 ♂.

Remarks : *Trilophidia annulata* is very variable in size and general colouration. It can easily be distinguished by the shape of the lophi of male epiphallus.

This species is very well distributed in Orissa (Map, 7). It is widely distributed in India and its range of distribution extends from Pakistan to North Borneo and extends into Palaearctic region in Mongolia, China, Korea and Japan.

Family III. HEMIACRIDIDAE

28. **Clonacris kirbyi* (Finot)

1903. *Euthymia kirbyi* Finot, *Annls Soc. ent. Fr.*, 71 : 622, 629.

1943. *Clonacris kirbyi* : Uvarov, *Ann. Mag. nat. Hist.*, (11) 10(66) : 388.

Material examined : *Mayurbhanj Dist.*—Baripada, 6.xi.1972, 1 ♀. *Keonjhar Dist.*—Ghatgaon, 19.viii.1972, 2 ♀♀ ; Atei Reserve Forest (Ghatgaon), 23.viii.1972, 1 ♀ ; Deogarh, 11.vi.1972, 1 ♂. *Sundargarh Dist.*—Barsuan, 15.ix.1972, 1 ♂.

Remarks : *C. kirbyi* can easily be separated in having head short and broad with face broader than long. Known in India from Tamil Nadu and Karnataka. Examination of available collections reveals that this species is rather limited in distribution in Orissa and we have found only from Mayurbhanj, Keonjhar, Sambalpur and Sundargarh Districts of Orissa (Map, 9).

29. **Gesonula punctifrons* (Stål)

1860. *Acridium (Oxya) punctifrons* Stål, *Kongl. Freg. Eug. Resa Zool.*, 5 Orthopt. : 336.
 1951. *Gesonula punctifrons* : Mistchenko, *Locusts and Grasshoppers of U. S. S. R. and adjacent countries*, Catantopinae, Leningrad : 172.

Material examined : Sambalpur Dist.—Sambalpur, 19.xii.1971, 2 ♂ ♂ and 2 ♀ ♀.

Remarks : *G. punctifrons* can easily be identified by the characteristic wide vertex in both sexes ; mesonotum with a rather narrow space between the lobes and dorsal valves of female ovipositor with small blunt teeth along the dorso-outer margin. Known from Tamil Nadu, Assam, and West Bengal.

In Orissa we have found it only from Sambalpur so far (Map, 9). There is a possibility of its occurrence in other areas as this species is known to occur in mixed habitat of grass and low vegetation. Recorded earlier from West Bengal, Assam Tamil Nadu.

30. *Hieroglyphus banian* (Fabricius)

1978. *Gryllus banian* Fabricius, *Ent. Syst. Suppl.* : 194.
 1914. *Hieroglyphus banian* : Kirby, *Faun. Brit. India Orth. (Acrididae)* : 204.
 1973. *Hieroglyphus banian* : Mason, *Bull. Br. Mus. nat. Hist. (Ent.)* 28(1) : 340.

Material examined : Mayurbhanj Dist.—Bangripasi, 13.ix.1972, 1 ♀. Dhenkanal Dist.—Angul, 29.ix. & 2.x.1972, 6 ♂ ♂, 8 ♀ ♀ ; Dhenkanal, 7.x.1972, 1 ♀. Sambalpur Dist.—Sambalpur, 11.ix.1980, 2 ♂ ♂, 5 ♀ ♀, Puri Dist.—29.xii.1899, 6 ♀ ♀ ; Barkul, 9-13.xi.1912, 1 ♂. Bolangir Dist.—Bolangir, 1.x.1972, 1 ♀. Ganjam Dist.—Chicacola, 4.xii.1891, 2 ♀ ♀.

Remarks : *H. banian* is characterised in having a bifurcate male cercus. The species is widely distributed in India, Bhutan, Bangladesh, Burma, Vietnam, Thailand and China and is a pest of paddy.

We have found this species in collections from Mayurbhanj, Dhenkanal, Sambalpur, Bolangir and Ganjam Districts of Orissa (Map, 9).

31. *Hieroglyphus nigrorepletus* (I. Bolivar)

1912. *Hieroglyphus nigrorepletus* Bolivar, *Trab. Mus. nac. Cienc. nat. Madr.*, No. 6 : 56.
 1914. *Hieroglyphus bettoni* : Kirby, *Faun. Brit. India, Orth. (Acrididae)* : 203.
 1973. *Hieroglyphus nigrorepletus* : Mason, *Bull. Br. Mus. nat. Hist. (Ent.)* 28(1) : 340.

Material examined : *Dhenkanal Dist.*—Angul, 29.ix.1972, 2 ♂♂ and 3 ♀♀. *Ganjam Dist.*—7.xii.1891. 1 ♂.

Remarks : *H. nigrerepletus* can easily be separated by characteristic marking on pronotum and shape of male cerci.

This species is found all over northern and southern India and Pakistan, east to and including Bihar and Orissa, north to Kashmir and west to southern Baluchistan ; apparently confined to Plain and low plateaus. In our studies on collections from Orissa we have found this species from Dhenkanal and Ganjam districts of Orissa (Map, 9).

32. *Hieroglyphus oryzivorous* Carl

1916. *Hieroglyphus oryzivorous* Carl, *Revue. suisse Zool.*, 24 : 480.

Material examined : *Dhenkanal Dist.*—Angul, 3.x.1972, 6 ♂♂.

Remarks : *H. oryzivorous* can be easily identified with the shape of male epiphallus. In India this species is distributed in Gujarat, Maharashtra, Andhra Pradesh, Orissa and Rajasthan.

It is fairly well distributed in Orissa but in our collections we have found it only from Angul in Dhenkanal District (Map, 9).

33. *Spathosternum prasiniferum prasiniferum* (Walker)

1871. *Heteracris* (?) *prasinifera* Walker, *Cat. Derm. Salt. Brit. Mus.*, 5 Suppl. : 65.

1914. *Spathosternum prasiniferum* : Kirby, *Faun. Brit. India, Orth. (Acrididae)* : 208.

1952. *Spathosternum prasiniferum prasiniferum* : Mishchenko, *Fauna USSR*. 4 no 2 : 127.

Material examined : *Mayurbhanj Dist.*—Bangriposi, 13.ix.1972, 1 ♂. *Keonjhar Dist.*—Keonjhar, 20-27.ix.1972, 9 ♂♂ and 7 ♀♀ ; patua, 30.iii.1973, 1 ♂ ; Ghatgaon, 1.iv.1973, 16 ♂♂, 3 ♀♀ ; Rankie, 12.viii.1983, 1 ♀. *Sundargarh Dist.*—Raurkela, 8, 9, 11.xii.1971, 15 ♂♂ and 15 ♀♀ ; Bonaigarh, 13, 15-17.xii.1971, 29 ♂♂, 23 ♀♀ ; Bishalvari Reserve Forest, 9.i.1972, 3 ♂♂ and 2 ♀♀ ; Sundargarh, 10-12.i.1972, 3 ♂♂ and 2 ♀♀. *Cuttack Dist.*—Cuttack 14.iv.1973, 1 ♂ ; Nandanakan, 22, 29.iii.1974, 4 ♂♂, 2 ♀♀. *Dhenkanal Dist.*—Angul, 29.ix. and 1, 3.x.1972, 7 ♂♂, 2 ♀♀, 10.iv.1973, 2 ♂♂. *Sambalpur Dist.*—Sambalpur, 19-23, 27.xii.1971, 57 ♂♂, 35 ♀♀, 3.xi.1972, 1 ♂, 2 ♀♀, 21.viii.1983, 1 ♂ ; Rairakhola, 25-26.xii.1971, 9 ♂♂, 6 ♀♀, 13.ix.1972, 1 ♀ ; Jharsuguda, 7.i.1972, 4 ♂♂, 4 ♀♀, 1.xi.1972, 2 ♀♀ ; Hirakud Dam, 25.ix.1972, 1 ♀, 5.xi.1972, 1 ♂, 22.vii.1983, 1 ♀. *Puri Dist.*—

Balugaon (Puri), 14.xii.1908, 1 ♀ ; Puri, 27.iii.1974, 2 ♂ ♂. *Bolangir Dist.*—Bolangir, 30.xii.1971 and 2.1.1972, 20 ♂ ♂, 10 ♀ ♀ ; Matkai Reserve Forest (Bolangir), 31.xii.1971, 7 ♂ ♂, 7 ♀ ♀. *Ganjam Dist.*—Taptapani, 14.iii.1974, 3 ♀ ♀.

Remarks : *S. p. prasiniferum* lives in the grassy habitats and can easily be separated from *Spathosternum prassiniferum sinense*, in having well developed tegmina reaching distal end of hind femora or slightly beyond it. Wings well developed.

This species occurs throughout India and has also been reported from south eastern China. *S. p. prasiniferum* is well distributed in Orissa and most of the records are from northern and north eastern regions. However, a few records are from central and south eastern parts (Map, 9).

Family IV CATANTOPIDAE

Subfamily TERATODINAE

34. **Teratodes monticollis* (Gray)

1832. *Gryllus monticollis* Gray, *Griffith's Anim. Kingd.*, 15 : 215.

1914. *Teratodes monticollis* : Kirby, *Faun., Brit. India Orth. (Acrididae)* : 235.

Material examined : *Sundargarh Dist.*—Bonaigarh, 17.xii.1971, 1 ♂. *Cuttack Dist.*—Nandankanan, 13.xii.1971, 1 ♀. (N) *Ganjam Dist.*—Chatrapur, 11.vii.1903, 1 ♂ and 1 ♀ ; Taptapani, 14.iii.1974, 1 ♂ (N).

Remarks : *T. monticollis* can readily be distinguished by large raised pronotum. Recorded earlier in India from southern region. The genus is endemic to India and Sri Lanka. In Orissa this species is rare in collection as we have found only few specimens from Sundargarh and Ganjam Districts (Map, 9).

Subfamily OXYINAE

35. **Oxya fuscovittata* (Marschall)

1836. *Gryllus fuscovittatus* Marschall, *Ann. Wien. Mus. Vienna*, 1 (2) : 221.

1971. *Oxya fuscovittata* : Hollis, *Bull. Br. Mus. nat. Hist. (Ent.)*, 26 (7) : 289.

Material examined : *Balasore Dist.*—Balasore, 9.xii.1955, 1 ♀. *Mayurbhanj Dist.*—Baripada, 14.xi.1955, 2 ♀ ♀. *Sundargarh Dist.*—Raurkela, 8, 11.xii.1971, 3 ♂ ♂. *Cuttack Dist.*—3.xii.1965, 1 ♂ ; Nandankanan, 27.iii.1974, 1 ♂ and 1 ♀. *Dhenkanal Dist.*—Angul, 29.ix.1972,

1 ♂ . *Sambalpur Dist.*—Sambalpur, 6.xi.1972, 1 ♂ . *Puri Dist.*—Balugaon, 20.iii.1974, 1 ♀ . *Baudhkhandmals Dist.*—Phulbani (Kotagarh), 12.xii.1973, 1 ♂ . *Ganjam Dist.*—Taptapani, 12.iii.1974, 1 ♂ and 1 ♀ . *Kalahandi Dist.*—Madanpur, Rampur, 6.x.1973, 1 ♀ . *Koraput Dist.*—Malkangiri, 2.xii.1973, 1 ♂ .

Remarks : *Oxya fuscovittata* can easily be distinguished by laterally compressed and weakly bifurcate male cercus and ventral surface of subgenital plate, in female it is almost completely flat or weakly concave.

This species is fairly well distributed in southern, north west and north east India. In Orissa it occurs almost throughout the State (Map, 10) but in low numbers.

36. *Oxya hyla hyla* Serville

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

1971. *Oxya hyla hyla* : Hollis, *Bull. Br. Mus. nat. Hist. (Ent.)* 26(7) : 282.

Material examined : *Balasore Dist.*—Balasore, 29.xi. & 8.xii.1955, 1 ♂ and 2 ♀ ♀ . *Keonjhar Dist.*—Keonjhar, 19.viii.1972, 1 ♂ ; Champagarh, Lulong, 8.xi.1972, 1 ♂ ; Patua, 30.iii.1973, 3 ♂ ♂ ; Atei Reserve Forest (Ghatgaon), 31.iii.1973, 1 ♀ ; Ghatgaon, 21.xii.1975, 2 ♂ ♂ and 1 ♀ ; Anandapur, 3.iv.1973, 18 ♂ ♂ & 12 ♀ ♀ . *Sundargarh Dist.*—Raurkela, 11.xii.1971, 2 ♀ ♀ ; Bonaigarh, 15.xii.1971, 1 ♀ ; Sundargarh, 21.ix.1972, 1 ♀ , 29.iii.1973, 2 ♂ ♂ . *Cuttack Dist.*—Cuttack, 5.xii.1965, 1 ♀ ; Nandankanan, 25.iii.1974, 1 ♂ . *Dhenkanal Dist.*—Angul, 1,3.x.1972, 3 ♀ ♀ ; Angul, 10.iv.1973, 1 ♀ . *Sambalpur Dist.*—Sambalpur, 22.xii.1971, 2 ♂ ♂ and 2 ♀ ♀ . *Bolangir Dist.*—Bolangir, 1, 2, 9.xi.1972, 3 ♂ ♂ . *Baudhkhandmals Dist.*—Kotagarh (Phulbani) 12.vii.1972, 1 ♂ .

Remarks : *Oxya hyla hyla* is variable in its general appearance and can easily be identified in having ventral surface of subgenital plate in female with two longitudinal ridges extending forwards from posterior margin, these ridges often toothed.

It is widely distributed in different parts of Indian sub continent and Africa. In Orissa we have found this species in northern part of Orissa with few records in central region (Map, 10).

37. **Oxya nitidula* (Walker)

1870. *Acridium nitidulum* Walker, *Cat. Derm., Salt. Br. Mus.*, 4 : 631.

1971. *Oxya nitidula* : Hollis, *Bull. Br. Mus. nat. Hist. (Ent.)*, 26(7) : 315.

Material examined : *Mayurbhanj Dist.*—Baripada, 17.iii.1972, 1 ♀
Keonjhar Dist.—Anandapur, 3.iv.1973. 28 ♂♂, 11 ♀♀. *Sundargarh Dist.*—Raurkela, Panposh, 11.xii.1971, 1 ♀. *Cuttack Dist.* 6.xii.1965, 3 ♂♂. *Sambalpur Dist.*—Sambalpur, 17.xii.1971, 3 ♂♂ ; Dhanupali, 23.xii.1971, 1 ♀ ; Sambalpur, 6.xi.1972, 2 ♂♂. *Bolangir Dist.*—Bolangir, 16.xi.1972, 1 ♀

Remarks : *Oxya nitidula* can easily be recognised by the truncate apex of the male cercus and in having a sub apical tooth on each side of the median apical spine on the ventral surface of subgenital plate in female.

Recorded earlier from south India and Sri Lanka. The few Records in Orissa are scattered and mostly in the northern half (Map, 10).

Subfamily COPTACRINAE

38. *Eucoptacra saturata* (Walker)

1870. *Acridium saturatum* Walker, *Cat. Derm. Salt. Br. Mus. Pt. III Locustidae* : 628.

1921. *Eucoptacra saturata* : Uvarov, *Ann. Mag. nat. Hist.*, (9) 7 : 503.

Material examined : *Mayurbhanj Dist.*—Bisoi, 23.iii.1973, 1 ♂.
Sambalpur Dist.—Deogarh, 11.vi.1972, 2 ♂♂ ; Sambalpur, 7.xi.1972, 2 ♂♂. *Baudhkhondmals Dist.*—Kotagarh, 15.xii.1973, 1 ♂. *Bolangir Dist.*—Bolangir (Matkai Reserve Forest), 31.xii.1971, 7 ♂♂, 4 ♀♀.

Remarks : *E. saturata* rather limited in distribution in India. We have records from Madhya Pradesh only. The occurrence of this species in adjoining Orissa extends its distributional range towards eastern part of India (Map, 11).

39. **Epistaurus sinetyi* Bolivar

1902. *Epistaurus sinetyi* Bolivar, *Annl. Soc. ent. Fr.*, 70 : 623.

1914. *Epistaurus sinetyi* : Kirby, *Faun. Brit. India, Orth. (Acrididae)* : 242.

Material examined : *Cuttack Dist.* Bhubaneshwar, 7.viii.1981, 1 ♂.
Ganjam Dist. Taptapani, 15.iii.1974, 1 ♂.

Remarks : *E. sinetyi* can easily be identified in having raised

pronotum, median carina cut by third sulcus. Tegmina well developed and obliquely truncated at apex.

In India this species is so far known only from Tamil Nadu and West Bengal. In Orissa we have found two examples of this species in Cuttack and Ganjam district (Map, 11).

Subfamily TROPIDOPOLINAE

40. **Oxyrrhepes obtusa* (de Haan)

1842. *Acridium (Oxya) obtusum* de Haan, *Verh. Ned. Overz. Bezitt. Orth.*, : 155, 156.

1929. *Oxyrrhepes obtusa* : Willemse, *Treubia*, 10 : 463.

Material examined : Mayurbhanj Dist.—Meghasoni, 19.iii.1973, 1 ♀.

Remarks : *O. obtusa* can easily be recognised by long triangular supra-anal plate, with pointed apex ; cercus slender and only reaching a little behind the supra-anal plate. The single record in Orissa is from Meghasoni in Mayurbhanj district (Map, 11).

Recorded earlier in India from Tamil Nadu, Karnataka, Madhya Pradesh, Rajasthan and Sikkim. It has also been reported from Sri Lanka, Burma, Indonesia and Taiwan.

41. **Tristria pulvinata* (Uvarov)

1921. *Tapinophyma pulvinata* (Uvarov), *Ann. Mag. nat. Hist.*, (9)7 : 497.

1929. *Tristria pulvinata* : Uvarov, *Revue suisse Zool.*, 29 : 559.

1970. *Tristria pulvinata* : Hollis, *J. nat. Hist.*, 4 : 465.

Material examined : Cuttack Dist.—Nandankanan, 27.iii.1974, 1 ♂ & 1 ♀.

Remarks : *Tristria pulvinata* can easily be identified in having anterior half of ventral margin of lateral lobe of pronotum, in female, weakly upcurved ; male subgenital plate, almost linear in ventral view.

Recorded earlier in India mostly from south India in Kerala, Karnataka and Tamil Nadu. It has also been recorded from West Bengal, Maharashtra, Punjab and Assam. The single record of the species from Nandankanan in Orissa (Map, 11) further extends its range in India.

Subfamily CALLIPTAMINAE

42. **Brachy xenia scutifera* (Walker)

1870. *Caloptenus scutifer* Walker, *Cat. Derm. Salt. Br. Mus.*, 4 : 704.

1914. *Brachy xenia scutifera* : Kirby, *Faun. Brit. India, Orth.*, (Acrididae) : 256.

Material examined : Bolangir Dist.—Bolangir, 2.i.1972, 1 ♂.

Remarks : *B. scutifera* can easily be distinguished in having very broad body, head broad ; pronotum very flat and broad ; lateral carinae obscure.

This genus is endemic to India and is known by only this species. Recorded earlier from Tamil Nadu and Andhra Pradesh in India. The present record from Orissa further extends the distribution of this species. We have found a single specimen of this species in collections from Bolangir District (Map, 11).

Subfamily EYPREPOCNEMINAE

43. **Choroedocus capensis* (Stål)

1815, *Gryllus capensis* Stål, *Nov. Acta. Soc. Sci. Upsal*, 1 : 108.

1921. *Choroedocus capensis* : Uvarov, *Trans. ent. Soc. Lond.*, : 108.

Material examined : Cuttack Dist.—Paradip (Mangrove Forest), 8.ix.1972, 1 ♀. Puri Dist.—Balugaon, 26.ix.1972, 1 ♀.

Remarks : *C. capensis* can easily be recognised in having numerous large brown blackish spots on tegmina ; male subgenital plate with truncate apex.

This species is widely distributed in Indian sub-continent, China and south east Asia. We have found only two females of this species mainly from coastal area of Cuttack and Puri Districts (Map, 12).

44. **Eyprepocnemis alacris alacris* (Serville)

1839. *Acridium alacre* Serville, *Ins. Orth.*, : 682.

1958. *Eyprepocnemis alacris alacris* : Dirsh, *Proc. R. ent. Soc. Lond.*, (B) 27 (3-4) : 40.

Material examined : Mayurbhanj Dist.—Bangriposi (Katra), 16.ix.1972, 1 ♂. Keonjhar Dist.—Keonjhargarh, 25.ix.1972, 1 ♂ ; Ghatgaon, 22.xi.1972, 1 ♀ ; Anandapur, 2.iv.1973, 1 ♀. Dhenkanal Dist.—Hirakud dam (Sambalpur), 5.xi.1972, 1 ♀. Puri Dist.—Balugaon, 24.iii.1973, 1 ♀. Bolangir Dist.—Salapali (Bolangir), 1.i.1972, 1 ♂.

Remarks : *E. alacris alacris* can easily be separated from other members of the genus in having bluish grey hind tibiae, with two whitish ring at the base tibial and reddish apex and tarsus ; male cercus gradually narrowing towards apex incurved and downcurved, with acute apex and the shape of male epiphallus.

This is a typical species of the genus with a wide distribution in northern, southern and eastern India. It has also been reported from Sri Lanka, Bangladesh, Pakistan and Afghanistan. This species is generally found in northern, north eastern, western and central districts of Orissa (Map, 12).

45. *Heteracris pulchra* (Bolivar)

1902. *Euprepocnemis pulchra* Bolivar, *Annls Soc. ent. Fr.*, 70 : 630.

1958. *Heteracris pulchra* : Dirsh, *Tijdschr. Ent.* 101 : 54.

Material examined : *Keonjhar Dist.*—Ghatgaon, 19, 21.viii.1972, 2 ♀ ♀ . *Puri Dist.*—Balugaon, 21-30.viii.1918, 1 ♂ ; Puri, 14, 19.ix.1972, 2 ♂ ♂ . *Sambalpur Dist.*—Sambalpur, 4.xi.1972, 1 ♀ . *Ganjam Dist.*—Burkuda Island, Chilka Lake, 17.vii.1914, 1 ♂ .

Remarks : *H. pulchra* is readily identified from other members of the genus in the absence of longitudinal black strip on the external side of hind femora. This species is recorded earlier in India from Tamil Nadu, Orissa, West Bengal and Uttar Pradesh. The present records from Orissa further extends the distribution range of this species in Orissa (Map, 12).

46. **Tylotropidius varicornis* (Walker)

1870. *Heteracris varicornis* Walker, *Cat. Derm. Salt. Br. Mus.*, 4 : 667.

1914. *Tylotropidius varicornis* : Kirby, *Faun. Brit. India*, Orth., (Acrididae) : 265.

Material examined : *Cuttack Dist.*—Bhubaneswar, 7.viii.1982, 1 ♀ . *Dhenkanal Dist.*—Angul, 12.iv.1973, 1 ♂ . *Baudhkhandmals Dist.*—Kotagarh, 15, 17.xii.1973, 1 ♂ and 1 ♀ .

Remarks : *T. varicornis* can easily be recognised by bituberculate prosternal spine ; tegmina semi-transparent having a row or triangular whitish spots upon the radial nervure, male supra-anal plate elongate and tri-angular.

This species has been recorded mainly from Goa, South India, Burma and Sri Lanka. The occurrence in Orissa further extends the distribution in eastern region of India (Map, 12).

Subfamily CATANTOPINAE

47. *Catantops pinguis innotabilis* (Walker)

1870. *Acridium innotabile* Walker, *Cat. Derm. Salt. Br. Mus.*, 4 : 629.

1953. *Catantops pinguis innotabilis* : Dirsh & Uvarov, *Tijdschr. Ent.*, 96(3) : 233.

Material examined : *Mayurbhanj Dist.*—Bangriposi, 16-17.ix.1972, 2 ♂ ♂ ; Bisoi (Deofata), 23.iii.1973, 1 ♂ ; Baripada, 9.viii.1983, 1 ♀ . *Keonjhar Dist.*—Ghatgaon, 19.viii.1972, 1 ♀ , 23.viii.1982, 1 ♀ ; Atei Reserve Forest, 20.viii.1972, 1 ♀ ; Keonjhargarh, 21, 23.ix.1972, 2 ♂ ♂ . *Sundargarh Dist.*—Bonaigarh, 17.xii.1971, 1 ♂ ; Sundargarh, 22.ix.1972, 2 ♀ ♀ , 16.viii.1983, 1 ♀ ; Banki, 29.iii.1973, 2 ♀ ♀ . *Cuttack Dist.*—Bhubaneswar, 4-6.xi.1912, 1 ♀ ; Anusupa lake, 29.viii.1972, 1 ♀ ; Ankula, Mandia, 30.viii.1972, 1 ♀ ; Nandankanan, 26.iii.1974, 1 ♀ ; *Dhenkanal Dist.*—Angul, 29-30.ix. & 1-3.x.1972, 18 ♂ ♂ , 20 ♀ ♀ ; Dhenkanal, 6-7.xi.1972, 3 ♂ ♂ , 1 ♀ ; Nimidha, 26.iii.1983, 1 ♀ ; Bogehora, 27.viii.1983, 1 ♀ . *Sambalpur Dist.*—Sambalpur, 12, 22.xii.1971, 1 ♂ , 4 ♀ ♀ , 26.ix.1972, 1 ♂ , 3, 7.xi.1972, 3 ♂ ♂ , 3 ♀ ♀ ; Jharsuguda, 1.xi.1972, 1 ♂ ; Deogarh, 23.iv.1973, 2 ♀ ♀ . *Puri Dist.*—Khandagiri, 7-8.xi.1972, 1 ♂ ; Puri, 14.ix.1972, 1 ♂ ; Gopalpur, 9, 11.x.1972, 1 ♂ , 3 ♀ ♀ , Botanical Garden ; Barang, 30.i.1974, 1 ♀ . *Bolangir Dist.*—Lathore, 22.v.1972, 1 ♀ ; Mahakhand, 31.v.1972, 1 ♂ ; Bolangir, 2.x.1972, 2 ♀ ♀ ; 10-11.xi.1972, 3 ♂ ♂ & 2 ♀ ♀ . *Ganjam Dist.*—Cheria Island (Chilka lake), 22.vii.1914, 1 ♀ ; Barkul, 1-3.vii.1914, 1 ♀ ; Barkuda Island, 17.ix.1919, 1.iv.1920, 16.viii.1920, 2 ♂ ♂ , 1 ♀ . *Kalahandi Dist.*—Madanpur-Rampur, 6, 8-9.xii.1973, 2 ♂ ♂ , 1 ♀ .

Remarks : *C. pinguis innotabilis* is very variable in size, colour pattern and in the shape of male cercus. Male cercus normally widened and slightly hammer shaped apically.

This species is widely distributed in Indian sub-continent. It is also widely distributed in Orissa and we have found it in almost all the district of Orissa except southern most Koraput District (Map, 13).

48. **Pirithoicus ophthalmicus* (Karny)

1907. *Catantops ophthalmicus* Karny, S. B. Akad. wiss. Wien, Vienna, 116 : 313, 330.

1953. *Pirithoicus ophthalmicus* : Dirsh & Uvarov, Tijdschr. Ent., 96(3) : 236.

Material examined : *Bolangir Dist.*—Bolangir (Matkai Reserve Forest), 31.xii.1971, 1 ♂ .

Remarks : *P. ophthalmicus* is very close to *Xenocatantops* but differs in having incurved frons, antennae longer than head and pronotum together, male cercus slightly downcurved and rounded at apex.

Recorded earlier from Tamil Nadu and Sri-Lanka. We have found

a single male of this species from Bolangir in Orissa (Map 13). The occurrence of this species in Orissa extend the range of this rare species in India.

49. **Xenocatantops karnyi* (Kirby)

1910. *Catantops karnyi* Syn. Cat. Orth., 3 : 483.

1982. *Xenocatantops karnyi* : Jago, Trans. Am. ent. Soc., 108 (No. 3) : 454.

Material examined : Mayurbhanj Dist.—Bangripasi (Katra), 16.ix.1972, 1 ♀. Sundargarh Dist.—Rourkela, 10.xii.1971, 1 ♂, 25.iii.1973, 1 ♂, 1 ♀ ; Sundargarh, 28.x.1972, 1 ♀. Sambalpur Dist.—Sambalpur, 7.xi.1972, 3 ♂ ♂, 1 ♀. Baudhkhondmals Dist.—Kotgarh, 13.xii.1973, 1 ♀.

Remarks : *Xenocatantops karnyi* can easily be distinguished with a black spot, approximating to square form in the middle of lateral lobe of pronotum.

Recorded earlier in India from Andhra Pradesh, Tamil Nadu, Uttar Pradesh and Himachal Pradesh. We have found this species in limited numbers mainly in north western and north eastern regions of Orissa (Map, 13).

50. **Stenocatantops splendens* (Thunberg)

1815. *Gryllus splendens* Thunberg, Mem. Acad. Sci. St. Petersb., 5 : 236.

1953. *Stenocatantops splendens* : Dirsh and Uvarov, Tijdschr. Ent., 96(3) : 237.

Material examined : Mayurbhanj Dist.—Lulong, 8.xi.1972, 1 ♀. Dhenkanal Dist.—Purnakot, 25.xi.1972, 1 ♂. Sambalpur Dist.—Deogarh, 11.vi.1972, 1 ♀ ; Sambalpur, 7.xi.1972, 2 ♂ ♂, 3 ♀ ♀. Bolangir Dist.—Bolangir, 1.i.1972, 1 ♀. Kalahandi Dist.—Madanpur-Rampur, 9.xii.1973, 1 ♂. Koraput Dist.—Bachel-Viziakagarm, Chandili, 30.xi.1973, 2 ♂ ♂.

Remarks : *Stenocatantops splendens* can easily be distinguished in having prosternal tubercle strongly curved and inclined backwards in profile.

This species is widely distributed in India and reported earlier from Arunachal Pradesh, Assam, Meghalaya, West Bengal, Uttar Pradesh, Madhya Pradesh and Tamil Nadu. It has also been known to occur widely in south east Asian region. Fairly well distributed in the central region of Orissa with extension in the southern region also (May, 13).

Subfamily CYRTACANTHACRINAE

51. *Anacridium flavescens* (Fabricius)

1793. (*Gryllus*) *flavescens* Fabricius, *Ent. Syst.*, 2 : 52.

1923. *Anacridium flavescens* : Uvarov, *Ann. Mag. nat. Hist.*, (9)11 : 488.

Material examined : *Sambalpur Dist.*—Hirakud dam, 5.xi.1972, 1 ♀ .
Ganjam Dist.—Barkul, 1-3.viii.1914, (apex of abdomen damaged) ;
Badampahar, 7.v.1972, 1 ♂ .

Remarks : *A. flavescens* can easily be separated in having wing base yellow with black fascia towards the hind margin.

Recorded earlier from Tamil Nadu, Andhra Pradesh, Bihar and Orissa. The present records of this species from Orissa (Map, 14) further extends the range of this species in the State. It has also been known from Sri Lanka.

52. *Cyrtacanthacris tatarica* (Linnaeus)

1758. *Gryllus Locusta tataricus* Linnaeus, *Syst. Nat.* (ed. X) 1 : 432.

1923. *Cyrtacanthacris tatarica* : Uvarov, *Bull. ent. Res.*, 14 : 39.

Material examined : *Mayurbhanj Dist.*—Bangripasi, 16.ix.1972, 1 ♀ .
Keonjhar Dist.—Anandapur, 2.ix.1972, 1 ♂ . *Sundargarh Dist.*—Raurkela,
8.xii.1971, 1 ♀ , 22.vi.1972, 1 ♀ , 25.iii.1973, 1 ♀ ; Banki (Sundargarh),
29.iii.1973, 1 ♂ . *Cuttack Dist.*—Ansapa lake, 26.viii.1972, 1 ♂ ; Bhag-
wanpur (Nandankanan), 24.iii.1974, 1 ♀ ; Bhubaneshwar, 8.viii.1982,
1 ♀ *Dhenkanal Dist.*—Angul, 2, 3.x.1972, 3 ♂ ♂ , 1 ♀ ; Dhenkanal,
8.x.1972, 1 ♀ . *Sambalpur Dist.*—Rairakhol, 25.xii.1971, 1 ♀ ; Jharsu-
guda, 17.ix.1972, 1 ♂ ; Deogarh Camp compound, 23.iv.1973, 1 ♂ .
Boudhkhandmals Dist.—Kotagarh, 4.xii.1973, 1 ♀ . *Ganjam Dist.*—Chilka
Lake, 29.ix.1972, 1 ♂ ; Taptapani, 15.iii.1974, 1 ♀ . *Bolangir Dist.*—
Bolangir, 2.x.1972, 1 ♀ , 10.xi.1972, 1 ♀ .

Remarks : *C. tatarica* can easily be distinguished in having tegmina with transverse oblique fasciae or irregular spots.

This species is distributed over whole of Africa except North Africa, Madagascar, S-W. Asia, S. Asia including Sri Lanka, Thailand, Vietnam Philippines, Sumatra, and Seychelles. It is widely distributed in India and present records from Orissa further extends its range of distribution. In Orissa it is well distributed and mainly confined to central and northern regions. (Map, 14).

53. **Chondracris rosea* (De Geer)

1773. *Acrydium roseum* De Geer, *Mem. Hist. Ins.*, 3 : 488.
1914. *Cyrtacanthacris rosea* : Kirby, *Faun. Brit. India, Orth.* (Acrididae) : 230.
1923. *Chondracris rosea* : Uvarov, *Bull. ent. Res.*, 14 : 39.
1975. *Chondracris rosea* : Tandon, *Dr. B. S. Chauhan Comm. Vol. Zool. Soc. India*, Calcutta : 396.

Material examined : Mayurbhanj Dist.—Lulong, 11.xii.1975, 1 ♀.

Remarks : This large species can easily be distinguished in having median carina of pronotum strongly tectiform, subgenital plate in male, elongate, acutely conical.

In India this species is widely distributed in the inner valleys of Brahmaputra and its tributaries in eastern Himalaya. The species is scanty in western Himalaya. There are records of its occurrence in West Bengal, Bihar, Madhya Pradesh, Tamil Nadu, Uttar Pradesh. The occurrence of this species in Orissa further extends the range of its distribution in India in the eastern region (Map, 14).

54. **Patanga succincta* (Johansson)

1763. *Gryllus Locusta succincta* Johansson, *Centuria Insectorum rariorum, Amoenitates Academicæ*, 6 : 398.
1923. *Patanga succincta* : Uvarov, *Ann. Mag. nat. Hist.*, (9) 12 : 364.

Material examined : Baudhkhandmals Dist.—Kotagarh, 17.xii.1973, 1 ♂

Remarks : This species can easily be distinguished in having tegmina with a straight venation in apical part, transverse veins forming almost right angle with the principal veins ; wings base generally rosy violet or colourless ; male subgenital plate large curved upwards, conical, apex pointed.

P. succincta is popularly known as Bombay Locust and is widely distributed throughout plains of Indian subcontinent and all over south and south eastern Asia and Malayan archipelago. During present study a single specimen was found at Kotagarh in Baudhkhandmals district of Orissa (Map, 14).

55. **Pachyacris vinosa* (Walker)

1870. *Acridium vinosum* Walker, *Cat. Derm. Salt. Br. Mus.*, 3 : 588.
1923. *Pachyacris vinosa* ; Uvarov, *Ann. Mag. nat. Hist.*, (9) 11 : 478.

Material examined : *Sundargarh Dist.*—Bishalvari Reserve Forest (Sundargarh), 9.i.1972, 1 ♂ *Sambalpur Dist.*—Hirakud dam, 5.xi.1972, 1 ♀. *Kalahandi Dist.*—Madanpur, Rampur, 10.xii.1973, 1 ♂.

Remarks : *P. vinosa* can easily be identified in having tegmina with oblique venations in apical part, transverse vein situated obliquely to principal vein, male cercus elongate conical with acuminate apex.

This species is fairly well distributed in India. Recorded earlier from Uttar Pradesh, Bihar, West Bengal, Assam, Meghalaya, Mizoram and Goa. It has also been known from Burma, Western and South Eastern China. In our present study we have found few specimens from Sundargarh, Sambalpur and Baudhkhondmals districts of Orissa (Map, 14).

SUMMARY

A detailed report of the Acridoidea fauna of Orissa is given here for the first time. It is based on collections made by scientists of the Zoological Survey of India. In all 55 species belonging to 4 families and 47 genera are reported of which 31 species are recorded for the first time from Orissa.

A key to the identification of genera of Acridoidea from Orissa has been provided. Notes on identification and general distribution of each species is also given. The distribution of each species within Orissa is traced and supported by maps.

ACKNOWLEDGEMENTS

We offer our grateful thanks to Dr. B. S. Lamba, Joint Director-in-Charge, Zoological Survey of India, Calcutta for his encouragement and interest in this work. We are also thankful to Dr. S. K. Bhattacharya and Dr. O. B. Chhotani, Dy. Directors, Zoological Survey of India for suggestions.

REFERENCES

- BHOWMIK, H.K. 1983. Report on a collection of Orthoptera (Insecta) from three north eastern districts of Andhra Pradesh and Chilka Lake. *Indian Mus. Bull.* Calcutta, 18 : 63-73.

- BHOWMIK, H.K. 1985. Outline of distribution with an index Catalogue of Indian Grasshoppers (Orthoptera : Acridoidea). *Rec. zool. Surv. India, Occ. Paper* No. 78 : 1-51, tab. 1.
- DIRSH, V.M. 1975. Classification of the Acridomorphoid Insects. E.W. Classey Ltd. Faringdon, Oxon. VII+171.
- KIRBY, W.F. 1914. *The Fauna of British India, Including Ceylon and Burma*, Orthoptera (Acrididae), IX+276 pp.—London.
- TANDON, S.K. 1976. A check list of the Acridoidea (Orthoptera) of India part I Acrididae. *Rec. zool. Surv. India, Occ. Paper* No. 3 : 1.48.

INSECTA : DERMAPTERA

G. K. SRIVASTAVA

Zoological Survey of India, Calcutta
Nizam Palace

234/4 Acharya J. C. Bose Road, Calcutta-700020

INTRODUCTION

Very little work appears to have been done on the Dermaptera fauna of Orissa except for a single record of *Proreus simulans* (Stal) by Burr (1914) and five other species viz., *Pyge opthalmica* Dohrn, *Diplatys flavobrunneus* sp. nov., *Forcipula quadrispinosa* Dohrn, *Labidura riparia* var. *inermis* (Pallas) and *Euborellia annulipes* (Lucas) by Chopard (1924). The record of *Pyge opthalmica* is doubtful since it is based on an immature specimen.

The present study is based on the material present in the Zoological Survey of India, Calcutta and a few examples collected by Shri P. S. Nathan, received from the Museum of Zoology, The University of Michigan, Ann Arbor, U.S.A.

Altogether 14 species belonging to 9 genera are recorded. It also includes a new species, *Diplatys chowdhuryi*. Brief description of each species is provided.

Most of the species are widely distributed throughout India except for *Titanolabis maindroni* (Borelli) which was hitherto confined to Southern India. The three species of *Diplatys* Serville, are at present known by their types and may perhaps have wider distribution when further exploration of fauna is taken up. It is likely that wooded hilly tracts may prove rewarding faunistically.

SYSTEMATIC ACCOUNT

Key to species* (on ♂♂) known from Orissa

- 1(8). Neck blattoid type, i.e., anterior and posterior cervical sclerites anterior to prosternum separated from each other; genitalia always with paired distal lobes

* *Diplatys flavobrunneus* Chopard, not included in the key since it is known by '♀' only.

- 2(3). Antennae 25-segmented or more, segments
4th and 5th transverse ... (Pygidicraninae)
Cranopygia picta
(Guérin-Ménéville)
- 3(2). Antennae 20-segmented or less, segments 4th
to 6th longer than broad ... (Diplatyinae)
- 4(5). Penultimate sternite rounded posteriorly ... *Diplatys tikaderi* Srivastava
- 5(4). Penultimate sternite with posterior margin
subtruncate or emarginate, postero-lateral
angles lobed
- 6(7). Penultimate sternite subtruncate posteriorly ;
distal lobes with virga convoluted and provi-
ded with membranous flange ... *Diplatys jawalagiriensis*
Kapoor*
- 7(6). Penultimate sternite with posterior margin
emarginate ; distal lobes with virga very
much reduced, represented by a black dot at
base ... *Diplatys chowdhuryi* sp. n.
- 8(1). Neck forficuloid type i.e., anterior and
posterior cervical sclerites fused. Genitalia
with either single median or paired distal
lobes
- 9(22). Genitalia with paired distal lobes
- 10(17). Virga in male genitalia, if present, not wider
at base and without a sinuous inner tube
- 11(12). Meso-and metasternum oblong, both with
posterior margin convex or tongue shaped ... (Titanolabinae)
Titanolabis maindroni
(Borelli)
- 12(11). Meso-and metasternum quadrate, former
briefly convex posteriorly and latter narrowed
with truncate margin ... (Carcinophorinae)
- 13(16). Apterous or elytra abbreviated
- 14(15). Usually apterous ; parameres with inner
apical angle entire ... *Euborellia annulipes* (Lucas)
- 15(14). Elytra present as narrow, lateral ovate flaps
on mesonotum and wings absent ; parameres
with inner apical angles concave ... *Euborellia stali* (Dohrn)
- 16(13). Elytra and wings well developed ... *Euborellia femoralis* (Dohrn)
- 17(10). Virga in male genitalia distinct, wider at
base with a distinct inner sinuous tube

* Not represented in Orissa

- 18(19). Elytra with a sharp ridge along the costal margin ; legs relatively short, posterior femora not longer than pronotum ... (Nalinae)
Nala lividipes (Dufour)
- 19(18). Elytra without any sharp ridge along the costal margin ; legs longer, posterior femora longer than pronotum ... (Labidurinae)
- 20(21). Sides of abdominal segments without spines ; forceps stout and arcuate ... *Labidura riparia* (Pallas)
- 21(20). Sides of certain abdominal segments with hooked spine ; forceps long and slender ... *Forcipula quadrispinosa* (Dohrn)
- 22(9). Genitalia with a single median distal lobe
- 23(24). Second tarsal segment narrowed, produced below the third segment ... (Chelisochinae)
Proreus simulans abdominalis Ramamurthi
- 24(23). Second tarsal segment broad, cordiform ... (Forficulinae)
- 25(26). Antennal segments stout, especially 4th and 5th ; forceps dilated internally in basal 2/3 ... *Elaunan bipartitus* (Kirby)
- 26(25). Antennal segments long and thin including 4th and 5th ; forceps not dilated internally .. *Hypurgus humerslis* (Kirby)

Family I. PYGIDICRANIDAE
Subfamily PYGIDICRANINAE

1. *Cranopygia picta* (Guérin-Ménéville)
(Figs. 1-2)

1838. *Pygidicrana picta* Guérin-Ménéville, *Magasin Zool.*, 8 : 70 ; pl. 236, fig. 1 (♀ ; India : Madras).
1911. *Kalocrania picta* ; Burr, *Genera Insect.*, 122 : 18.
1915. *Acrania picta* ; Burr, *J. R. micr. Soc.*, 1915 ; 436, pl. 7, fig. 6.
1959. *Cranopygia picta* ; Hincks, *Syst. mono. Dermaptera*, 2 : 98.

Material examined : Balighai near Puri, 1 ex. (abdomen missing), 16-20.vii.1911 (N. Annandale and Gravelly).

♂ : Head yellowish brown, black laterally, posteriorly and along the middle line yellow ; antennae with basal segment yellowish and rest dark brown ; pronotum with a black band extending along the entire length of either sides of median sulcus. Tegmina fuscous, with a pair of yellow stripes ; abdomen and forceps dark blackish brown.

Head triangular, sutures distinct, hind margin feebly emarginate in middle ; eyes about as long as genae. Antennae 35-40 segmented. Pronotum about as long as broad, truncate posteriorly. Elytra and wings ample. Abdomen long, cylindrical, gently expanded posteriorly, finely pubescent. Ultimate tergite subquadrate, gently expanded posteriorly, rugosely punctate, hind margin incrassate. Penultimate sternite with posterior margin in middle thickened and gently emarginate, a faint median sulcus also present in apical half only. Forceps and genitalia as seen in figs. 1-2.

♀ : Agrees with male but penultimate sternite obtuse in middle posteriorly and forceps simple and straight with apices gently incurved.

Measurements (in mm) :

	♂	♀
Length of body	22.5-28.0	21.0-27.5
Length of forceps	6.25-6.5	6.5-7.01

Distribution : INDIA : Assam (Kobo), West Bengal (Calcutta), Orissa (Puri), Mysore (Coorge, Ammatti). Sri Lanka and Sumatra.

Subfamily DIPLATYINAE

2. *Diplatys tikaderi* Srivastava
(Figs. 3-5)

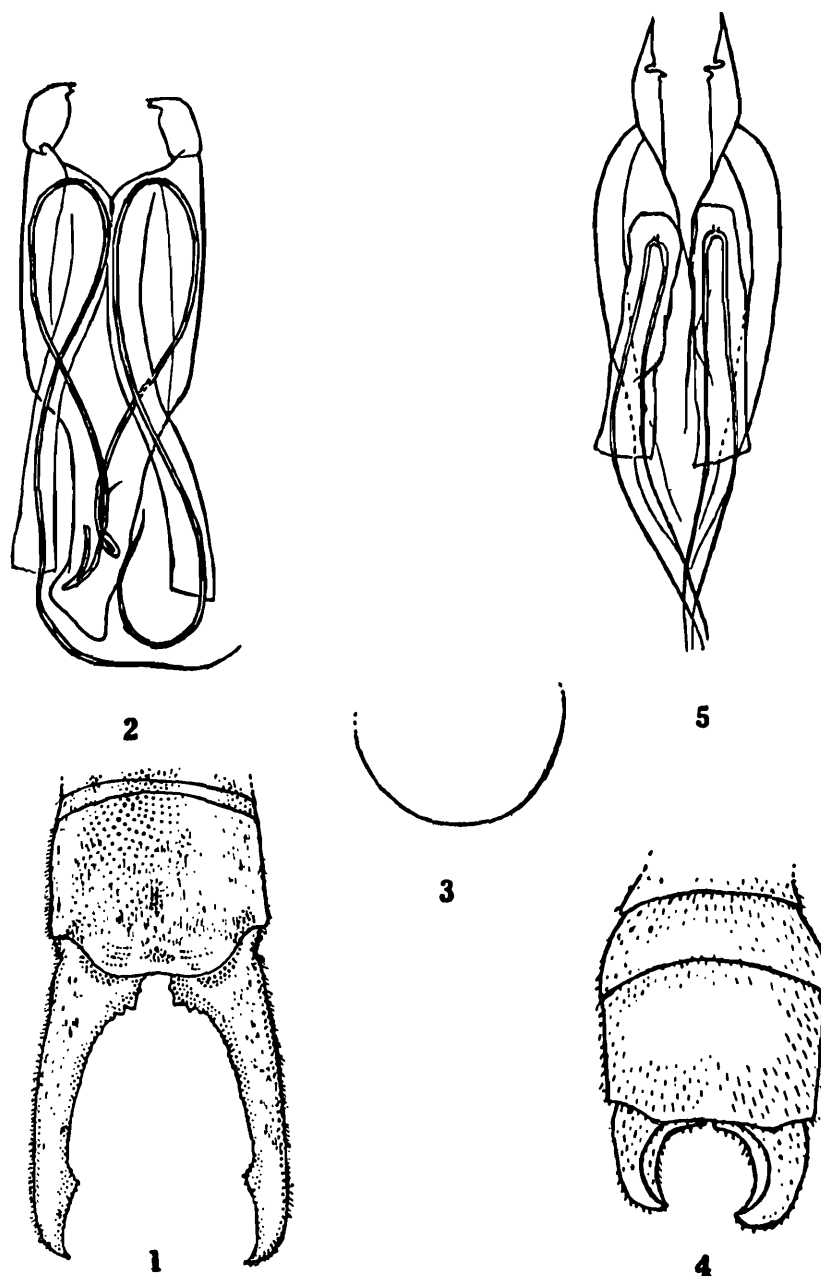
(in press) *Diplatys tikaderi* Srivastava, *Fauna of India, Dermoptera*.

Material examined : Holotype ♂ (genitalia mounted between two coverslips and pinned with the specimen), Lulong, Mayurbhanj Dist., 14.ii.1975, (R. L. Chowdhury).

♂ : General colour yellowish dark brown, head and pronotum somewhat lighter ; antennae with basal two segments yellow ; legs with base and apex of femora, apical half of tibiae and whole of tarsi yellow. Strongly pubescent, abdomen and forceps covered with short pubescence.

Head about as long as broad, smooth, frons moderately convex, occiput in middle weakly depressed, post-ocular carina sharp and complete, transverse suture obsolete, median suture distinct, hind margin emarginate. Eyes about as long as the post-ocular area. Antennae partly broken (11 segments on the left and 10 on the right

remaining). Pronotum about as long as broad, contracted posteriorly, sides moderately convex and hind margin well rounded, median sulcus



Figs. 1-5 : 1 & 2. *Cranopygia picta* (Guérin-Ménéville), ♂, 1. Ultimate tergite and forceps, 2. Genitalia ; 3-5. *Diplatys tikaderi* Srivastava, Holotype ♂, 3. Posterior margin of penultimate sternite, 4. Ultimate tergite and forceps, 5. Genitalia.

almost obsolete. Elytra and wings well developed, former with axillary angles feebly rounded showing a small, triangular scutellum. Legs normal. Abdomen long, slender, smooth, tergites 8th and 9th greatly expanded, each tergite with a weak transverse depression near

base. Penultimate sternite smooth, covered with short pubescence, narrowed posteriorly with hind margin subrotundate. Ultimate tergite quadrate, forceps and genitalia as seen in figs. 4-5.

♀ : Unknown.

Measurements (in mm) : Holotype ♂

Length of body 12.4

Length of forceps 0.7

Distribution : Known from the type locality only.

3. *Diplatys chowdhuryi* sp. n.

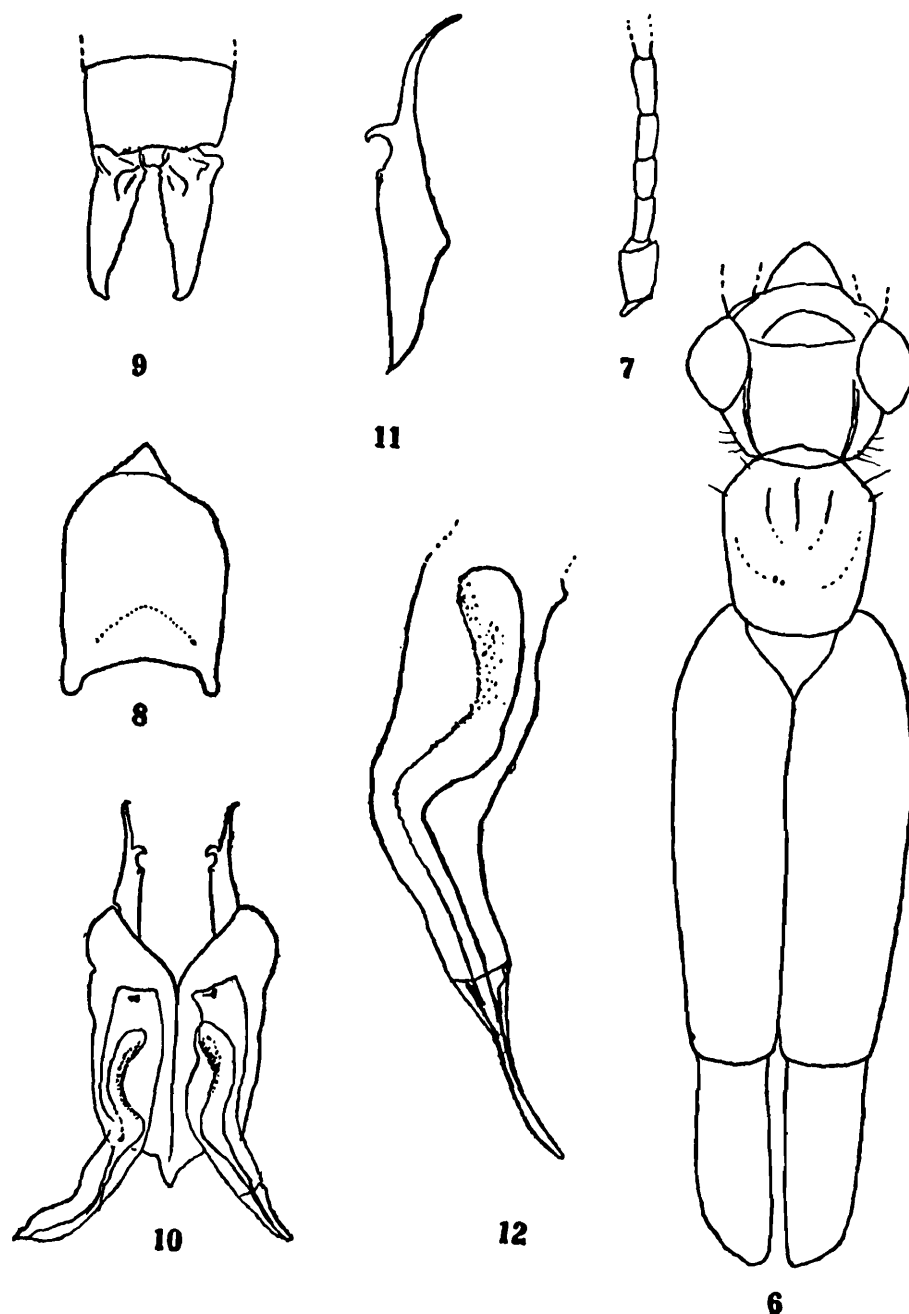
(Figs. 6-12)

Material examined : Holotype ♂ : Lulong, near Simlipal Hills, Mayurbhanj Dist., (genitalia mounted between two coverslips and pinned with the specimen), 15.ii.1975 (*R. L. Chowdhury*), deposited in the Zoological Survey of India, Calcutta.

♂ : Head, posterior half of abdomen, ultimate tergite and forceps brownish black, antennae light blackish brown, pronotum, legs, anterior half of abdomen dull yellowish brown, elytra dull yellowish brown in basal half and brownish black in apical half.

Head with frons raised, occiput depressed, post-ocular carina complete, hind margin sinuate. Eyes prominent, about twice as long as the post-ocular length. Antennae partly broken (right antennae except basal segment missing, left antennae with 17 segments remaining), 1st stout, expanded apically, slightly shorter than the distance between antennal bases ; 2nd short ; 3rd long and slender ; 4th only slightly longer than broad, shorter than the 3rd ; 5th about as long as the 3rd but stouter, remaining gradually increasing in length and thinning, a few apical ones shorter. Pronotum longer than broad, contracted posteriorly, lateral margin straight, hind margin briefly rounded, prozona convex and metazona depressed. Legs long and slender and typical for the genus. Elytra and wings well developed, smooth, former, with inner basal angle rounded off to show a triangular scutellum. Abdomen convex, covered with fine pubescence, smooth, slender, slightly expanded posteriorly. Penultimate sternite depressed in posterior 1/3 with a fine median groove, hind margin concave, postero-lateral angles produced into a lobe. Ultimate tergite

weakly transverse, smooth, sloping and narrowed posteriorly, hind margin trisinate, laterally oblique. Forceps with branches depressed,



Figs. 6-12 : *Diplatys chowdhuryi* sp. n., Holotype ♂, 6. Anterior portion of body, without legs, 7. A few basal antennal segments, 8. Penultimate sternite, 9. Ultimate tergite and forceps, 10. Genitalia 11. Paramere, enlarged, 12. Distal lobe, enlarged.

straight, tapering apically with the tip gently hooked and pointed, at base above with an oblique crest, internal margin finely crenulate. Genitalia with parameres strongly narrowed in apical 1/3, internally

with a pair of hooked teeth of which apical one larger ; distal lobes with virga reduced, represented by a small dot at base, provided with a chitinous denticulate rod, strongly narrowed apically and projecting beyond the distal lobes.

♀ : Unknown.

Measurements (in mm) :

	Holotype ♂
Length of body	9.8
Length of body	1.0

Remarks : This species comes extremely close externally to *Diplatys jawalagiriensis* Kapoor from India (Tamil Nadu and Karnataka) but differs by the shape of penultimate sternite in having the posterior margin concave with postero-lateral angles slightly more strongly lobed (*vs* hind margin subtruncate or convex with postero-lateral angles less strongly lobed in *D. jawalagiriensis*, fig. 13) and genitalia with parameres in apical 1/3 strongly narrowed, distal lobes with virga very much reduced, represented by a dot at base and provided with a chitinous denticulate rod, narrowed apically (*vs* virga very characteristically convoluted and provided with membranous flange, chitinous denticulate rod narrowed apically figs. 14-15).

4. *Diplatys flavobrunneus* Chopard

(Fig. 16)

1924. *Diplatys flavobrunnea* Chopard, *Rec. Indian Mus.*, 26 : 167 (♀ ; Barkuda Isl.).

1955. *Diplatys flavobrunneus* (emend.) ; Hincks ; *Syst. mono. Dermaptera*, 1 : 127 (probably a ♂ not ♀).

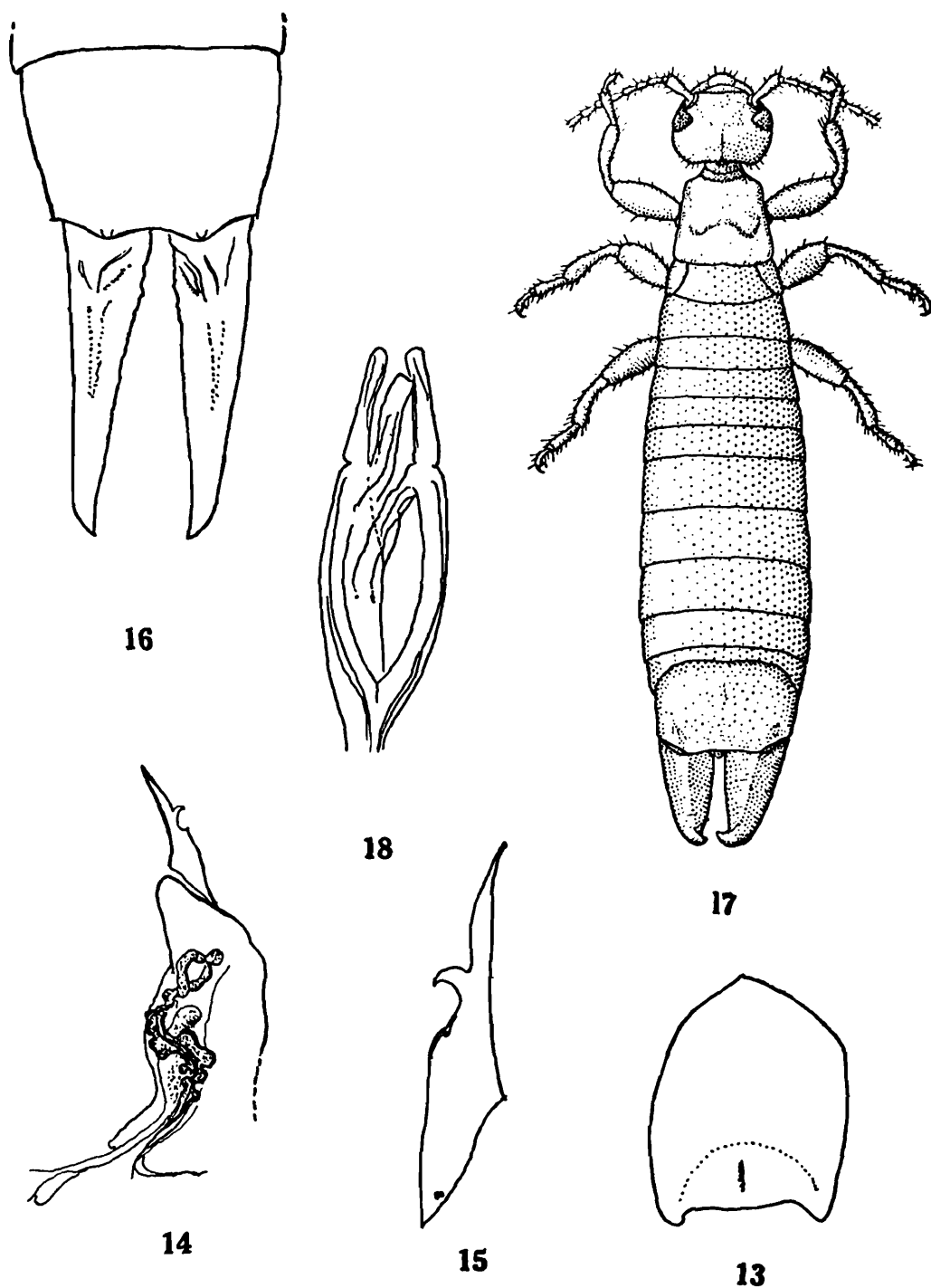
Material examined : Holotype ♀ , Barkuda Island (Chilka Lake), Aug., 1919 (*F. H. Gravely*).

♂ : Unknown.

♀ : General colour yellowish brown with head, apical half of elytra, posterior half of 9th and whole of ultimate tergite blackish. Build slender, finely pubescent, on legs, sides of pronotum and in the basal portion of elytra a few long hairs present.

Head about as long as broad, frons moderately convex, not well differentiated from weakly depressed occiput, transverse suture obsolete,

median suture fairly distinct, hind margin emarginate, post-ocular carina moderately distinct, slightly curved, extending up to the hind margin. Eyes prominent, longer than the post-ocular length. Antennae yellow, 15-segmented or more. Pronotum longer than broad, contracted



Figs. 13-18 : 13-15. *Diplatys jawalagiriensis* Kapoor, ♂, 13. Penultimate sternite 14. Genitalia (left half only) 15. Paramere, enlarged ; 16. *Diplatys flavo-brunneus* Chopard, Type ♀, Ultimate tergite and forceps ; 17-18. *Titanolabis maindroni* (Borelli), ♂, 17. Dorsal view, 18. Genitalia.

posteriorly, anteriorly convex, sides lightly convex, hind margin subtruncate. Elytra and wings well developed, former with axillary angle rounded off, exposing a small, yellow, triangular scutellum. Legs long and slender. Abdomen long and slender. Penultimate sternite subtriangular posteriorly. Ultimate tergite and forceps as seen in fig. 16.

Measurements (in mm) : Holotype ♀

Length of body 10.0

Length of forceps 1.5

Distribution : INDIA : Orissa, Barkuda Is. (Chilka Lake).

Remarks : The Holotype ♀ earlier preserved in spirit is now transferred on a card. Due to long preservation in spirit its body colour has faded.

Family II : ANISOLABIDIDAE

Subfamily : TITANOLABINAE

5. *Titanolabis maindroni* (Borelli)

(Figs. 17-18)

1911. *Homoeolabis maindroni* Borelli, *Boll. Musei Zool. Anat. Comp. R. Univ. Torino*, (640) 24 : 2 (♂, Pondicherry).

1982. *Titanolabis maindroni* ; Srivastava, *Annali Mus. civ. Stor. nat. Giacomo Doria*, 86 : 98, 99.

Material examined : Koraput dist., Jeypore, 1975 ft., 1 ♀, 1.x.1958 (P.S. Nathan).

♂ : General colour blackish brown with legs yellow.

Head pear-shaped, convex, sutures obsolete, hind margin straight. Antennae 11-segmented, 1st stout, about as long as the distance between antennal bases ; 2nd short ; 3rd long and slender ; 4th stouter and shorter than preceding ; 5th equal to 3rd but stouter, remaining gradually increasing in length and thinning, each narrowed basally. Pronotum longer than broad, broadened posteriorly, all margins straight. Mesonotum transverse, laterally with ovate elytra, hind margin convex. Metanotum transverse, hind margin truncate. Legs stout. Abdomen spindle shaped, convex, punctulate, sides of segments obtuse angled posteriorly, segments 6th-9th rugosely punctulate. Penultimate sternite rounded posteriorly, obtuse in middle. Ultimate tergite and forceps and genitalia as seen in figs. 17-18.

♀ : Agrees with males in most characters.

Measurements (in mm) :

	♂	♀
Length of body	15.0-21.0	12.1-20.0
Length of forceps	2.5-2.0	1.7-3.4

Distribution : INDIA : Orissa (Jeypore), Karnataka, Tamil Nadu, Pondicherry and Kerala.

Also known from Sri Lanka.

Remarks : This species was hitherto known from South India and the present record from Orissa extends its distribution further North eastwards.

Subfamily : CARCINOPHORINAE

6. *Euborellia annulipes* (Lucas)

(Figs. 19-21)

1847. *Forficesila annulipes* Lucas, *Annls. Soc. ent. Fr.*, (2) 5 : 84 (Sex ? ; Jardin des Plantes Paris (introduced).
 1853. *Forficula (Labidura) annulipes* ; Fischer, *Orthoptera Europa*, Leipzig : 69, pl. 6, figs. 6a-c.
 1864. *Forficelisa annulipes* ; Dohrn, *Sttetin ent. Ztg.*, 25 : 290.
 1910. *Anisolabis annulipes* ; Burr, *Fauna Brit. India, Dermaptera* : 84, pl. 3, fig. 24.
 1915. *Euborellia annulipes* ; Burr, *J. R. micr. Soc.*, 1915 : 527, 528 & 545.
 1959. *Anisolabis (Euborellia) annulipes* ; Bey-Bienko, *Ent. Obzor*, 38(3) : 607.

Material examined : Koraput Dist., Jeypore, 1775 ft. 1 ♂, Sept., 1958 (P. S. Nathan).

♂ : General colour shining blackish brown. Antennae with basal and a few ante-apical segments yellow, rest greyish brown ; pronotum pale on sides. Legs yellow, femora banded with black.

Head with frons convex ; eyes black, much smaller than genae. Elytra and wings generally absent, rarely present. Abdomen with sides of segments 6th-9th acute, striate and carinate. Penultimate sternite triangular, posteriorly rounded in middle. Ultimate tergite transverse, median sulcus faint. Branches of forceps remote or subcontiguous, trigonal in basal one third only, afterwards depressed and tapering, apices pointed and gently incurved. Genitalia as seen in fig. 21.

♀ : Agrees with male but differs in those characters that are associated with this sex.

Measurements (in mm) :

	♂	♀
Length of body	9.5-10.9	11.0-13.6
Length forceps	1.9-2.1	2.6-3.1

Distribution : World wide.

Remarks : The general colouration and the body size vary considerably. It is very similar to *E. compressa* (Menozzi) but differs in having femora and tibiae banded with black and parameres rounded externally.

7. *Euborellia stali* (Dohrn)

(Figs. 22-23)

1864. *Forficesila stali* Dohrn, *Stettin ent. Ztg.*, 25 : 286 (♀ ; Java).
 1867. *Anisolabis stali* ; Scudder, *Proc. Boston Soc. nat. Hist.*, 18 : 308.
 1910. *Borellia stali* ; Burr, *Fauna Brit. India, Dermaptera* : 88.
 1911. *Euborellia stali* ; Burr, *Genera Insect.*, 122 : 31.

Material examined : Mayurbhanj Dist., Baripada, Hamilton Garden, 5 ♂♂, 2 ♀♀, 15 nymphs, 17.iii.1973 (S. K. Gupta).

♂ : General colour black to brownish black. Antennae with one or two distal segments yellow but their position variable. Pronotum yellowish on sides ; legs yellowish and femora banded with black.

Head convex, sutures fine but distinct or sometimes faint. Eyes much smaller than genae. Antennae 16-18 segmented. Pronotum gently widened posteriorly with margin rounded, sides straight, a little reflexed. Elytra abbreviated in the form of narrow lateral ovate flaps on mesonotum. Wings absent. Abdomen gently dilated at about middle, sides of abdominal segments 6th to 9th acute posteriorly and carinate. Penultimate sternite rounded posteriorly. Ultimate tergite strongly transverse. Forceps with branches subcontiguous at base, almost straight and tapering posteriorly, incurved in apical 1/3, right branch more so, trigonal above in basal 1/2, internal margin crenulate. Genitalia as seen in fig. 23.

♀ : Agrees with male in most characters excepting weakly transverse ultimate tergite, slightly narrowed posteriorly ; penultimate sternite obtuse posteriorly and forceps simple and straight.

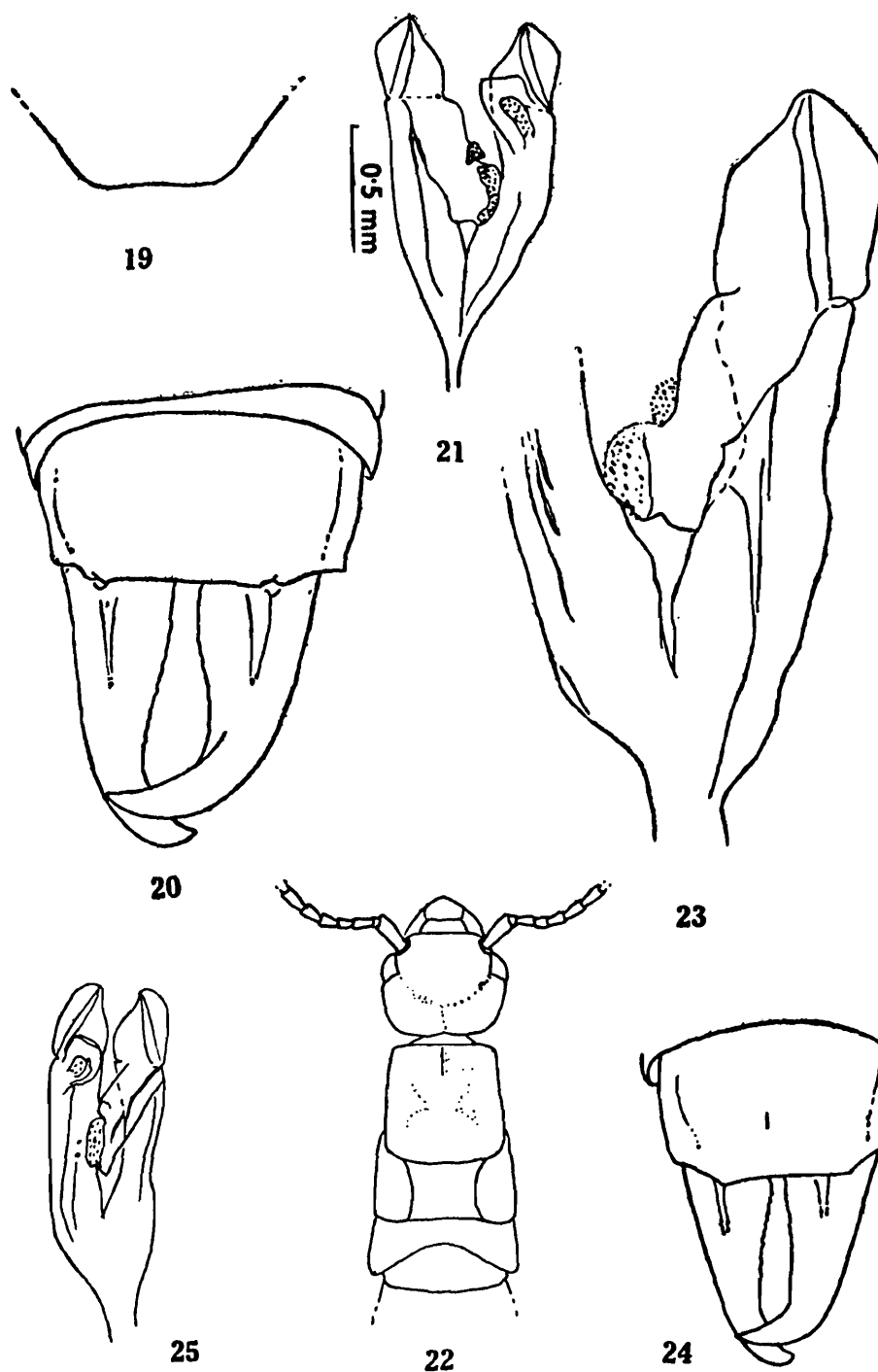


Fig. 19-25 : 19-21. *Euborellia annulipes* (Lucas), ♂, 19. Posterior margin of penultimate sternite, 20. Ultimate tergite and forceps, 21. Genitalia 22 & 23. *Euborellia stali* (Dohrn), ♂, 22. Anterior portion of body without legs, 23. Genitalia with right half and a portion of left half; 24 & 25. *Euborellia femoralis* (Dohrn), ♂, 24. Ultimate tergite and forceps, 25. Genitalia.

Measurements (in mm) :

	♂	♀
Length of body	8.5-9.8	9.0-10.5
Length of forceps	1.2-2.5	1.0-2.2

Distribution : Widely distributed throughout the Oriental Region. Also reported from Madagascar, East coast of Africa, Bahamas, Cuba, Jamaica, Porto Rico and Barbados.

Remarks : It occupies intermediate position between *E. annulipes* (Lucas) and *E. abbreviata* Srivastava and can be easily differentiated from the former in having elytra as narrow ovate flaps on mesonotum and from the latter by the absence of virga.

8. *Euborellia femoralis* (Dohrn)

(Figs. 24-25)

1863. *Labidura femoralis* Dohrn, *Stettin. ent. Ztg.* 24 : 321 (♀, Ceylon).
 1888. *Psalis femoralis* ; Bormans, *Annali Mus. civ. Stor. nat. Giacomo Doria*, 2(6) : 434.
 1915. *Landex femoralis* ; Burr, *J. R. micr. Soc.*, 1915 : 446 (Partim).
 1954. *Euborellia femoralis* ; Hincks, *Verh. naturf. Ges. Basel*, 65(1) : 11, fig. 2 (♂ genitalia).
 1959. *Anisolabis (Euborellia) femoralis* ; Bey-Bienko, *Ent. Obzor.*, 38 : 606.

Material examined : Koraput Dist., Jeypore, 1775 ft., 3♂♂ 3♀♀, 2 nymphs, Sept., 1958 (*P. S. Nathan*) ; Dhenkanal Dist., Angul, 1♂, 30.ix.1972 (*K. Rai*).

♂ : General colour brownish black ; antennae testaceous yellow ; pronotum laterally and wings at base pale ; legs yellowish, femora banded with black.

Head convex, sutures faint, hind margin emarginate ; antennae 16-segmented. Pronotum longer than broad, gently rounded posteriorly. Elytra and wings generally well developed. Abdomen finely punctulate, sides of segments 7th-9th acute, rugosely punctate, carinate. Penultimate sternite briefly rounded posteriorly. Ultimate tergite transverse, rugose, finely punctulate, weakly tumid above the roots of forceps. Forceps sub-contiguous, straight, occasionally right branch more curved than the left, inner margin finely crenulate. Genitalia as seen in fig. 25.

♀ : Agrees with ♂ in most characters except that sides of

abdominal segments rounded ; penultimate sternite obtuse posteriorly ; ultimate tergite narrowed posteriorly and forceps simple, contiguous and straight.

Measurements (in mm) :

	♂	♀
Length of body	8.4-9.2	8.7-9.6
Length of forceps	1.5-1.6	1.7-1.8

Distribution : India, Burma, Sri Lanka, Indonesia (Sumatra, Java, Borneo and Sumba) and China.

Remarks : This species comes very close to *Euborellia plebeja* (Dohrn) but differs in males in having the sides of abdominal segments 6th to 9th carinate.

Family III LABIDURIDAE

Subfamily NALINAE

9. *Nala lividipes* (Dufour)

(Figs. 26-27)

1820. *Forficula pallipes* Dufour, *Ann. gener des Phys. de Bruxelles*, 4 : 316, pl. 116, fig. 7, 7a & 7b (♂, ♀ ; Lower Catatonia, Spain).
 1882. *Forficula lividipes* Dufour, *Ann. Sci. Nat.*, 13 : 340 (new name proposed).
 1900. *Labidura lividipes* ; Bormans, *Das Tierreich*, Leif. 11 : 36.
 1911. *Nala lividipes* ; Burr, *Genera Insect.*, 122 : 36.

Material examined : Keonjargarh, 22 exs., 19.ix.1972, 15 exs., 21.xi.1972 and 31 exs., 26.ix.1972 ; Dhenkanal dist., Angul, 7 exs., 29.ix.1972, 13 exs., 30.ix.1972 (*K. Rai*), Purnakote, 2 exs., 3.iii.1975, Majhipara, 2 exs., 2.iii.1975 (*R. L. Chowdhury*) ; Mayurbhanj dist., Lulong, near Simlipal Hills, 3 exs., 15.ii.1975 (*R. L. Chowdhury*) ; Sambalpur Dist., Sambalpur, 8 exs., 3.xi.1972 (*C. B. Srivastava*) ; Puri Dist., Balugaon, 5 exs., 17.vi.1969 (*K. N. Nair*) ; Koraput dist., Jeypore, 1775 ft., 3 ♂♂, 5 ♀♀, Sept., 1958 (*P. S. Nathan*).

♂ : General colour dull blackish brown, with varying intensity ; mouth parts, sides of pronotum and leg joints dirty yellow.

Head convex, hind margin emarginate in middle ; eyes shorter than the post-ocular length ; antennae 20-segmented with a few distal segments yellow. Pronotum longer than broad, gently widened posteriorly with margin rounded. Elytra and wings well developed,

former keeled along the costal margin. Abdomen finely pubescent, gradually enlarging posteriorly ; ultimate tergite transverse, tumid above the roots of forceps, depressed in the middle ; penultimate sternite triangular, emarginate in middle posteriorly. Forceps with branches stout, gently incurved, tapering, apices pointed, inner margin ventrally crenulate with a distinct tooth at apical third, often obsolete. Genitalia as seen in fig. 27.

♀ : Agrees with male but ultimate tergite narrowed posteriorly ; forceps simple and straight, crenulate internally in basal half.

Measurements (in mm) :

	♂	♀
Length of body	6.1 -8.7	6.0-9.0
Length of forceps	1.55-2.65	1.5-1.65

Distribution : Widely distributed ; occurring in the Palaearctic Region, Tropical Asia and Australia.

Remarks : Body colour ranges from blackish brown to testaceous brown ; inner tooth of forceps often obsolete.

This species is quite common in Calcutta during rainy season and is attracted to light in large numbers.

Subfamily : LABIDURINAE

10. *Labidura riparia* (Pallas)

(Figs. 28-29)

1773. *Forficula riparia* Pallas, *Reise Russ. Reichs*, 2 : 727. (sex ? ; Shores of Irtysh River, Western Siberia).

1863. *Labidura riparia* ; Dohrn, *Stettin. ent. Ztg.*, 24 : 313.

Material examined : Keonjargarh, 1 ♀, 19.ix.1972, 1 ♂, 1 ♀, 20.xi.1972, 2 ♀ ♀, 25.xi.1972 ; 3 ♂ ♂, 2 ♀ ♀, 26.ix.1972 ; Dhenkanal Dist., Angul, 1 ♀, 29.ix.1972, 1 ♀, 30.ix.1972, 1 ♂, 1.xi.1972 (K. Rai) ; Ganjam Dist., Rambha, 1 ♀, 31.xii.1973 (R. L. Chowdhury) ; Puri Dist., Bank of Chilka Lake, near Fishing base, Balugaon, 1 ♀, 21.iii.1973 Kalijugeshwar, Chilka Lake, 1 ♀, 22.iii.1973, (V. K. Premkumar), 1 ♀, 19.iii.1974 (R. K. Kacker) ; Balugaon, 1 ♂, 1 ♀, 23.ii.1975 (G. Ramakrishna).

♂ : General colour varies from yellowish brown to dark blackish

brown with various intermediate shades. Antennae, legs and wings generally testaceous.

Head convex, sutures faint or distinct ; eyes prominent but shorter than genae in length ; antennae 25-35 segmented. Pronotum slightly longer than broad, sides straight or often convex, posteriorly rounded. Abdomen punctulate, gradually enlarging posteriorly ; ultimate tergite transverse, smooth, disc convex, two sharp spines generally present on posterior margin or obsolete ; penultimate sternite obtusely triangular, hardly emarginate in middle posteriorly. Forceps remote at base, keeled above for a short distance, long, cylindrical, tapering, internally toothed but their position extremely variable. Genitalia as seen in fig. 29.

♀ : Agrees with male but slightly smaller in size, abdomen dilated in middle ; ultimate tergite narrowed posteriorly ; forceps simple, straight and contiguous throughout.

Measurements (in mm) :

	♂	♀
Length of body	14.0-24.0	12.0-19.0
Length of forceps	4.0-10.0	3.0- 5.0

Distribution : World wide.

Remarks : This is an extremely variable species in general body colouration, size, shape of pronotum, texture of elytra and wings, ultimate tergite and forceps, especially its inner armature.

All these variations have been described in detail by Burr (1910), Hebard (1923) and more recently by Brindle (1966) who has discussed the synonymy of the species also.

11. *Forcipula quadrispinosa* (Dohrn)

(Figs. 30-31)

1863. *Labidura quadrispinosa* Dohrn, *Stettin. ent. Ztg.*, 24 : 311 (♂, Tranquaber, India and Sri Lanka).

1897. *Forcipula quadrispinosa* ; Bolivar, *Annls. Soc. ent. Fr.*, 66 : 283.

Material examined : Puri dist., Kalijugeshwar Island (Chilka lakes), 1 ♂, 22.iii.1973, under stones (V. K. Premkumar).

♂ : General colour dark blackish brown, antennae, legs and sides of pronotum tawny ; finely pubescent.

Head slightly longer than broad, sutures faint ; eyes one third as long as the genae ; antennae 35-segmented. Pronotum quadrate, anterior margin straight, sides gently convex, hind margin rounded, median sulcus faint ; prozona tumid and metazona flat. Elytra well developed, rugose, humeral angles prominent ; wings as long as pronotum, of same texture as elytra. Abdomen gently dilated posteriorly, sides of segments 3rd-5th with a sharp spine. Ultimate tergite, forceps and parameres as seen in figs. 30-31.

♀ : Agrees with male but sides of segments without spines ; ultimate tergite narrowed posteriorly ; forceps simple and straight.

Measurements (in mm) :

	♂	♀
Length of body	18.0-24.0	18.5-23.6
Length of forceps	7.5-17.5	6.0-8.0

Distribution : India, Bhutan, Burma, Sri Lanka, Thailand, Indo-China Java, Philippine Islands. Also Reunion and Mauritius.

Remarks : Intraspecific variations in the shape of ♂ forceps are quite common.

Family IV : CHELISOCHIDAE

Subfamily : CHELISOCHINAE

12. *Proreus simulans abdominalis* Ramamurthi

(Figs. 32-34)

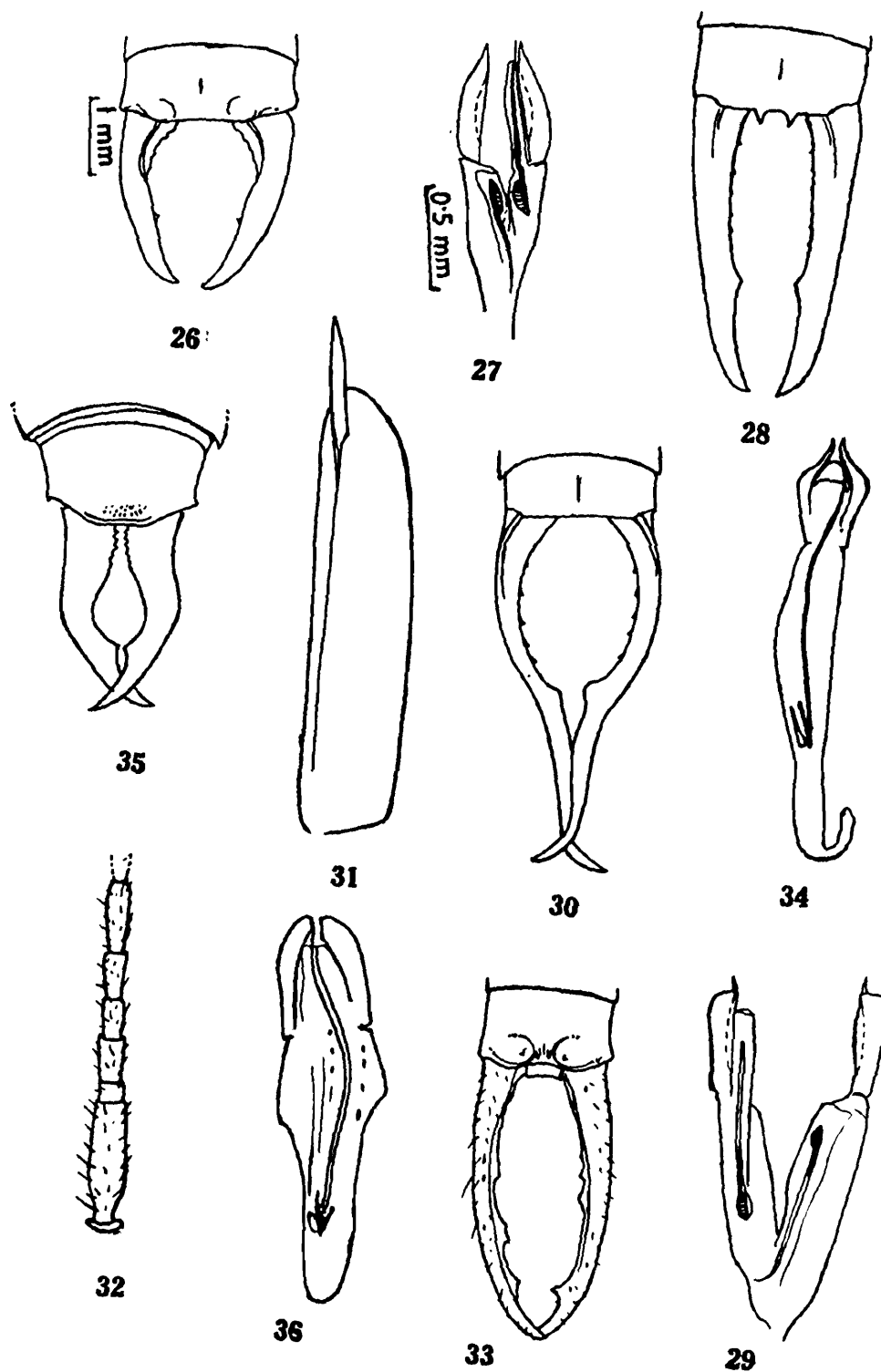
1965. *Proreus abdominalis* Ramamurthi, *Ann. Mag. nat. Hist.*, (13) 8 : 61, figs. 8-10 (♂, ♀ ; India : Karnataka, Bangalore).

1976. *Proreus simulans abdominalis* ; Srivastava, *Rec. zool. Surv. India, Occ. pap.*, 2 : 50.

Material examined : Puri Dist., Balugaon, 1 ♂, 13.i.1972 (C.B. Srivastava) ; Near Cuttack, Bhutmundi, 2 ♂ ♂, 8.i.1972 (R.L. Chowdhury).

♂ : General colour yellowish brown, head orange red ; pronotum yellowish laterally ; legs yellowish ; elytra and wings yellowish with fuscous band laterally.

Head smooth, weakly depressed, occiput gently raised, hind margin sinuate ; antennae 25-segmented, segments long and slender ; eyes



Figs. 26-36 : 26 & 27. *Nala lividipes* (Dufour), ♂, 26. Ultimate tergite and forceps, 27. Genitalia, 28-29. *Labidura riparia* (Pallas), ♂, 28. Ultimate tergite and forceps, 29. Genitalia ; 30 & 31. *Forcipula quadrispinosa* (Dohrn), ♂, 30. Ultimate tergite and forceps, 31. Paramere, enlarged ; 32-34. *Proreus simulans abdominalis* Ramamurthi, ♂, 32. A few basal antennal segments, 33. Ultimate tergite and forceps, 34. Genitalia ; 35 & 36. *Hypurgus humeralis* (Kirby), ♂, 35. Ultimate tergite and forceps, 36. Genitalia.

smaller than genae in length. Pronotum gently widened and rounded posteriorly. Elytra and wings well developed. Abdomen almost parallel sided, punctate ; ultimate tergite weakly transverse, depressed in middle posteriorly with two pairs of compressed tubercles, of which inner pair smaller, tumid above the roots of forceps, hind margin concave in middle, laterally oblique. Pygidium transverse, subvertical, truncate posteriorly or often convex. Forceps and genitalia as seen in figs. 33-34.

♀ : Agrees with male but ultimate tergite with weakly developed tubercles and laterally with obliquely tuberculated carina ; forceps internally, below and above serrated.

Measurements (in mm) :

	♂	♀
Length of body	9.6-13.2	10.3-12.4
Length of forceps	4.1-7.2	3.9-4.9

Distribution : India and Burma.

Remarks : *Proreus abdominalis* Ramamurthi (1965) represents the Indian race of the *Proreus simulans* (Stål). The forceps are slightly curved in middle with whole of internal margin crenulate and a distinct tooth near apex, sometimes another weaker one at about middle also.

In *P. simulans* (Stål) of which several examples from Philippines are present before me, the forceps are almost straight and armed internally with a sharp tooth a little beyond middle and another a little before apex, otherwise smooth.

Family V FORFICULIDAE

Subfamily FORFICULINAE

13. *Hypurgus humeralis* (Kirby)

(Figs. 35-36)

1891. *Opisthocosmia humeralis* Kirby, *J. Linn. Soc. (zool.)*, 23 : 532 (♀ ; Ceylon).

1907. *Hypurgus humeralis* ; Burr, *Trans. R. ent. Soc. Lond.*, 1907 : 102 ; 1916. *J. R. micr. Soc.*, 1916 : 14, pl. 3, fig. 7 (♂ genitalia).

Material examined : Keonjargarh, 1 ♂, 26.ix.1972, at light (K. Rai) ; Sundargarh Dist., Tensa, 1 ♂, 14.ix.1972 (S. Khera).

♂ : General colour blackish brown ; elytra with a yellow spot at humeral angles and wings yellowish in basal half and sometimes with an oval spot.

Head convex, smooth, sutures obliterated, hind margin sinuate ; antennae 12-jointed, 3rd and 4th equal but shorter than 5th, distal segments long and thin. Pronotum as broad as head anteriorly, longer than broad, anterior margin straight with angles projecting, sides convex a little reflexed, gently contracted posteriorly with margin rounded, median sulcus distinct, often faint ; prozona tumid. Elytra and wings ample. Legs long, hind metatarsus distinctly longer than the 2nd and 3rd segments together. Abdomen convex, smooth, enlarged in middle, sides of 5th-8th convex, finely tuberculated along the margin, lateral tubercles on 3rd tergite weakly and on 4th strongly developed. Penultimate sternite ample with posterior margin rounded. Pygidium small, scarcely visible from above, obtuse. Ultimate tergite, forceps and genitalia as seen in figs. 35-36.

♀ : Agrees with male but the sides of abdominal segments smooth and forceps subcontiguous, straight, trigonal in basal half only, tapering apices pointed and gently incurved and crossing, inner margin unarmed.

Measurements (in mm) :

	♂	♀
Length of body	7.4-9.4	8.1-10.6
Length of forceps	2.1-2.2	2.0-2.1

Distribution : India, China, (Yunnan), Burma, Sri Lanka and Borneo.

Remarks : Some variations exist in the elytral spot.

14. *Elaunon bipartitus* (Kirby)

(Figs. 37-38)

1891. *Sphingolabis bipartita* Kirby, *J. Linn. Soc. (zool.)*, 23 : 526 (♂, ♀ : India).

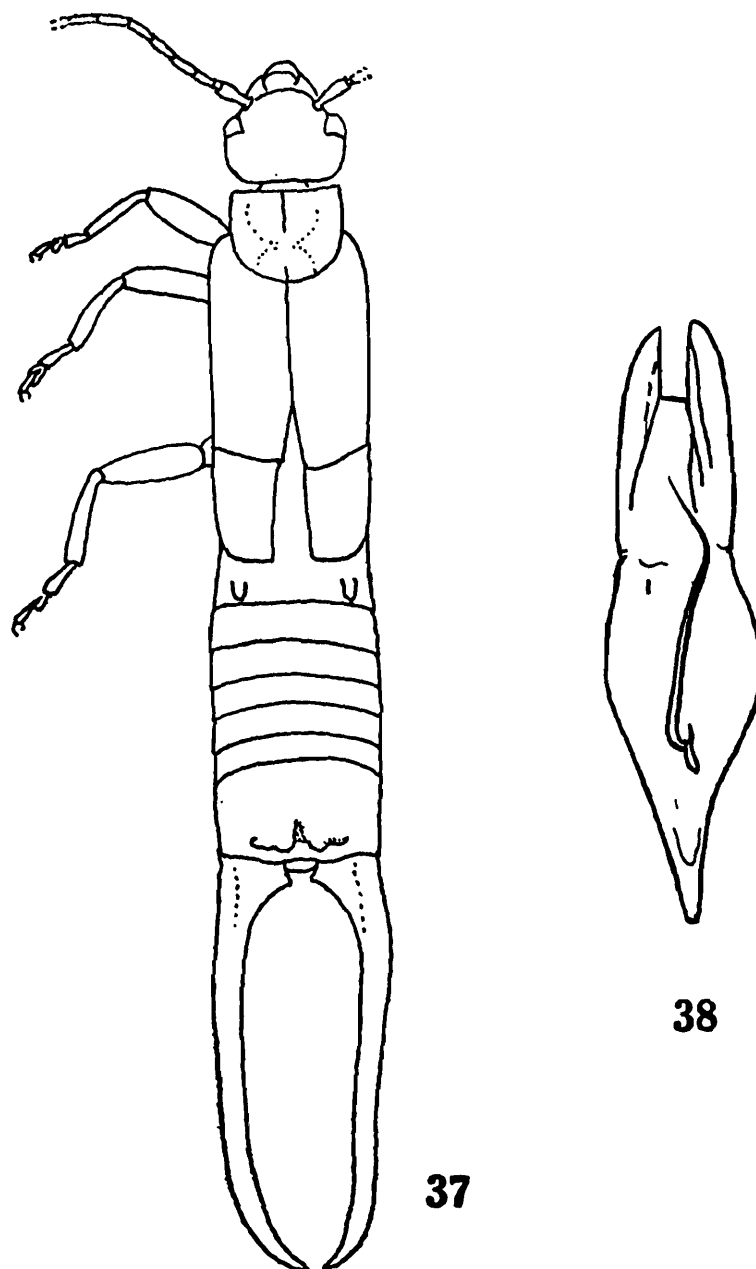
1900. *Apterygida bipartita* ; Bormans, *Das. Tierreich*, 11 : 112.

1910. *Elaunon bipartitus* ; Burr, *Fauna Brit. India Dermaptera* : 163, pl. 6, figs. 53, 53a, pl. 10, fig. 102.

Material examined : Koraput Dist., Jeypore, 1775 ft., 1 ♂, 2 ♀ ♀, Sept., 1958 (P.S. Nathan).

♂ : General colour shining yellowish brown and shaded with black ; head, pronotum brownish, latter yellow laterally ; elytra yellow, banded with fuscous laterally ; wings yellow. Legs brownish, abdomen and forceps brownish black.

Head smooth, convex, sutures fine but distinct, hind margin faintly emarginate in middle ; antennae 12-segmented, 1st long, subclavate ; 2nd small ; 3rd long, conico-cylindrical, almost equal to 4th but shorter than 5th ; remaining long and cylindrical ; eyes smaller than genae in



Figs. 37-38. *Elaunon bipartitus* (Kirby), ♂, 37. Dorsal view, 38. Genitalia.

length. Pronotum as long as broad, gently narrowed posteriorly, sides and hind margin convex, forming an arch, median sulcus faint. Elytra and wings ample. Legs not very long, hind metatarsus equal to 2nd and 3rd segments together ; 2nd lobed. Abdomen long, parallel sided, often (in f, brachylabia) gently dilated in middle, with deep punctures,

lateral tubercles on 3rd weakly and on 4th strongly developed. Penultimate sternite ample, gently narrowed apically with margin rounded. Ultimate tergite transverse, punctate, with distinct tumid elevations above the roots of forceps separated by a deep median groove, hind margin trisinate. Forceps (in f. *macrolabia*) long, cylindrical, tapering to pointed apices which meet, often gently undulate, internally at base with an obtuse tooth, (in f. *brachylabia*) the inner basal dilation extends up to one fourth of the total length with margin strongly dentate. Pygidium short and obtuse. Genitalia as seen in fig. 38.

♀ : Agrees with ♂ in most characteres except that the ultimate tergite lacks tumid elevations above the roots of forceps and very slightly narrowed posteriorly and the branches of forceps contiguous, rather depressed, tapering apically and crossing, inner margin finely crenulate.

Measurements (in mm) :

	♂	♀
Length of body	7.5-11.8	8.1-12.4
Length of forceps	2.7- 5.4	2.0- 2.5

Distribution : India, Sri Lanka, Annam, Philippine Islands, New Guinea and Australia.

ACKNOWLEDGMENTS

I am thankful to the Director, Zoological Survey of India, Calcutta for providing necessary facilities during the course of present study and to Dr. I. J. Cantrall, Museum of Zoology, The University of Michigan, Ann Arbor (U.S.A.) for sending some material of *Dermaptera* collected by P. S. Nathan for my study.

REFERENCES

- BRINDLE, A. 1966. The revision of the subfamily Labidurinae (*Dermaptere*, *Labiduridae*). *Ann. Mag. nat. Hist.*, (13) 9 : 239-269.
- BURR, M. 1910. Fauna of British India, including Ceylon and Burma-*Dermaptera* : xviii, 217 pp., 10 pls.

- Burr, M. 1914. More notes on Indian Dermaptera. *Rec. Indian Mus.*, **10** : 281-294.
- CHOPARD, L. 1924. The Fauna of an Island in Chilka Lake. The Dermaptera and Orthoptera of Barkuda Island. *Rec. Indian Mus.*, **26** : 165-167 (Dermaptera), fig. 1.
- HEBARD, M. 1923. Studies in Indian Dermaptera. *Mem. Dep. Agric. India ent. Ser.*, **7** : 195-242, pls. 19-21.
- RAMAMURTHI, B.N. 1965. Dermaptera from South India. *Ann. Mag. nat. Hist.*, (13) **8** : 59-63, figs. 1-12.

INSECTA : DICTYOPTERA : BLATTARIA

K. P. MUKHERJEE

Zoological Survey of India
'M' Block, New Alipur, Calcutta-700 053

INTRODUCTION

The present paper deals with taxonomic studies on the Blattids collected by various survey parties of the Zoological Survey of India in recent years. The Blattid fauna of Orissa comprising twelve species under seven families and ten genera are reported here. All the species have been recorded for the first time from the State. From localities as mentioned under "Material examined".

SYSTEMATIC ACCOUNT

Family I. DEROCALYMMIDAE

1. *Pseudoglomeris glomeris* (Saussure)

1863. *Perisphaeria glomeris* Saussure, *Me'm. Soc. Gene've*, 17 : 135.
1869. *Derocolymma glomeris* : Saussure, *Me'm. Soc. Gene've*, 20 : 277.
1904. *Pseudoglomeris glomeris* : Kirby, *Syn. Cat. Orth.*, 1 : 190.

Material examined : 2 exs., Bolangir (At light), coll. J. M. Julka, 9.xi.1972.

Diagnosis : Head dark brown with a circular yellow spot at base of each antenna ; antennae yellow ; palpi yellow with concolourous hairs ; pronotum more or less triangular in shape, black with yellowish-brown margins ; legs dark brown, tarsi comparatively lighter coloured ; tegmina exceeding apex of wings, dark brown but pale at apical half ; wings dark brown, apices comparatively lighter ; abdomen dorsally yellowish, ventrally dark brown ; supra-anal plate of male much broader than long, posterior margin semicircular ; subgenital lamina exceeding supra-anal lamina hindwards, semicircular, wider than long ; the left style dark brown, much curved, right yellowish, conical ; cerci yellow. Body length 14-20 mm.

Distribution : India : West Bengal, Orissa, Manipur, Arunachal Pradesh, Karnataka and Tamilnadu. Elsewhere : Sri Lanka.

2. *Trichoblatta sericea* Saussure

1863. *Perisphaeria sericea* Saussure, *Me'm. Soc. Gene've*, 17 : 138.
 1895. *Trichoblatta sericea* : Saussure & Zehntner, *Revue suisse Zool.*, 3 : 45.
 1964. *Trichoblatta sericea* : Princis, *Orthopterorum Catalogus*, Part 6 : 208.

Material examined : 8 exs., Sundimunda, Raikhol Inspection Bungalow, distt. Sambalpur, coll. *P. K. Maiti*, 28.xii.1971 ; Hathisalpara, distt. Bolangir, 1 km. West of Forest Bungalow, coll. *P. K. Maiti*, 30.xii.1971 ; Bolangir, coll. *J. M. Julka*, 9.xi.1972 ; Sundargarh (Rajbari), coll. *J. M. Julka*, 26.x.1972 ; Gururia, Simplipal Hills, North-East of Joshipur, distt. Mayurbhanj, coll. *J. K. Sen*, 13.xi.1972.

Diagnosis : Black species ; head black with a yellow spot at base of each antenna ; antennae uniformly yellowish brown ; palpi yellow ; thorax uniformly black ; femora and tibiae dark brown, tarsal segments yellowish-brown ; abdomen black, eight segmented ; cerci yellowish-brown. This species is ovo-viviparous. Body-length 15-30 mm.

Distribution : India : Gujarat, Maharashtra, Bihar, West Bengal, Orissa, Meghalaya, Arunachal Pradesh, Sikkim, Tamilnadu, Karnataka and Kerala. Elsewhere : Not recorded so far from outside India.

Family II. BLATTIDAE

3. *Neostylopyga sexpustulata* (Walker)

1871. *Polyzosteria sexpustulata* Walker, *Cat. Derm. Salt. Brit. Mus.*, London, 5 Suppl. Blatt., : 36.
 1904. *Blatta sexpustulata* : Kirby, *Syn. Cat. Orth.*, 1 : 140.
 1957. *Stylopyga sexpustulata* : Princis, *Opusc. ent.*, 22 : 97.
 1966. *Neostylopyga sexpustulata* : Princis, *Orthopterorum Catalogus*, Part 8 : 537.

Material examined : 4exs., Phulbani, Panchayat Bhawan, *K. V. Surya Rao*, 16.i.1972 ; Kotagarh, distt. Phulbani, coll. *K. V. Surya Rao*, 24.i.1972.

Diagnosis : Brown to dark brown species ; head reddish brown ; antennae and palpi unicolourous with head except lighter basal segments of antennae ; prothorax reddish-brown ; mesothorax dark brown with a pair of yellow spots ; metathorax uniformly dark brown ; legs dark

brown, forefemur with a comb of spines ; mid-and hindfemora with two rows of spines ; tibiae and tarsi with sparse spines and hairs ; abdomen dark brown, segments two and six with a pair of yellow marks laterally ; cerci dark brown ; supra-anal lamina distinctly exceeding subgenital lamina, tip triangularly incised ; subgenital lamina very broad, conical behind ; styli equal to supra-anal lamina. Body-length 14-25 mm.

Distribution : India : Uttar Pradesh, Bihar, Orissa, Karnataka and Andhra Pradesh. Elsewhere : Java (Indonesia).

4. *Neostylopyga rhombifolia* (Stoll)

1813. *Blatta rhombifolia* Stoll, *Repre's. exact. Colore'e d'apre's nature d. Spectres etc.*, 2 : 5, 14.
1868. *Periplaneta rhombifolia* : Walker, *Cat. Blatt. Brit. Mus.*, : 130.
1897. *Stylopyga rhombifolia* : Finot, *Act. Soc. Scient.*, Chili, 7 : 198.
1966. *Neostylopyga rhombifolia* : Princis, *Orthopterorum Catalogus*, Part 8 ; 534.
1976. *Neostylopyga rhombifolia* : Nayar et al., *General and Applied Entomology* : 138-139.

Material examined : 6 exs., Jharsuguda, distt. Sambalpur coll. P. K. Maiti, 6. i. 1972 ; Taptapani, P. W. D. Bunglow, distt. Ganjam, coll. R. K. Kacker, 15. iii. 1974.

Diagnosis : Head ventrally brownish-yellow and dorsally yellow, with a transverse stripe bwtween eyes, a semi-circular stripe at level of antennae and a transverse stripe above epistome ; antennae dark brown with pale hairs ; first and second palpal joints pale yellow, third joint yellow with a dark brown stripe, terminal segment dark brown ; prothorax yellow, with one black stripe along borders, being curved inside at posterior border, two black marks and a median black longitudinal sttipe connecting both marks with posterior border ; mesothorax also with a black stripe along border curving inside both anteriorly and posteriorly ; abdomen black, each segment with a yellow spot on each side except last two segments ; legs yellowish-brown and black. Body-length 15-30 mm.

Distribution : INDIA : Himachal pradesh, Gujarat, Rajasthan, Madhya Pradesh, Bihar, West Bengal, Orissa, Tripura, Karnataka and Andaman & Nicobar Islands. Elsewere : Sri Lanka, Burma and Africa.

5. *Periplaneta americana* (Linnaeus)

1758. *Blatta americana* Linnaeus, *Syst. naturae*, 10th Ed., 1 : 424.
 1831. *Kakerlac americana* : Serville, *Ann. Sci. nat.*, 22 : 39.
 1838. *Periplaneta americana* : Burmeister., *Handb. ent.*, 2 : 503.
 1846. *Stylopyga americana* : Fischer, *Bull. Soc. Nat. Mosc.*, 19 : 477.
 1965. *Periplaneta americana* : Keven, *Ent. Rec.*, 77 : 39.

Material examined : 2 exs., Atei Reserve Forest, distt. Keonjhar, coll. S. K. Gupta, 29.iii.1973 ; P. W. D. Inspection Bungalow, Sambalpur, coll. D. P. Sanyal, 5.vi.1972.

Diagnosis : The American Cockroach, *Periplaneta americana* (Linnaeus) is the largest domestic pest. Its total length varies from 25-40 mm. A heavily pigmented reddish-brown species with well developed compound eyes ; pronotum with indistinct pale margins ; wings fully developed ; femora armed with strong spines ; ovipositor valves in female pronounced ; cerci well developed and styli distinct. Common names of this species are Ship Cockroach, Bombay Canary, American Cockroach, etc. It flies weakly and is common in the streets and open fields at night. During day time it may also be seen. The American Cockroach is the principal pest of the kitchen. It is a native of Mexico and Central America but it has now been carried by commerce throughout the world.

Distribution : A consmopolitan species.

Family III. BLATTELLIDAE

6. *Blattella germanica* (Linnaeus)

1767. *Blatta germanica* Linnaeus, *Syst. naturae*, 1 (2) ; 668.
 1967. *Blattella germanica* : Snodgrass, *Insects their wings and means of living* : 77-79.
 1969. *Blattella germanica* : Princis, *Orthopterorum Catalogus*, Part 13 : 807.

Material examined : 22 exs., Haldinallah, Rairakhol, distt. Sambalpur, coll. P. K. Maiti, 27.xii.1971 ; Gaundrial village, 5 kms. west of Bolangir, distt. Bolangir, coll. P. K. Maiti, 2.i.1972 ; P. W. D. Inspection Bungalow, Keonjhar, coll. S. K. Mitra, 14.viii. 1972 ; Atei Reserve Forest, distt. Keonjhar, coll. S. K. Mitra, 20.viii.1972 ; Badrama Reserve Forest, 3 kms. West of Forest Rest House, distt. Sambalpur, coll. D. P. Sanyal, 6.vi.1972 ; Inspection Bungalow, Deogarh, distt. Sambalpur, coll. D. P. Sanyal, 10.vi.72 ; Sambalpur, coll. J. M. Julka, 6.ii.1972 (At light) ; Bolangir, coll. J. M. Julka, 9.ii.1972 (At light), Circuit House, Keonjhar, coll. K. Rai, 19.ix. and 25.ix. 1972.

Diagnosis : This small tan German Cockroach is rather slender, boat-shaped and pale yellowish-brown species, about five eighths of an inch in length, with two dark spots on front shield of body. Margins of pronotum straw yellow. Tegmina and wings extending beyond abdomen. Legs elongated and spiny. Last ventral segment entire in both sexes.

The species prefers warm and moist conditions. It is one of the most common pest of household, grocery, restaurants, dining halls, baths, bakeries, etc. and is also found in the fields. It is also known as the waterbug and the crotonbug and is ovo-viviparous. Body-length 9-15 mm.

Distribution : A world-wide distributed species.

7. *Blattella humbertiana* (Saussure)

1863. *Polyzosteria humbertiana* Saussure, *Me'm. Soc. Gene've*, 17 : 131.
1901. *Phyllodromia humbertiana* : Kirby, *Syn. Cat. Orth.*, 1 : 90.
1950. *Blattella humbertiana* : Princis, *Ark. Zool.*, (2) 1 : 27.
1969. *Blattella humbertiana*, Princis, *Orthopterorum Cat.*, Pt. 13 : 842.

Material examined : 48 exs., Brooks hill, 2 kms. North of Sambalpur, 20.xii.1971 ; Rairakhol, distt. Sambalpur, 25.xii.1971 ; Haldinallah, Rairakhol, 27.xii.1971 ; Sundimunda, Rairakhol, 27.xii.1971 ; Sundimunda, Rairakhol Inpection Bunglow, 28.xii.71 ; Matkai Reserve Forest, distt. Bolangir, 31.xii.1971 ; Gaundrial village, 5 kms. West of Bolangir, distt. Bolangir, 2.i.1972 ; Engineering College Campus, Jharsuguda, distt. Sambalpur, 7.i.1972 ; Bishalbari Reserve Forest, distt. Sundargarh, 9.i.1972 ; Belijuri village, 4 kms West of Sundargarh, 11. i.1972. All coll. *P. K. Maiti*. Mohana, distt. Ganjam, coll. *V C. Agrawal*, 21.xii.1971 ; Basantapur, Baripada, distt. Mayurbhanj, coll. *S. K. Mitra*, 9.viii.1972 ; Phulbani, coll. *K. V. Surya Rao*, 14.i.1972 ; Asha Sagar, Bhawanipatna, distt. Kalahandi, coll. *K. V. Surya Rao*, 31.i.1972 ; Panchayet Bhawan, distt. Phulbani, coll. *K. V. Surya Rao*, 16.i.1972 ; Badrama Reserve Forest, 3 kms. west of Forest Rest House, distt. Sambalpur, coll. *D. P. Sanyal*, 6.vi.1972 ; Sambalpur Road, coll. *D. P. Sanyal*, 10.vi.1972 ; Brahmani River Bank, distt. Sambalpur, coll. *D. P. Sanyal*, 17.vi.1972 ; Taltapahar Inpection Bunglow, Bonaigarh, distt. Sambalpur, coll. *D. P. Sanyal*, 18.vi.1972 ; Teak plantation, Forest Rest House, Panposh, distt. Sundargarh, coll.

D. P. Sanyal, 21.vi.1972 ; Joshipur, distt. Mayurbhanj, coll. *J. K. Sen*, 14.ii.1972 ; Bahadurpur, Bangriposi, distt. Mayurbhanj, coll. *K. Rai*, 13.ix.1972 ; Keonjhar, coll. *K. Rai*, 23.ix.1972.

Diagnosis : A small brown, apterous species. Head yellow, frontal region yellowish-brown. Eyes yellowish-brown to dark brown. Antennal scape and pedicel yellow, rest yellowish-brown. Palpi yellow. Prothorax marked with black and light brown. Meso and metathorax unicolourous with thorax. Legs yellow. Abdomen yellowish-brown, each segment with a rectangular dark-brown spot on each side which are connected by a narrow stripe of similar colour and the stripe is projected backward in the middle upto half of each segment. Cerci yellowish-brown but dark brown at base. Body length 10-15 mm.

Distribution : Widely distributed species in the world.

Family IV. EPILAMPRIDAE

8. *Stictolampra plicata* (Navás)

1904. *Opisthoplatia plicata* Nava's, *Bol. Soc. aragon. Cienc. nat.*, 3 : 130.

1910. *Rhcnoda plicata* : Selford, *Genera Insect.*, 101 : 9.

1967. *Stictolampra plicata* : Princis, *Orthopterorum Catalogus*, part 11 : 683.

Material examined : 20 exs., Rairakhol, distt. Sambalpur, coll. *P. K. Maiti*, 25.xii.1972 ; Haldinallah & Vicinity, coll. *P. K. Maiti*, 27.xii.1972 ; Inspection Bunglow, Joshipur, distt. Mayurbhanj, coll. *J. K. Sen*, 16.xi.1972 ; Barang, distt. Puri, coll. *S. Biswas*, 1.ii.1974 ; Lulung, distt. Mayurbhanj, coll. *D. P. Sanyal*, 11.xii.1975 ; Lulang, Jogindrapur, distt. Mayurbhanj, coll. *D. P. Sanyal*, 12.xii.1975 ; Forest Rest House, Lulung, distt. Mayurbhanj, coll. *D. P. Sanyal*, 13.xii.1975.

Diagnosis : Dark grey species ; dorsum of head dark grey with yellowish-brown lateral borders, ventrally black but yellow at apex, and a round yellow spot at base of each antenna ; antennae dark brown, third segment elongated, annulated except at base ; palpi yellowish-brown, apical segment dark ; pro and mesothorax dark grey with yellowish-brown marks ; legs yellowish-brown and dark brown ; abdomen dark grey ; cerci dark brown. Body-length 18-19 mm.

Distribution : INDIA : Himachal Pradesh, Gujrat, Madhya Pradesh, Bihar, West Bengal, Orissa, Assam, Arunachal Pradesh, Sikkim, Tamilnadu, Karnataka and Kerala.

9. *Haanina auriculata* (Brunner)

1865. *Epilamora auriculata* Brunner, *Nouv. Syst. Blatt.*, : 181.
 1904. *Molytria auriculata* : Kirby, *Syn. Cat. Orth.*, 1 : 115.
 1910. *Homolopteryx auriculata* : Shelford, *Genera Insecta.*, 101 : 7.
 1967. *Haanina auriculata* Princis, *Orthopterorum Catalogus*, Part 11 : 643.

Material examined : 2 exs., Inspection Bungalow, Joshipur, Mayurbhanj distt., coll. J. K. Sen, 16.xi.1972 ; Baripada, Palbani, distt. Mayurbhanj, coll. S. K. Gupta, 18.iii.1973.

Diagnosis : Dark brown and yellow species ; head ventrally yellow with three black stripes between the eyes ; antennae brown, filiform with pale hairs ; palpi yellow, apex black ; dorsum of thorax dark brown above and yellow laterally, prothorax arched, extending much beyond head, posterior border almost straight ; mesothorax concolorous with prothorax ; legs brownish-yellow ; abdomen dark brown, yellow laterally ; cerci yellowish-brown. Body-length 24-30 mm.

Distribution : INDIA : Only recorded from the State of Orissa.

Family V. PYCNOSCELIDIDAE

10. *Pycnoscelus surinamensis* (Linnaeus)

1758. *Blatta surinamensis* Linnaeus, *Syst. naturae*, 10th Ed., 1 : 424.
 1903. *Pycnoscelus surinamensis* : Rehn, *Trans. Am. ent. Soc.*, 29 : 131, 136.
 1964. *Pycnoscelus surinamensis* : Princis, *Orthopterorum Catalogus*, part 6 : 264.

Material examined : 4 exs., Talta Hill, Bonaigarh, distt. Sundargarh, coll. D. P. Sanyal, 18.vi.1972 ; Bagra water falls, Jeypur, distt. Koraput, coll. K. V. Surya Rao, 15.ii.1972 ; Diamonguda, 2 kms. South-east of Gurguria Forest Rest House, distt Mayurbhanj, coll. J. K. Sen, 13.xi.1972 ; Gurguria, Simlipal Hills, coll. J. K. Sen, 13.xi.1972.

Diagnosis : This burrowing, dusty-tail cockroach, is a robust, dark brown or blackish lubberly, tropical species with pale brown wings measuring 14 to 20 mm. in length. Tegmina and wings usually slightly short or extending beyond tip of the abdomen. This species shows much variations in shell character. It burrows beneath piles of leaves, trash, and similar debris and is a swift runner ; gives birth to living young ; often feeds upon growing plants. It occurs both in houses and in open fields.

Distribution : A fairly well distributed species throughout the Oriental Region and also in Surinam (S. America).

Family VI. HOMEOGAMIIDAE

11. *Therea nuptialis* (Gerstaecker)

1861. *Corydia naptialis* Gerstaecker, *Arch. Naturgesch.*, 27(1) : 113.
 1904. *Corydia nuptialis* : Kirby, *Syn. Cat. Orth.*, 1 : 167.
 1924. *Corydia nuptialis* : Chopard, *Rec. Indian Mus.*, 26 : 113.
 1963. *Therea nuptialis* : Princis, *Orthopterorum Catalogus*, part 4 : 85.

Material examined : 5 exs., Banpada, near, Konarak, distt. Puri, coll. Y. Chaturvedi, 19.ix.1972 ; Biswanathpur, distt. Kalahandi, coll. A. K. Mandal, 9.vii.1974.

Diagnosis : It is an oval-shaped, beautiful, garden pest cockroach, Head black, ventrally embeded with black hairs at the base of eyes which run a little below the margins of antennae ; one white spot present on each side between the antennae ; antennae serrate, black ; palpi black with yellow hairs ; pronotum black, about one and a half times as broad as long, posterior margin semicircular ; tegmina black with three pairs large yellow spots, middle pair being largest and with an additional spot adjacent to it ; two-thirds of wing yellow from base, rest black and with a small yellow area at apex ; legs black ; abdomen black with more or less triangular yellow spots on each segments laterally on both sides ; supra anal lamina of male transverse and distinctly exceeding the subgenital lamina, posterior margin almost straight with slight emargination in the middle, subgenital lamina semicircular posteriorly ; cerci and styli black, the latter with few long bristly hairs at apex. Body-length 20-29 mm.

Distribution : INDIA : Assam, Bihar, Orissa, and Tamilnadu.

Family VII. BLABERIDAE

12. *Calolampra irrorata* (Fabricius)

1775. *Blatta irrorata* Fabricius, *Syst. Ent.*, : 272.
 1868. *Epilampra irrorata* : Walker, *Cat. Blatt. Brit. Mus.*, London : 231.
 1904. *Calolampra irrorata* : Kirby, *Syn. cat. Orth.*, 1 : 117.
 1951. *Calolampra irrorata* : Rehn, *Mem. Amer. Ent. Soc.*, No. 14 : 62-64.
 1963. *Calolampra irrorata* : Princis, *Orthopterorum Catalogus*, part 4 : 149.

Material examined : 2 exs., Keonjhar (Forest adjacent to paddy field), coll. S. K. Mitra, 24.viii.1972 ; 2 kms. East of P.W.D. Inspection Bungalow, Deogarh, distt. Sambalpur, coll. D. P. Sanyal, 10.vi.1972.

Diagnosis : Head yellow with one transverse black stripe between the eyes and another black, longitudinal stripe from the level of antennae to palpi ; antennae filiform with pale hairs, first antennal segment brown with yellow base, second and third wholly brown ; palpi yellow, apical segment with brownish stripe ventrally ; thorax yellow ground colour with dark brown spots ; legs yellow with apical tarsal segment brownish at apex ; abdomen yellow with dark brown spots all over ; cerci yellowish-brown with pale hairs. Body-length 18-33 mm.

Distribution : INDIA : Madhya Pradesh, West-Bengal, Orissa and Tamilnadu. Elsewhere : Australia.

ACKNOWLEDGEMENT

Author is thankful to the Director, Zoological Survey of India for providing laboratory facilities and to Shri P. Parui for his helpful suggestions in the preparation of this paper.

REFERENCES

- ESSIG, E. O., 1942. *College Entomology* : 1-831. (The Macmillan Company, New York.)
- NAYAR, K. K., ANANTHAKRISHNAN, T. N. AND DAVID, B. V., 1976. *General and Applied Entomology* : 1-589. (Tata Mc Graw-Hill Publishing Co. Ltd., New Delhi.)
- REHN, J. W. H., 1951. Classification of the Blattaria as indicated by their wings. *Mem. Amer. Ent. Soc.*, No. 14 : 1-134, 12 pls.
- SNODGRASS, R. E., 1967, *Insects Their Ways and Means Of Living* : 1-362. (Dover Publications, Inc., New York.)

INSECTA : HEMIPTERA

L. K. GHOSH, B. BISWAS, S. P. CHAKRABORTY AND G. C. SEN

Zoological Survey of India, Calcutta-700053

INTRODUCTION

The information available on hemipteran fauna of Orissa is meagre. No attempt was made earlier to explore the insect fauna in general and hemipteran in particular from Orissa although the State is endowed with rich cultivable land, diverse climatic conditions, heterogenous physiographical nature and rich flora and fauna.

The earliest reference on this group from Orissa is that of van der Goot (1917) wherein he mentioned the occurrence of two species in the Barkuda island of Chilka Lake and at Rambha in the Ganjam district. Later, Annandale (1921), in his survey of the fauna of the Barkuda island reported two more species. Subsequently, Sengupta and Behura (1957), while presenting an annotated list of pests of over 60 crops from the state of Orissa, listed 60 species in 50 genera of Hemiptera which were directly or indirectly involved in causing crop damage. Thereafter, Sengupta, Das and Behura (1962) recorded 16 species of Aphids from the State. Subsequently, some stray records (about 22 spp.) on Hemiptera were also made by Behura (1963, 1965); Behura and Bohidar (1979); and Behura, Das and Dash (1973) and while studying the Coccids of the Orissa, Varshney (1987) has reported 70 species.

The present faunistic account deals with 58 species in 49 genera under 18 families of Hemiptera, of which 17 species (in 16 genera) are hitherto reported for the first time from Orissa. In all 166 species of Hemiptera are thus known from Orissa. On perusal of literature and present work as many as 166 species of Hemiptera are now known from the Orissa and very likely many more species of the order may be found if specialised surveys of different groups are undertaken.

Thus, the total number of hemipteran species so far known from

the State stands at 166, a list of which is given at the end. Keys for families and genera so far reported are also given.

The material dealt with here, was collected during 1963-1986 by different parties of Zoological Survey of India. Among the 58 species which are reported here, 23 species in 19 genera under 5 families belong to the suborder Homoptera and 35 species in 30 genera under 13 families to Heteroptera. The families Cicadellidae and Membracidae under Homoptera and Lygaeidae and Pentatomidae under Heteroptera are relatively more dominant. For each species, the original reference and subsequent reference (s), particularly relating to nomenclatural changes are given. Running keys to families and genera for easy identification of the various taxa, distributional records within the State and elsewhere, economic importance and characteristic features etc. are also given.

The classification is basically followed Sensus (Distant, 1902, 1910). All the material examined is in the National Zoological Collections at the Zoological Survey of India, Calcutta.

KEYS TO HEMIPTERA OF ORISSA

A. *Key to the suborders of HEMIPTERA*

1(2) Forewings usually of equal consistency	...	HOMOPTERA
2(1) Forewings usually thickened basally and membranous apically	...	HETEROPTERA

B. *Key to families of suborder HOMOPTERA*

1(2) Pronotum prolonged backward into a process	...	MEMBRACIDAE
2(1) Pronotum not as above	...	3
3(4) Abdomen usually with a pair of siphunculi arising from 5th or 6th tergite ; tarsi two-segmented	...	APHIDIDAE
4(3) Abdomen without such siphunculi	...	5
5(6) Both sexes with a pupal stage ; mostly soft bodied and often covered with a copious secretion of white wax on body more or less powdery	...	7
6(5) Pupal stage absent ; body not as above	...	9

7(8)	Tarsi with 2 subequal segments and pad-like empodium or spines between the claws ; body more or less powdery	...	ALEURODIDAE
8(7)	Tarsi single-jointed and with a single claw ; body covered with waxy secretion	...	COCCIDAE (COCCOIDEA)
9(10)	Last antennal segment terminating in a filament, anal area of wing distinctly reticulated	...	FULGORIDAE
10(9)	Last antennal segment normal ; wing not as above	...	11
11(12)	Hind tibiae with a number of rows of spines ; postclypeus greatly expanded ; ocelli situated on vertex	...	CERCOPIDAE
12(11)	Hind tibiae with two rows of spines ; postclypeus not greatly expanded ; ocelli situated between the eyes	...	CICADELLIDAE

C. Key to the genera of different families of suborder Homoptera

Family I. *Aleurodidae*

1(2)	Seventh abdominal segment shorter than sixth, vasiform orifice subacute, operculum almost filling the orifice, a trilobed figure present surrounding the orifice ...	<i>Aleurolobus</i>
2(1)	Seventh abdominal segment not shorter than sixth, vasiform orifice small, often with a row of teeth within its caudal margin. Pupal case with well developed tracheal pores usually with internal teeth ...	<i>Dialeurodes</i>

Family II. *Aphididae*

1(2)	Siphunculi with many short and long hairs ; cauda transversely oval with a median stylus	...	<i>Greenidea</i>
2(1)	Siphunculi without hairs ; cauda variously shaped but never with a median stylus	...	3
3(4)	Frons with processi or tubercles	...	<i>Oregma</i>
4(3)	Frons without processi or tubercles	...	5
5(6)	Tergite 8 and cauda shortened ; head in apterae usually fused with pronotum	...	<i>Pemphigus</i>
6(5)	Tergite 8 and cauda normal ; head in apterae usually distinct from pronotum	...	7

7(8)	Ultimate rostral segment stiletto-shaped ; siphunculi calf-shaped, reticulated with isodia- metrical cells	...	<i>Macrosiphoniella</i>
8(7)	Ultimate rostral segment variously shaped but never stiletto-shaped	...	9
9(10)	Siphunculi with strong spinular imbrications ; dorsal abdominal hairs with widely expanded apices ; cauda with a bulbous base and blunt apex	...	<i>Pentalonia</i>
10(9)	Siphunculi with normal imbrications and dorsal abdominal hairs not as above	...	11
11(12)	Siphunculi gently clavate ; dorsum of head in apterae spinulose	...	<i>Myzus</i>
12(11)	Siphunculi subcylindrical or cylindrical but never clavate ; dorsum of head in apterae not spinulose	...	13
13(14)	Siphunculi reticulated with isodiametrical cells ; 3rd antennal segment with a few basal secondary rhinaria in apterae	...	<i>Macrosiphum</i>
14(13)	Siphunculi only with spinular imbrications and with isodiametrical cells ; 3rd antennal seg- ment without secondary rhinaria in apterae	...	15
15(16)	Siphunculi shorter or longer than its basal width and much shorter than cauda, without distinct flange and with faint spinular, imbri- cation	...	<i>Brachysiphoniella</i>
16(15)	Siphunculi much longer than its basal width and about as long as to much longer than cauda	...	17
17(18)	Spiracles of abdominal segments 1 and 2 placed close together ; abdominal segments without lateral abdominal tubercles ; lateral frontal tubercles pronounced	...	<i>Lipaphis</i>
18(17)	Spiracles of abdominal segments 1 and 2 placed far apart ; abdominal segments with lateral abdominal tubercles ; lateral frontal tubercles not or hardly pronounced	...	19
19(20)	Hind tibiae with a row of peg-like stridulatory spines ; lateroventral areas of abdominal segments 6 and 7 with rows of spinules forming interconnecting striae	...	<i>Toxoptera</i>

20(19)	Hind tibiae normal ; lateroventral areas of abdominal segments 6 and 7 with normal spinules not forming interconnecting striae ...	...	21
21(22)	Abdominal dorsum with spinules, those in apterae from distinct polygonal pattern ...	<i>Rhopalosiphum</i>	
22(21)	Abdominal dorsum usually without spinules ...	...	23
23(24)	Cauda pale, elongated, basally constricted and with only 4 hairs medially ; hindwing with one oblique vein ...	<i>Hysteroneura</i>	
24(23)	Cauda usually dark, slightly or not constricted ; usually more than 4 hairs ; hind wing with two oblique veins ...	...	25
25(28)	Processus terminalis longer, about 4-5 times as long as base of antennal segment VI ; first tarsal chaetotaxy 3, 3, 3 ...	...	26
26(27)	Cauda pale to dark and with 5-7 hairs ; processus terminalis about 5 times as long as base of antennal segment VI ...	<i>Schizaphis</i>	
27(26)	Cauda usually dark and with 9-17 hairs ; processus terminalis about 4 times as long as base of antennal segment VI ...	<i>Longiunguis</i>	
28(25)	Processus terminalis shorter, about 2-3 times as long as base of antennal segment VI ; first tarsal chaetotaxy 3, 3, 2 ...	<i>Aphis</i>	

Family III. CERCOPIDAE

Genus *Clovio* Stål

Family IV. CICADELLIDAE

1(2)	Tegmina with four longitudinal veins or sectors and usually without appendix ...	<i>Empoasca</i>	
2(1)	Tegmina always with less than four longitudinal veins ...	...	3
3(4)	Body long and robust in size ...	<i>Cicadella</i> (= <i>Tettigoniella</i>)	
4(3)	Body of moderate size ...	...	5
5(6)	Tegmina with only one apical cell ...	<i>Nephotettix</i>	
6(5)	Tegmina with more than one apical cell ...	...	7
7(8)	Vertex conically produced ; frontal sutures distinct above the antennal pits ...	<i>Parabolocratus</i>	

8(7)	Vertex abtusely produced	...	...	9
9(10)	Tegmina with 4 apical cells ; Aedeagus with apical process ; pygofer with a long appendage in inner surface	...		
10(9)	Tegmina with 3 apical cells ; Aedeagus without apical process ; Pygofer with a long appendage in inner surface	...	...	11
11(12)	Male plate broadened basal third, gradually eonverging to rounded apex	...		
12(11)	Male plate slender, elongate throughout, apical third slightly tapered	...		

*Idiocerus**Exitianus**Amritodus*

Family V. FULGORIDAE

1(2)	Posterior to tibiae with a long robust mobile spur at the apices ; face broad upto about twice as long as its greatest width	...		
2(1)	Posterior tibiae without such mobile spur, with six or seven spines, face much narrow	...		

*Nilaparvata**Dichoptera*

Family VI. MEMBRACIDAE

1(2)	Presence of rudimentary scutellum entirely concealed by the pronotum	...		
2(1)	Scutellum normal	...	...	3
3(4)	Posterior process rising obliquely direct near base of pronotum and then rectangularly directed to about or beyond the posterior angle of inner margin of tegmina	...		
4(3)	Posterior process not as above	...	...	5
5(8)	Hind wings with 4 apical cells	...	...	6
6(7)	Base of posterior process distant from or rarely touching the apex of scutellum ; posterior process more or less arcuate ; scutellum as long as broad	...		
7(6)	Base of posterior process contiguous with or only slightly above scutellum and tegmina ; posterior process not arcuate ; scutellum wider than long	...		
8(5)	Hind wings with 3 apical cells	...	...	9
9(10)	Scutellum clearly visible ; suprahumeral present	...		
10(9)	Scutellum partly concealed ; suprahumeral absent	...		

*Oxyrhachis**Anchon**Leptocentrus**Otinotus**Tricentrus**Coccosterphus*

D. *Key to families of suborder HETEROPTERA*

1(2)	Scutellum reaching at least to the base of the membrane, or at least half as long as the abdomen	...	3
2(1)	Scutellum not reaching to the base of the membrane, nor to middle of abdomen	...	9
3(4)	Hemelytra longer than the body folded in at the base of membrane; head always clypeated	...	Plataspidae
4(3)	Hemelytra straight, not folded in at the base of membrane	...	5
5(6)	Spiracles of the basal ventral segment exposed, not hidden by the metasternum	...	Tessaratomidae
6(5)	Spiracles of the basal ventral segment not exposed	...	7
7(8)	Scutellum reaching at least to the base of the membrane or at least half as long as abdomen; hemelytra folded in at basal membrane	...	Pentatomidae
8(7)	Scutellum much longer, covering the whole of the abdomen above and the anal appendages; hemelytra straight, not folded in at base of membrane	...	Scutelleridae
9(10)	Tarsi two jointed; hemelytron without an embolium	...	Capsidae
10(9)	Tarsi three-jointed	...	11
11(12)	Rostrum stout, bent at the base; hemelytra complete, membrane distinct	...	Reduviidae
12(11)	Rostrum rather normal, not bent at the base	...	13
13(14)	Antennae inserted on the upper parts of the sides of the head; legs of moderate length; ocelli present	...	Coreidae
14(13)	Antennae inserted below a line drawn from the centre of the eye to the apex of the face	...	15
15(16)	Ocelli present; membrane with 4-5 longitudinal veins; cuneus absent	...	Lygaeidae
16(15)	Ocelli absent	...	17
17(18)	Sixth ventral segment in both sexes entire	...	Pyrrhocoridae
18(17)	Sixth ventral segment in the female always cleft at base	...	Largidae

Family VII. COREIDAE

1(2) Pronotum with lateral angles produced into acute black spines directed a little forward and upward ; the anterior thickly and strongly pilose	...	<i>Clavigrallas</i>
2(1) Pronotum with lateral angles not as above	...	3
3(4) Posterior femora incrassated and spined beneath ; mesosternum normal, lateral pronotal spines present	...	<i>Riptortus</i>
4(3) Posterior femora normal ; mesosternum broadly sulcate ; lateral pronotal spines absent	...	<i>Leptocoris</i>

Family VIII. LYGAEIDAE

1(2) Sutures between IV & V sternite not extending to lateral margin ; usually three dorsal scent glands ; collar moderately broad, posterior lobe of pronotum prominently punctate		<i>Pachybrachius</i>
2(1) All abdominal sutures extending to lateral margin ; generally two dorsal scent gland openings	...	3
3(4) Abdominal spiracle on segment II & VII located dorsally, clavus impunctate	...	5
4(3) Not all abdominal spiracles dorsal	...	9
5(6) Anterior area of the pronotum densely pilose		<i>Lygaeosoma</i>
6(5) Anterior area of the pronotum not pilose	...	7
7(8) Metathoracic scent gland openings inconspicuous.	...	<i>Spilostethus</i>
8(7) Metathoracic scent gland openings conspicuous ; presence of at least two black maculate spots at basal area of pronotum	...	<i>Graptostethus</i>
9(10) All abdominal spiracles ventral ; cross veins present on membrane of forewing resulting in close basal cells ; femora very weakly spinous ; basal margin of the pronotum distinctly broader than its length	...	<i>Dinomachus</i>
10(9) Not all abdominal spiracles ventral, single abdominal spiracle between segments II to VII. dorsal ; baccula long commonly extending to base of head, fore femora with spines, anterior femora spined below.	...	<i>Oxycarenus</i>

Family IX. PENTATOMIDAE

1(2)	Scutellum extends to about or beyond middle of abdomen ; membrane small or moderate ...	3
2(1)	Scutellum never extends beyond middle of abdomen ; membrane large ; antennae 5-segmented ...	<i>Aspongopus</i>
3(4)	Rostrum slender ; basal joint not incrassate nor inserted at labrum ...	... 7
4(3)	Rostrum robust, basal joint incrassate, inserted at labrum ...	5
5(6)	Lateral pronotal margins crenulate or dentate ; anterior angles slightly spinous, posterior angle spinously produced ...	<i>Canthecona</i>
6(5)	Pronotum not as above ; second joint of antennae more than twice as long as third ; abdominal spine obtuse, short ...	<i>Asopus</i>
7(8)	Basal abdominal spine present ...	9
8(7)	Basal abdominal spine absent ...	13
9(10)	Basal spine of abdomen acute and moderately long ...	<i>Piezodorus</i>
10(9)	Basal spine of abdomen usually tuberculate ...	11
11(12)	Pronotum with the lateral margin truncate behind the eyes ; lateral margins of head laterally sinuate ...	<i>Nezara</i>
12(11)	Pronotum with lateral margin normal ; lateral margin of head scarcely sinuate ...	<i>Menida</i>
13(14)	Head deflected ; body obovate, strongly convex ventrally ...	<i>Eusarcocoris</i>
14(13)	Head not deflected, body not as above ...	15
15(16)	Head narrowed in front ...	... 17
16(15)	Head emerginate ; scutellum about as long as broad at base ; abdomen obscurely tuberculate at base ...	<i>Plautia</i>
17(18)	Pronotum obscurely sexangular, anterior margin somewhat truncate, not distinctly elevated and callous ...	<i>Bagrada</i>
18(17)	Pronotum not sexangular ...	... 19
19(20)	Anterior lateral margins of pronotum entire, straight, somewhat acute, anterior margin somewhat callous centrally ...	<i>Agonoscelis</i>

- 20(19) Anterior lateral margin of pronotum acutely
reflexed, anterior margin normal ... *Dolycoris*

Family X. SCUTELLERIDAE

Genus *Chrysocoris* Hahu

Family XI. PYRRHOCORIDAE

- 1(2) Apical angle of Corium elongately acute ... *Dysdercus*
2(1) Apical angle of Corium more or less rounded,
not elongately acute ... *Antilocur*

Family XII. LARGIDAE

Genus *Physopelta* Amy. and Serv.

Family XIII. REDUVIIDAE

- 1(2) First joint of antennae much longer than
head : antennae not incrassated ... *Harpactor*
2(1) First joint of antennae distinctly shorter than
head ; antennae incrassated ... 3
3(4) The spongy furrow of each anterior tibia not
occupying more than half its length ... *Pirates*
4(3) The spongy furrow of each anterior tibia
occupies more than half of its length ... *Ectomocoris*

AQUATIC HEMIPTERA

Key to families :

- 1(2) Abdomen with apical long filiform appen-
dages ; legs sometimes very long ; tarsi
1-jointed ... *Nepidae*
2(1) Abdomen without such appendages, legs of
moderate length ... 3
3(4) Anterior legs usually raptorial ... 5
4(3) Anterior legs normal ... 7
5(6) Head in front of eyes conically produced ;
larger in size ; fore legs invariably raptorial ... *Belostomatidae*
6(5) Head very broad with prominent eyes ;
smaller in size ... *Pelagonidae*
7(8) Posterior femora long and extending far
beyond abdominal apex ... *Gerridae*
8(7) Posterior femora normal ... 9

- 9(10) Head very elongate in front of eyes, much longer than width across eyes ; rostrum long and exposed ... *Hydrometridae*
- 10(9) Head broad : rostrum short and concealed ... *Corixidae*

Family XIV. NEPIDAE

- 1(2) Body very long and narrow ; pronotum slender, very much longer than broad, anterior pronotal margin distinctly shorter than width of head including eyes ... *Ranatra*
- 2(1) Body oblong ; pronotum about as long as broad, its anterior margin about twice as broad as head ... *Laccotrephes*

Family XV. BELOSTOMATIDAE

- 1(2) Posterior tibiae and tarsi prominently ampliatly compressed, anterior tarsi with one claw ... *Lethocerus*
- 2(1) Posterior tibiae and tarsi not prominently compressed ; head subtriangularly produced ; anterior tarsi with two claws ... *Sphaerodema*

Family XVI. PELOGONIDAE

Genus *Pelagonus* Latrellie

Family XVII. GERRIDAE

- 1(2) Anterior tarsi short ; rostrum almost reaching anterior coxae ... *Cylindrostethus*
- 2(1) Anterior tarsi much longer, about as long as tibiae ... 3
- 3(4) Body much smaller in size (3.5-7 mm) ; anterior femora about as long as tibiae ; anterior tarsi much shorter than tibiae ; body oblong... *Metrocoris*
- 4(3) Body larger in size (13-16 mm) ; anterior femora longer than the tibiae ; tibial spine distinct ; anterior tarsi about as long as the tibiae ; body rather elongate ... *Ptilomera*

Family XVIII. HYDROMETRIDAE

Genus *Rhagovelia* Mayr

Family XIX. CORIXIDAE

- 1(2) Antennae 4-segmented ; scutellum covered ... *Corixa*
- 2(1) Antennae 3-segmented ; scutellum not covered ... *Micronecta*

III. SYSTEMATIC ACCOUNT

The species of which the collections were available for the present study are included here.

Suborder HOMOPTERA

Family I. APHIDIDAE

Genus 1. *Aphis* Linnaeus1. *Aphis craccivora* Koch

1854. *Aphis craccivora* Koch, *Die pflanzenlause Aphiden* Nunburg, 1 : 124-125.

1962. *Aphis craccivora* : Sengupta, Dash and Behura, *Prkruti-Utkal Univ. J. Sci.*, 2 : 33-39.

Material examined : Many apterae and alate viviparous females, on *Cajanus cajan* (Leguminosae), Cuttack, 25.xi.1966, coll. L. K. Ghosh.

Distribution : India : Orissa (Cuttack) ; also widely distributed in the country. It is a cosmopolitan species.

Remarks : Brown to blackish brown shiny black aphids infest all the aerial parts of the host plants. Black ants usually attend to these aphids. This common aphid of beans is a vector of several diseases of plants.

2. *Aphis gossypii* Glover

1877. *Aphis gossypii* Glover. *Rept. corn. Agr. Operations Deptt. for 1876* : 36.

1962. *Aphis gossypii* : Sengupta, Dash and Behura, *Prakruti Utkal Univ. J. Sci.*, 2 : 33-39.

Material examined : Many apterous and alate viviparous females, on *Hibiscus* sp. (Malvaceae), Bhubaneswar ; 25.xi.1966, coll. S. K. Ghosh.

Description : India : Widely distributed including Orissa ; Elsewhere : Cosmopolitan.

Remarks : This is usually called cotton aphid and is also a pest of Cucurbits. This is highly polyphagous species infesting 459 plant species in 275 genera belonging to 85 plant families. It is commonly found throughout the plains and hills of India. It is subject to extreme colour variation. The species is well known virus vector for several diseases of cucumber, sugarcane, cotton, groundnut, Papaya, sweet potatoes and citrus in India. It transmits 44 virus diseases of plants.

Genus 2. *Hysteroneura* Davis3. *Hysteroneura setariae* (Thomas)

1878. *Siphonophora setariae* Thomas, *Bull. Ill. nat. Hist. Surv.*, 1 : 5.

1988. *Hysteroneura setariae* : Behura & Mahapatra, *Prakruti Utkal. Univ. J. Sci.*, 512 : 63.

Material examined : Sev. exs., Bhubaneswar, on *Triticum vulgare*. 10.11.1968, coll. L. K. Ghosh.

Distribution : India : all over including Orissa ; Elsewhere : Cosmopolitan.

Remarks : This species was first noticed in Philippines in 1958 (Baltzar 1965). David, Rajasingh & Narayanan (1967) recorded this species from Orissa for the first time. This species is characterised by hind wing with one oblique vein. Behura & Mahapatra (1968) have made a detailed morphological study of this species.

Genus 3. *Rhopalosiphum* Koch4. *Rhopalosiphum maidis* (Fitch)

1855. *Aphis maidis* Fitch, *N. Y. Agric. soc. Trans.*, 16 : 551.

1969. *Rhopalosiphum maidis* : Chowdhuri, Basu, Chakrabarti, Raychaudhuri, *Oriental Ins.*, 3 : 90.

Material examined : Many apterous viviparous females, on *Triticum sativum* (Gramineae), Cuttack, 24.xii.1966. coll. S. K. Ghosh.

Distribution : Cosmopolitan. Throughout India.

Remarks : This corn leaf aphid is a well known pest of a large number of graminaceous crops. This is the common aphid species on maize and causes appreciable injury by attacking the inflorescence.

Genus 4. *Lipaphis* Mordvilko5. *Lipaphis erysimi* (Kaltenbach)

1843. *Aphis erysimi* Kaltenbach, *Mon. Fan. Pflanz. l. 99*.

1983. *Lipaphis erysimi* : Behura and Bohider, *The Aphids* : 37.

Material examined : Many apterae and alatae, on *Brassica* spp. (Cruciferae) Cuttack, 25.xii.1966, coll. L. K. Ghosh.

Distribution : India : Orissa (Cuttack), Arunachal Pradesh, Assam, Bihar, Himachal Pradesh, Manipur, Meghalaya, Nagaland, Rajasthan,

Sikkim, Tamil Nadu, Tripura, Uttar Pradesh, West Bengal. Elsewhere : Cosmopolitan.

Remarks : This mustard aphid attacks mostly cruciferous plants in India and carries their viruses in most parts of the world.

Genus 5. *Myzus* Passerini

6. *Myzus persicae* (Sulzer)

1776. *Aphis persicae* Sulzer, *Abgekurgt Gesch Ins.* : 105.

1963. *Myzus persicae* : Behura, *Proc. 1st Summer School of zoology* (Simla, 1961) : 52.

Material examined : Many apterous viviparous females, on *Coriandrum sativum*, Cuttack, 23.i.1980, coll. L. K. Ghosh.

Distribution : Cosmopolitan. Throughout India.

Remarks : This is also a highly polyphagous species and transmits many virus diseases of tropical crops. It is a vector of 90 virus diseases of plants.

Family II. CERCOPIDAE

Genus 6. *Clovia* Stal

7. *Clovia bipunctata* Kirby

1891. *Clovia bipunctata* Kirby, *J. Linn. Soc. (Zool.)*, 24 : 163.

1908. *Clovia bipunctata* : Distant, *Fauna Brit. India*, 4 : 94.

Material examined : 10 exs., Cuttack, 14. i. 1974, coll. R. L. Chowdhury.

Distribution : India : Orissa (Cuttack), also Bihar and West Bengal. Elsewhere : Sri Lanka.

8. *Clovia puncta* Walker

1851. *Clovia puncta* Walker, *List Hom.*, 3 : 718.

1908. *Clovia puncta* : Distant, *Fauna Brit. India*, 4 : 94.

1976. *Clovia puncta* : Dutta & Ghosh, *Eos*, : 42.

Material examined : 6 exs., Ganjam, Chatgaon, 20. viii. 1972, coll. S. K. Mitra ; 6 exs. Anandapur Agril. farm, 3. iv. 1973, coll. S. K. Gupta and Party.

Remarks : This species is characterised by its almost uniform pale colour, having the black spot near the apex of inner margin of tegmina.

Distribution : India : Orissa (Anandapur, Ganjam, Ghatgaon), also Bihar. Madhya Pradesh, Maharashtra, Sikkim and West Bengal.

Family III. CICADELLIDAE

Genus 7. *Cicadella* Dumeril

9. *Cicadella spectra* (Distant)

1853. *Tettigonia albida* Signoret, *Annls. Soc. ent. Fr.* : 663.

1908. *Tettigoniella spectra* : Distant, *Fauna Brit. India*, 4 : 211.

1910. *Cicadella spectra* : Distant, *Insect. Tram.* 10 : 234.

Material examined : 5 exs., Ganjam, Dighaphand, 4. iii. 1976, coll. R. L. Chowdhuri ; 1 ex., Keonjhar, 24. viii. 1972, coll. ? 1 ex., Mayurbhanj, 13. ii. 1976, coll. S. K. Mitra.

Distribution : India : Orissa : (Ganjam, Kathpal, Keonjhar, Mayurbhanj), Bihar, Madhya Pradesh, Maharashtra, West Bengal. Elsewhere : Bangla Desh, Ceylon.

Remarks : This is usually called white rice leafhopper. Although the species enjoys both tropical and subtropical distribution, there is apparently no record of its transmitting any viral disease in rice. It is a minor pest of paddy, sometimes feeding on wild grasses.

Genus 8. *Exitianus* Ball.

10. *Exitianus indicus* (Distant)

1908. *Athysanus indicus* Distant, *Fauna Brit. India*, 4 : 344.

1938. *Exitianus indicus* : Oman, *Kans. Univ. Sci. Bull.*, 24 : 383.

Material examined : 1 ex., Puri, Chilka lake, 19. ii. 1969, coll. K. N. Nair ; 2 exs., Mayurbhanj, Kathpal, 13. ii. 1976, coll. R. L. Chowdhury.

Distribution : India : Orissa (Chilka Lake, Mayurbhanj) ; Bihar, Jammu, West Bengal ; Elsewhere : Nepal Tarai

Genus 9. *Nephotettix* Matsumura

11. *Nephotettix nigropicta* (Kirkaldy)

1859. *Pediopsis apicallis* Motsch., *Etud. Ent.*, : 110.

1870. *Thamnotettix nigropicta* Stal, *vet-A K. Forh.* : 740.

1906. *Nephotettix nigropicta* : Kirk., *Rep. exp. Stat. Haw. Plant Assoc.* pt. 1x : 333.

1908. *Nephotettix apicalis* Distant, *Fauna Brit. India*, 4 : 360.

1971. *Nephotettix nigropicta* : Ghauri, *Bull. ent. Res.*, 60(3) : 481-512.

Material examined : 6 exs., Ganjam, Surrounding Dighaphand 4. iii. 1976., coll. *R. L. Chowdhuri & party*; 12 exs., Puri, Bhisari, 1. i. 1974, coll. *R. L. Chowdhuri*.

Remarks : It is usually called green ricehopper. This species is recorded as a pest on rice in India. It is recorded as a vector of plant viral diseases viz., Rice dwarf, rice yellow dwarf, rice transitory, yellowing and rice tungro. The species enjoys a wide distribution in all rice growing areas.

Distribution : India : Orissa (Ganjam, Puri), Punjab, West Bengal, Elsewhere : Sri Lanka.

Genus 10. *Parabolocratus* Fieber

12. *Parabolocratus albomaculatus* (Distant)

1908. *Thomsoniella albomaculatus* Distant, *Fauna Brit. India*, 4 : 280.

1918. *Parabolocratus albomaculatus* : Distant, *Fauna Brit. India*, 7 : 32.

Material examined : 1 ex., Puri, Bhisari, 1. i. 1974, coll. *R. L. Chowdhuri & Party*.

Distribution : India : Orissa : (Puri), Bihar, Jammu, South India. Elsewhere : Bangla Desh, Sri Lanka and Pakistan.

Remarks : The species is reported for the first time from Orissa.

Genus 11. *Amritodus* Anufriev

13. *Amritodus atkinsoni* (Lethierry)

1889. *Idiocerus atkinsoni* Lethierry, *J. Asiat. Soc. Beng.*, 18 : 252.

1906. *Idiocerus atkinsoni* : Distant, *Fauna Brit. India*, 6 : 86.

1970. *Amritodus atkinsoni* : Lethierry, *Anufriev. J. nat. Hist.*, 4(3) : 375-380.

Material examined : Sev. exs., Puri, 19. ii. 1989, coll. *K. N. Nair*.

Distribution : India : Orissa (Puri), Bihar, Madhya Pradesh, Maharashtra, Punjab, Uttar Pradesh, West Bengal. Elsewhere : Sri Lanka.

Remarks : This species can be recognised by two distinct spots on the scutellum. It is a serious pest of mango throughout the plains in India.

Genus 12. **Idiocerus** Lewis14. **Idiocerus clypealis** Lethierry

1889. *Idiocerus clypealis* Lethierry, *J. Asiat. Soc. Beng.*, 8 : 252.
1908. *Idiocerus clypealis* : Distant, *Fauna Brit. India*, 4 : 187.

Material examined : Sev. exs., Ganjam, Pudamari, 22. ii. 1976, coll. R. L. Chowdhuri & party ; 5 exs., Ganjam, Dighaphand, 4.iii.1976, coll. R. L. Chowdhuri & party.

Distribution : India : Orissa (Ganjam) ; Bihar, Maharashtra, Punjab, Rajasthan, Tamil Nadu, West Bengal ; Elsewhere : Sri Lanka.

Remarks : This species is characterised by its lighter colour with two spots on the scutellum and dark spots on the vertex. It is a well known pest of mango throughout the plains in India.

15. **Idiocerus maculatus** Distant

1912. *Idiocerus maculatus* Distant, *Ann. Mag. nat. Hist.*, 8th Ser., 10 : 605.
1916. *Idiocerus maculatus* Distant, *Fauna Brit. India*, 6 : 226.

Material examined : 5 exs., Puri, Chilka, 19.ii.1969, coll. K. N. Nair ; 2 exs., Ganjam, Pudamari, 24.ii.1976, coll. R. L. Chowdhury.

Distribution : India : Orissa : (Gopuda Island, Chilka Lake) ; also widely distributed in the plains.

Family IV. FULGORIDAE

Genus 13. **Dichoptera** Spinola16. **Dichoptera hyalinata** (Fabricius)

1781. *Fulgora hyalinata* Fabricius, *Spec. Ins.* 2 : 315.
1839. *Dichoptera hyalinata* : Spinola, *Annl. soc. ent. Fr.*, 13 : 289.
1906. *Dichoptera hyalinata* : Distant, *Fauna Brit. India*, 3 : 238.

Material examined : 3 exs., Phulbani, Kotagarh, 15.xii.1973, coll. D. P. Sanyal.

Distribution : India : Orissa (Kotagarh), Andaman Is., Karnataka, and West Bengal.

Family V. MEMBRACIDAE

Genus 14. *Oxyrhachis* Germar17. *Oxyrhachis tarandus* (Fabricius)

1798. *Membracis taranda* Fabricius, *Ent. Syst. Suppl.*, : 514.
 1835. *Oxyrhachis tarandus* : Germar, *Res. ent. Sills.*, 3 : 232.
 1908. *Oxyrhachis tarandus* : Distant, *Fauna Brit. India*, 4 : 4.
 1975. *Oxyrhachis tarandus* : Ananthasubramanian & Ananthakrishnan, *Rec. zool. Surv. India*, 68 : 169.

Material examined : 2 exs., Sambalpur, 22.xii.1971, coll. P. K. Maiti party ; 8 exs., Sundergarh, Panposh, forest, 8.xii.1971, coll. P. K. Maiti & party ; 4 exs., Bolangir, 2.i. 1972, coll. P. K. Maiti & party.

Distribution : India : Orissa (Bolangir, Sambalpur, Sundergarh), Bihar, Maharashtra, Mysore, Tamil Nadu and West Bengal.

Remarks : This species is also widely distributed in India, The brown colour of the adult with the posterior pronotal process curved up from the apex of the wings is remarkable in simulating thorns & dried up twigs of the host plants (Panda & Behura 1957). This species is attended by the ant *Camponotus (Tanaemyrmex) compressus* Latr. It is a minor pest of *Acacia arabica*, occurring sometimes on *Cajanus indicus* also.

Genus 15. *Anchon* Buckton18. *Anchon echinatum* Distant

1908. *Anchon echinatum* Distant, *Fauna Brit. India*, 4 : 51.

Material examined : 1 ex., Cuttack, 22.ii.1970, coll. S. Khera & Party.

Distribution : India : Orissa (Cuttack) ; Elsewhere : Myitta ; Tenasserim.

Remark ; The species is recorded for the first time from Orissa state.

Genus 16. *Tricentrus* Stal19. *Tricentrus gibbosulus* Walker

1858. *Tricentrus gibbosulus* Walker, *Ins. Saund. Hom* ; : 80.
 1908. *Tricentrus gibbosulus* : Distant, *Fauna Brit. India*, 4 : 53.

Material examined : 1 ex., Sambalpur, near Sambalpur jail, 19.xii. 1981, coll. P. K. Maiti & party.

Distribution : India : Orissa (Sambalpur), Assam, Tamil Nadu and West Bengal.

Remark : The species is reported for the first time from Orissa.

Genus 17. *Leptocentrus* Stal

20. *Leptocentrus leucaspis* Walker

1851. *Centrotus taurus* Walker, *List. Hom.*, 2 : 602.
1858. *Leptocentrus leucaspis* Walker, *List. Hom. Suppl.*, : 158.
1908. *Leptocentrus leucaspis* : Distant, *Fauna Brit. India*, 4 : 30.
1975. *Leptocentrus leucaspis* : Ananthasubramanian & Ananthakrishnan, *Rec. zool. Surv. India*, 68 : 194.

Material examined : 2 exs., Sundergarh, St. Merry's School Campus, 2.i.1972, coll. P. K. Maiti & Party.

Distribution : India : Orissa (Sundergarh), South India, West Bengal ; Elsewhere : Sri Lanka.

Remark : The species is recorded for the first time from Orissa.

21. *Leptocentrus taurus* (Fabricius)

1775. *Membracis taurus* Fabricius, *Syst. Ent.*, : 675.
1868. *Leptocentrus taurus* Stal, *Hem. Fabr.*, 2 : 50.
1908. *Leptocentrus taurus* : Distant, *Fauna Brit. India*, 4 : 28.
1975. *Leptocentrus taurus* : Ananthasubramanian & Ananthakrishnan, *Rec. zool. Surv. India*, 68 : 28.

Material examined : 3 exs., Sundergarh, St. Marry's School Campus, 12.i.1972, coll. P. K. Maiti & Party.

Distribution : India : Orissa (Sundergarh), Assam, Sikkim, Tamil Nadu, West Bengal ; Elsewhere : Borneo ; Burma ; Myitta, Singapore, Tenasserim.

Remarks : This is a widely distributed membracid being common in the District of Balasore & Cuttack (Panda & Behura 1957). According to them, it is more common during the summer and the monsoon months than in winter in Orissa. The insects are generally found sucking sap near the axils of the leaves and small twigs of the host plants. One of the diagnostic features of the species is the body which is more pigmented and punctate. They are usually found attended by the common ant *Camponotus (Tanaemyrmex) compressus* Latr.

Genus 18. **Otinotus** Buckton22. **Otinotus oneratus** (Walker)

1858. *Centrotus oneratus* Walker, *Ins. Saund. Hom.* : 78.
 1908. *Otinotus oneratus* Distant, *Fauna Brit. India*, 4 : 40.
 1975. *Otinotus oneratus* : Ananthasubramanian & Ananthakrishnan, *Rec. zool. Surv. India*, 68 : 214.

Material examined : 30 exs., Cuttack, C.R.R.I., 7.xii.1968, coll. G. S. Arora ; 2 exs., Sundergarh, 11.i.1972, coll. P. K. Maiti & Party ; 5 exs., Keonjhar, 23.ix.1972, coll. K. Rai & Party ; 11 exs., Keonjhar, Ghatgaon, 20.xi.1972, coll. J. K. Sen & Party ; 2 exs., Dhenkanal, Shankarpur, 7.x.1972, coll. K. Rai & Party ; 4 exs., Sundergarh, Barsua Rly. Station, 15.ix.1972, coll. S. Khera & Party.

Disiribution : India : Orissa (Balasore, Cuttack, Keonjhar, Shankarpur, Sundergarh), Bihar, Maharashtra, Tamil Nadu and West Bengal ; Elsewhere : Sri Lanka.

Remarks : This is one of the most widely distributed membracids in India. According to Behura (1951) and Panda & Behura (1956) the species is known to infest 48 different species of plants belonging to about 23 plant families. It is found all the year round, but is most abundant during the rains and autumn. These membracids exhibit cryptic colouration. The adults are parasitised by *Indoxenos* spp. (Strepsiptera).

Genus 19. **Coccosterphus** Stal23. **Coccosterphus minutus** (Fabricius)

1786. *Membracis minutus* Fabricius, *Ent. Syst. Suppl.*, : 54.
 1869. *Coccosterphus minutus* Stål, *Hem. Afr.*, 2 : 57.
 1908. *Coccosterphus minutus* : Distant, *Fauna Brit. India*, 4 : 71.
 1975. *Coccosterphus minutus* : Ananthasubramanian & Ananthakrishnan, *Rec. zool. Surv. India*, 68 : 255.

Material examined : 1 ex., Ganjam, Pudamari, 26.ii.1976, coll. R. L. Chowdhuri & Party.

Distribution : India ; Orissa (Ganjam), South India.

Remark : The species constitutes a new record from Orissa.

Suborder HETEROPTERA

Family VI. LYGAEIDAE

Genus 20. **Dinomachus** Distant24. **Dinomachus rhacinus** Distant

1906. *Dinomachus rhacinus* Distant, *Ann. Soc. ent. Belg.*, 1 : 410.

1909. *Dinomachs rhacinus* : Lefroy, *Ind. Ins. life* ; 688.

Material examined : 3 exs., Keonjhar, Ghatgaon, 29.ii.1973, coll. S. K. Gupta & Party.

Distribution : India : Orissa (Keonjhar), North-West India, Uttar Pradesh and West Bengal.

Genus 21. **Graptostethus** Stal25. **Graptostethus servus** (Fabricius)

1787. *Cimex servus* Fabricius, *Mant. Ins.*, 2 : 300.

1901. *Graptostethus servus* Distant, *Ann. Mag. nat. Hist.* (7) 7 : 537.

1904. *Graptostethus servus* : Distant, *Fauna Brit. India*, 2 : 89.

Material examined : 5 exs., Keonjhar, Anandapur, 4.iv.174, coll. S. K. Gupta & party ; 1 ex., Labongi, 11.iv.1973, coll. S. K. Gupta & party ; 2 exs., Berbero, 12.i.1974, coll. R. L. Chowdhuri & party.

Distribution : India : Orissa Berbero, (Keonjhar, Labongi), Assam, Bihar, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Nilgiri Hills and West Bengal.

Remark ; This species is a very minor pest of the plants attacked e.g. sunflower, Cotton, Sugarcane etc.

Genus 22. **Lygaeosoma** Spinola26. **Lygaeosoma bipunctata** (Dallas)

1852. *Lygaeus bipunctata* Dallas, *List. Hem. Brit. Mus.* 2 : 547.

1868. *Lygaeosoma bipunctatus* Stal, *Hem. Afr.*, 1 : 72.

Material examined : 3 exs., Mayurbhanj, Basantpur, 9.vii.1972, coll. S. K. Mitra & party ; 2 exs., Cuttack, Attigarh, 26.viii.1972, coll. S. K. Mitra & party.

Distribution ; India : Orissa (Cuttack, Mayurbhanj) Maharashtra.

Remarks : The species is recorded for the first time from Orissa.

Genus 23. *Spilostethus* Stal27. *Spilostethus hospes* (Fabricius)

1794. *Lygaeus hospes* Fabricius, *Ent. Syst.*, 4 : 150.
 1904. *Lygaeus hospes* : Distant, *Fauna Brit. India*, 2 : 6-7.
 1914. *Spilostethus hospes* Bergroth, *Ent. Mitteil.*, 2 : 356.

Material examined : 6 exs., Dhenkanal, Angul, 13.iv.1973, coll. S. K. Gupta & party ; 1 ex., Sambalpur, 28.ix.1972, coll. S. Khera & party.

Disiribution ; India : Orissa (Dhenkanal, Sambalpur), Maharashtra, Tamil Nadu.

Remark : It is common on sugarcane and Sorghum ears in South India. This species is characterised by redwhite or black spots or bands on the body : wings are characterised by 4-5 simple veins in the membrane of hemelytra. According to Mukhopadhyaya (1983), both *Spilostethus hospes* & *S. pandurus* may play important role in controlling the noxious weed like *Calotropis* spp. (N. O. Asclepiadaceae.)

28. *Spilostethus pandurus* (Scopoli)

1763. *Cimex pandurus* Scopoli, *Ent. Carn. Exhib. Ins. Carniol*, iv. 368 : 126-127.
 1885. *Lygaeus pandurus* Reuter, *Rev. Ent.*, 4 : 201.
 1906. *Lygaeus pandurus* : Oshanin, *Verz. Pal. Hem.*, 1 : 247.
 1912. *Spilostethus pandurus* Oshanin, *Kat. Pal. Hem.* 1 : 27.

Material examined : 2 exs., Keonjhar, 13.iii.1973, coll. S. K. Gupta & party ; 3 exs., Sambalpur, 28.ix.1972, coll. S. Khera & party ; 4 exs., Bolangir, 20.ix.1972, coll. S. Khera & party.

Distribution : India : Orissa (Bolangir, Keonjhar, Sambalpur) Karnataka : Maharashtra, Madhya Pradesh, Punjab, Tamil Nada, Uttar Pradesh, West Bengal.

Remark : The species is casual visitor on cotton and *Calotropis*.

Genus 24. *Pachybrachius* Usinger29. *Pachybrachius nietneri* (Dohrn)

1860. *Plociomerus nietneri* Dohrn, *Stett. Ent. Zeit.*, 21 : 404-405.
 1904. *Pamera nietneri* Distant, *Fauna Brit. India, Rhynchota*, 2 : 53.
 1946. *Pachybrachius nietneri* : Usinger, *Bull. Bernice. P. Bishop Mus.* 189 : 30.
 1959. *Pachybrachius nietneri* : Hidaka, *Kontyu*, 27 (2) : 271,

Material examined : 1 ex., Keonjhar, Barjanpal forest, 30.iii.1973, coll. *S. Khera & Party* : 1 ex., Cuttack, 21.ii.1970, coll. *S. Khera & Party*.

Distribution : India ; Orissa (Keonjhar, Cuttack), West Bengal.

Remark : The species is a new record for Orissa state.

Family VII. PENTATOMIDAE

Genus 25. *Asopus* Burmeister

30. *Asopus malabaricus* (Fabricius)

1775. *Cimex malabaricus* Fabricius, *Syst. Ent.*, : 718.

1904. *Asopus malabaricus* Distant, *Fauna Brit. India*, 1 : 255.

1985. *Asopus malabaricus* : Datta, Ghosh and Dhar, *Rec. zool. surv. India occ. paper* No. 80 : 2.

Material examined : 2 exs., Orissa ; Japlapur, date ?, coll. ?.

Distribution : India : Orissa (Japlapur), Assam, Bihar, Madhya Pradesh, Maharashtra and West Bengal.

Genus 26. *Canthecona* Amy. & Serv.

31. *Canthecona furcellata* Wolff.

1801. *Canthecona furcellata* Wolff., *lc.*, 5 : 182.

1904. *Canthecona furcellata* Distant, *Fauna Brit. India*, 1 : 248.

Material examined : 3 exs., Sundargarh, Tensahouse garden, 17.ix.1972, coll. *S. Khera & party*.

Distribution : India : Orissa (Sundargarh), Bihar, Maharashtra, Tamil Nadu, West Bengal.

Remark : The early instar nymphs are usually phytophagous and later they become predaceous on other insects.

Genus 27. *Agonoscelis* Spinola

32. *Agonoscelis nubila* (Fabricius)

1775. *Cimex nubila* Fabricius, *syst. Ent.*, : 712.

1851. *Agonoscelis nubila* Dallas, *List. Hem.*, 1 : 179.

1904. *Agonoscelis nubila* : Distant, *Fauna Brit. India*, 1 : 189.

Material examined : 6 exs., Sundargarh, Mahantipara, 23.ix.1972, coll. *S. Khera & party*.

Distribution : India : Orissa (Sundergarh), Bihar, Karnataka, Madhya Pradesh, Maharashtra, Meghalaya, Tamil Nadu and West Bengal ; Elsewhere : Burma.

Genus 28. **Eusarcocoris** Hahn

33. **Eusarcocoris guttiger** (Thunberg)

1783. *Cimex guttiger* Thunb., *Nov. Ins. sp.*, 2 : 32.

1851. *Eusarcocoris guttiger* Dallas, *List. Hem.*, 1 : 288.

1904. *Eusarcocoris guttiger* : Distant, *Fauna Brit. India*, 1 : 165.

Material examined : 1 ex., Mayurbhanj, 26.iii.1973, coll. S. K. Gupta & party.

Distribution : India : Orissa (Mayurbhanj), Maharashtra, Nagaland, Sikkim, South India and West Bengal ; Elsewhere : Sri Lanka.

Remarks : The species is a new record from Orissa. In the plains of South India, it is a minor pest of *Pennisetum typhoideum* (N. O. Gramineae).

34. **Eusarcocoris montivagus** Distant

1904. *Eusarcocoris montivagus* Distant, *Fauna Brit. India*, 1 : 166.

Material examined : 1 ex., Keonjhar, 4.iv.1973, coll. S. K. Gupta & party.

Distribution : India : Orissa (Keonjhar) ; commonly found in the Northeastern India.

Remark : The species is recorded for the first time from Oriasa.

Genus 29. **Menida** Motschulsky

35. **Menida histrio** (Fabricius)

1787. *Cimex histrio* Fabricius, *Mant. Inst.* II : 296.

1868. *Menida histrio* Fabricius, *Hem. Afr.* : 34.

1904. *Menida histrio* : Distant, *Fauna Brit. India*, 1 : 228.

1985. *Menida histrio* : Datta, Ghosh and Dhar, *Rec. zool. Surv. India*, occ. paper No. 80 : 13.

Material examined : 2 exs., Puri, Balugaon, 30.xii.1973, coll. R. L. Chowdhuri & party ; 2 exs., Cuttack, 14.iv.1973, coll. S. K. Gupta & party.

Distribution : India : Orissa (Balugaon, Cuttack), Karnataka, and N. E. part.

Remarks : The species is commonly found on wheat and sugarcane. It is a new record from Orissa.

Genus 30. **Piezodorus** Fieber

36. **Piezodorus rubrofasciatus** Fabricius

1787. *Piezodorus rubrofasciatus* Fabricius, *Mant. Ins.* 2 : 1.

1868. *Piezodorus rubrofasciatus* : Stål, *Hem. Afr.*, 1 : 32.

1904. *Piezodorus rubrofasciatus* : Distant, *Fauna Brit. India*, 1 : 224.

Material examined : 4 exs., Bolangir, Titlagarh Rly. Station, 5.x.1972, coll. S. Khera & party.

Distribution : India : Orissa (Bolangir), Assam ; Maharashtra and West Bengal.

Genus 31. **Plautia** Stal

37. **Plautia fimbriata** Fabricius

1787. *Plautia fimbriata* Fabricius, *Mant. Ins.*, 2 : 295.

1864. *Plautia fimbriata* : Stal, *Hem. Afr.*, 1 : 191.

1904. *Plautia fimbriata* : Distant, *Fauna Brit. India*, 1 : 191.

Material examined : 1 ex., Mayurbhanj, arround court and collector's office, Baripada, 8.viii.1972, coll. S. K. Mitra & party.

Distribution : India : Orissa (Mayurbhanj), Assam, Maharashtra, Nagaland, Sikkim, Tamil Nadu and West Bengal.

Remark : The species is a new record from Orissa.

Family VIII. SCUTELLERIDAE

Genus 32. **Chrysocoris** Hahn.

38. **Chrysocoris purpureus** (Westwood)

1775. *Cimex stockerius* Fabricius, *Syst. Ent.*, : 696 (1).

1868. *Chrysocoris purpureus* Stål, *Hem. Afr.*, 1 : 10(1) & 11(6).

1904. *Chrysocoris purpureus* : Distant, *Fauna Brit. India*, 1 : 55.

Material examined : 10 exs., Sambalpur, 27.ix.1972, coll. S. Khera & party.

Distribution : India : Orissa (Sambalpur) and widely distributed in Southern part of the country.

39. **Chrysocoris stollii** (Wolff.)1801. *Cimex stollii* Wolff., *lc.* 2 : 48.1904. *Chrysocoris stollii* Distant, *Fauna Brit. India*, 1 : 58.

Material examined : 12 exs., Sambalpur, 28.ix.1972, coll. S. Khera & party.

Distribution : India : Orissa (Sambalpur), and widely distributed throughout the country.

Remark : The species is common on the plants of N. O. Euphorbiaceae.

Family IX. TESSARATOMIDAE

Genus 33. **Aspongopus** Laporte40. **Aspongopus janus** (Fabricius)1775. *Cimex janus* Fabricius, *Syst. Ent.*, : 714.1832. *Aspongopus janus* Lap. *Ess. Hém.*, : 58.1902. *Aspongopus janus* Distant, *Fauna Brit. India*, 1 : 381.

Material examined : 2 exs., In and around of Dhutra Rly. Station, 18.ix.1972, coll. S. Khera & party.

Distribution : India : Orissa (Dhutra) and enjoys a wide range of distribution throughout the country.

Remark : The species is a sporadic pest of cucurbits in most parts of India.

Family X. PYRRHOCORIDAE

Genus 34. **Antilochus** Stal41. **Antilochus coqueberti** (Fabricius)1803. *Lygaeus coqueberti* Fabricius, *Syst. Rhyn.* : 222.1902. *Antilochus coqueberti* Distant, *Fauna Brit. India*, 2 : 101.

Material examined : 1 ex., Keonjhar, Anandapur, 4.iv.1973, coll. S. K. Gupta & Party.

Distribution : Orissa (Keonjhar), Andaman islands, Assam, Kashmir, South India and West Bengal.

Genus 35. **Dysdercus** Amy. and Serv.42. **Dysdercus cingulatus** (Fabricius)1775. *Cimex cingulatus* Fabricius, *Syst. Ent.*, : 719.1902. *Dysdercus cingulatus* Distant, *Fauna Brit. India*, 2 : 118.

Material examined : 2 exs., Dhenkanal, Angul, Labongi, 11.iv.1973, coll. *S. K. Gupta & party* : 1 ex., Mayurbhanj, Kathpal, 15.ii.1976, coll. *R. L. Chowdhury & party* ; 1 ex., Berbera, 12.i.1974. coll. *R. L. Chowdhury & party* ; 2 exs., Sambalpur, 26.ix.1972, coll. *S. Khera & party* ; 1 ex., Sambalpur, Bank of river, 25.ix.1972, coll. *S. K. Khera & party*.

Distribution : India : Orissa (Berbera, Dhenkanal, Mayurbhanj, Sambalpur), Assam, Karnataka, Nicobar islands, Sikkim and West Bengal.

Remark : It usually attacks *Gossypium* spp., *Lagenaria* spp., *Hibiscus* spp. & *Brassica* spp.

These are known as "Cotton stainers" in India. This bug is commonly found in all cotton growing regions. The Reduviid *Harpactor costalis* is predaceous on these bugs. The characteristic features of this species is black marking on the wings and white bands on the abdomen.

Family XI. LARGIDAE

Genus 36. *Physopelta* Amy. and Serv.

43. *Physopelta schlanbuschi* (Fabricius)

1787. *Cimex schlanbuschi* Fabricius, *Mant. Ins.*, 2 : 299.

1868. *Physopelta schlanbuschi* Stal, *Hem. Afr.*, 1 : 80.

1902. *Physopelta schlanbuschi* : Distant, *Fauna Brit. India*, 2 : 99.

Material examined : 2 exs., Naraj, Cuttack, 5-6.ii.1974, coll. *S. Biswas & party*.

Distribution : India : Orissa (Cuttack) and Assam.

Remark : The species is a new record from Orissa.

Family XII. REDUVIIDAE

Genus 37. *Ectomocoris* Mayr

44. *Ectomocoris quadriguttatus* (Fabricius)

1781. *Reduvius quadriguttatus* Fabricius, *Spec. Ins.*, 2 : 380.

1902. *Ectomocoris quadriguttatus* Distant, *Fauna Brit. India*, 2 : 298.

Material examined : 1 ex., Mayurbhanj, Satholi, Butniti, 10.x.1976, coll. *B. C. Saha & party*.

Distribution : India : Orissa (Mayurbhanj), Northeast and Southern part.

Remark : The species is reported for the first time from Orissa.

Genus 38. **Pirates** Serv.45. **Pirates atromaculatus** Stal

1870. *Pirates atromaculatus* Stal, *Ofv. Vet. Ak Fosh.*, : 692.
 1902. *Pirates atromaculatus* : Distant, *Fauna Brit. India*, 2 : 301.

Material examined : 1 ex., Banki, Sundergarh, 29.iii.1973, coll. J. K. Sen & Party.

Distribution : India : Orissa (Sundergarh), Assam and Nagaland.

Remark : The species is reported for the first time from Orissa.

Genus 39. **Harpactor** Laporte46. **Harpactor fuscipes** (Fabricius)

1787. *Reduvius fuscipes* Fabricius, *Mant. Ins.*, 2 : 312.
 1891. *Harpactor bicoloratus* Kirby, *J. Linn. Soc. Zool.*, 24 : 120.
 1902. *Harpactor fuscipes* Distant, *Fauna Brit. India*, 2 : 333.

Material examined : 2 exs., Katra, Bangriposi, 16.ix.1972, coll. K. Rai & party.

Distribution : India : Orissa (Katra) and Maharashtra.

Remark : The species is reported for the first time from Orissa.

47. **Harpactor marginatus** (Fabricius)

1794. *Reduvius marginatus* Fabricius, *Ent. Syst.*, 4 : 196.
 1903. *Harpactor marginatus* Distant, *Ann. Mag. nat. Hist.*, (7) 11 : 205.

Material examined : 2 exs., Sambalpur, 28.ix.1972, coll. S. Khera & party.

Distribution : India : Orissa (Cuttack, Sambalpur), Andhra Pradesh and North India.

AQUATIC HEMIPTERA

Family XIII. **BELOSTOMATIDAE**Genus 40. **Lethocerus** Lundblad48. **Lethocerus indicus** (Lep. & Serv.)

1775. *Belostoma indicum* Lep. & Serv., *Encyel. Meth.*, 10 : 272.
 1906. *Belostoma indicum* Distant, *Fauna Brit. India*, 3 : 38.
 1934. *Lethocerus indicus* Lundblad, *Arch. Hydrobiol. Plankton*. 12 (suppl.) : 52.

Material examined : 1 ex., Puri, Botanical garden, Barang, 30.i.1974, coll. S. Biswas & party.

Distribution : India : Orissa (Puri), widely distributed in the country ; Elsewhere : Sind.

Remarks : This is the largest member of the heteropteran insects. The species is characterised by fore legs which are prehensile. The middle and hind legs flattened with fringes of hairs and are adapted for swimming. They are economically important because of their predaceous nature. Sometimes human beings are victimised by their painful bite.

Genus 41. *Sphaerodema* Laporte

49. *Sphaerodema annulatum* (Fabricius)

1803. *Nepa annulatum* Fabricius, *Syst. Rhync.*, : 106.

1863. *Sphaerodema annulatum* Dnt., *Annls. Soc. ent. Fr.*, : 397.

1906. *Sphaerodema annulatum* Distant, *Fauna Brit. India*, 3 : 35.

Material examined : 1 ex., Mayurbhanj, Kathpal, around fishing farms, 12.ii.1976, coll. *R. L. Chowdhury & party* ; 1 ex., Ganjam, Pudemari, 26.ii.1976, coll. *R. L. Chowdhury & party*.

Distribution : India : Orissa (Mayurbhanj, Ganjam), and also distributed in other parts ; Elsewhere : Silhet, Sind.

Remark : The males are in habit of carrying the eggs which are cemented to the back. The eggs are carried until they hatch.

Family XIV. CORIXIDAE

Genus 42. *Micronecta* Kirkaldy

50. *Micronecta proba* Distant

1910. *Micronecta proba* Distant, *Fauna Brit. India*, 5 : 348.

Material examined : 2 exs., Ganjam, Pudemari, 24.ii.1986, coll. *R. L. Chowdhuri & party*.

Distribution : India : Orissa (Ganjam), Uttar Pradesh and West Bengal.

Remark : The species is reported for the first time from Orissa.

Family XV. GERRIDAE

Genus 43. *Cylindrostethus* Fieber

51. *Cylindrostethus productus* (Spinola)

1840. *Gerris productus* Spinola., *Ess. Hem.* : 64.

1902. *Cylindrostethus productus* Distant, *Fauna Brit. India*, 2 : 184,

Material examined : 5 exs., Mayurbhanj, Upper Barakamra, 28.i.1986, Coll. S. M. Ali & party.

Distribution : India : Orissa (Mayurbhanj), Southern part.

Remark : The species is a new record from Orissa.

Genus 44. *Metrocoris* Mayr

52. *Metrocoris compar* (Buch.)

1883. *Halobatodes compar* Buch., *Rep. voy. "Challenger" zool.* 7(19) : 68.

1902. *Metrocoris compar* Distant, *Fauna Brit. India*, 2 : 189.

Material examined : 2 exs., Mayurbhanj, Jorandi, Simlipal tiger reserve, 31.1.1986, coll. S. M. Ali & party.

Distribution : India ; Orissa (Mayurbhanj), also known from the eastern part of the country.

Remark : The species constitutes a new record from Orissa.

Genus. 45. *Ptilomera* Amy. & Serv.

53. *Ptilomera laticaudata* (Hardw.)

1825. *Gerris laticaudata* Hardw., *Trans. Linn. Soc.*, 14 : 134.

1843. *Ptilomera laticaudata* Amy. & Serv., *Hem.*, 8 : 414.

1902. *Ptilomera laticaudata* : Distant, *Fauna Brit. India*, 2 : 185.

Material examined : 8 exs., Mayurbhanj, Simlipal tiger reserve, upper Barakamra, 28.i.1986, coll. S. M. Ali & party.

Distribution : India : Orissa (Mayurbhanj), also known from the south ; Elsewhere : Sri Lanka.

Remark : It is also reported for the first time from Orissa.

Family XVI. HYDROMETRIDAE

Genus 46. *Rhagovelia* Mayr

54. *Rhagovelia nigricans* (Burmeister)

1863. *Velia nigricans* Burmeister., *Handls. Ent.*, 2 : 213.

1903. *Rhagovelia nigricans* Distant, *Fauna Brit. India*, 5 : 137.

Material examined : 6 exs., Puri, 10.ix.1974, coll. R. L. Chowdhury & party.

Distribution : India : Orissa (Puri), Southern part ; Elsewhere : Sri Lanka.

Remark : The species is reported for the first time from Orissa.

Family XVII. NEPIDAE

Genus 47. *Laccotrephes* Stal55. *Laccotrephes griseus* (Guerim)

1829. *Nepa griseus* Guerim, *Iconogr. Regue. Anin. Ins.*, 18 : 352.
1868. *Laccotrephes maculatus* Stal, *Hem. Afr.*, 1 : 135.
1910. *Laccotrephes griseus* Montand, *Annl. Mus. zool. Napoli*, 3(10) 3(1+10) : 3.
1910. *Laccotrephes griseus* : Distant, *Fauna Brit. India*, 5 : 314.

Material examined : 3 exs., Bolangir, Mahakhon, 29.v.1972, coll. D. P. Sanyal.

Distribution : India : Orissa (Bolangir), Madras, West Bengal ; Elsewhere : Sri Lanka. The species is more common in South India.

56. *Laccotrephes ruber* (Lennaeus)

1764. *Nepa ruber* Linnaeus, *Mus. Ind. Utr.*, : 165.
1864. *Laccotrephes ruber* Stal, *Hem. Afr.*, 1 : 135.
1906. *Laccotrephes ruber* : Distant, *Fauna Brit. India*, 3 : 18.

Material examined : 2 exs., Balangir, Mahakhond, 29.v.1972, coll. D. P. Sanyal ; 22 exs., Puri, Balengaon, 22.ii.1969, coll. K. N. Nair.

Distribution : India : Orissa (Bolangir, Puri), Assam, Jammu and Kashmir and Nagaland.

Genus 48. *Ranatra* Fabricius57. *Ranatra elongata* Fabricius

1790. *Ranatra elongata* Fabricius, *Skrivt. af. Nat. selsk. I*, 1 : 228.
1906. *Ranatra elongata* : Distant, *Fauna Brit. India*, 3 : 20.

Material examined : 9 exs., Mayurbhanj, Kathpal, 13.ii.1976, coll. R. L. Chowdhuri & Party.

Distribution : India : Orissa (Mayurbhanj), widely distributed throughout the country.

Family XVIII. PELOGONIDAE

Genus 49. *Pelogonus* Latr.58. *Pelogonus marginatus* (Latr.)

1804. *Acanthia marginatus* Latr., *Hist. Ins.*, 12 : 242.
1843. *Pelogonus marginatus* Amy. & Serv., *Hem.* : 409.

Material examined : 4 exs., Dhenkanal, Angul, 9.iv.1973, coll. S. K. Gupta & Party.

Distribution : India : Orissa (Baigonpal, Dhenkanal), and all over the plains of the country.

SUMMARY

The paper presents an account of 58 species belonging to 49 genera distributed over 18 families of Hemiptera from Orissa. Of these, 23 species belonging to 19 genera under 6 families are Homoptera and 35 species in 30 genera distributed over 13 families are Heteroptera. 17 species comprising 16 genera are reported for the first time from the state. Two homopteran families viz., Cicadellidae and Membracidae and two heteropteran families, Lygaeidae and Pentatomidae are relatively more dominant. Running key to various taxa, wherever applicable, is provided for easy identification of the group. Besides, references and distribution for each species are given. Notes on the available biological information, characteristic feature of the species, wherever possible, are also incorporated. A list of hemipteran species so far known from Orissa is appended. The paper is based on the collections made by various survey parties of Zoological Survey of India.

ACKNOWLEDGEMENTS

The authors are grateful to Prof. M. S. Jairajpuri, Director, Zoological Survey of India for the Laboratory facilities. Hearty thanks are due to Drs. S. K. Bhattacharya, R. K. Varshney, Scientist-SF, S. K. Tandon, Scientist-SE and R. C. Basu, Scientist-SD, Z.S.I. for numerous courtesies. Help rendered by Mrs. M. Ghosh, Zoological Assistant, Hemiptera Section, is thankfully acknowledged. Sincere gratitude is expressed to Dr. O. B. Chhotani, Scientist-SF, Z. S. I. for his constructive criticism for the improvement of the paper. In connection with the work, some valuable reprints were sent by Dr. B. K. Behura, Visiting Professor, Meerut University, Meerut (U.P.) to whom the authors are highly thankful.

REFERENCES

- ANNANDALE, N. 1921. The Fauna of an island in Chilka Lake. *Rec. Indian Mus.*, **22** (4) : 318-319.
- BALTAZAR, C. R. 1965. The rusty plum aphid in the Philippines. *Philipp. J. P. Ind.*, **30** : 159-163.
- BEHURA, B. K. 1951. Habits of the common membracids ("Tree hopper") *Otinotus oneratus* Walk. (Homoptera : Rhynchota). *J. Bombay nat. Hist. Soc.*, **50** (2) : 294-304.
- BEHURA, B. K. 1963. Aphids of India : A survey of published information. *Proc. First Summer School of Zoology* (Simla, 1961) : 25-78.
- BEHURA, B. K, AND BOHIDAR 1970. Studies on the Aphididae of India-V. on the morphology of the lotus aphid *Rhopalosiphum nymphaeae* (Linn.). *Prakruti-Utkal Univ.* **7** (1) : 57-76.
- BEHURA, B. K., DAS, M. M. AND DASH, B. 1973. Studies on the Aphididae of India.-XIV. On the aerial population of Aphids (Aphididae, Homoptera) flying over Bhubaneswar, Orissa at ground level. *Prakruti-Utkal Univ. Sci.* **10** (1 & 2) : 31-44.
- BEHURA, B. K. AND MAHAPATRA, SUSHAMA. 1968. Studies on the Aphididae of India-II. On the Morphology of *Hysteroneura setariae* Thomas. *Prakruti-Utkal Univ.* **5**(2) : 63-81.
- DAVID, S. K., RAJASING, S. G. AND NARAYANAN, K. 1967. Notes on the taxonomy and other aspects of certain species of aphids in India. *J. Bombay nat. Hist. Soc.*, **65**(2) : 510.
- DISTANT, W. L. 1902. *The Fauna of British India, Rhynchota*, **1** : 1-438.
- DISTANT, W. L. 1904. *Ibid.* **2** : 1-503.
- DISTANT, W. L. 1906. *Ibid.* **3** : 1-503.
- DISTANT, W. L. 1908. *Ibid.* **4** : 1-501.
- DISTANT, W. L. 1910. *Ibid.* **5** : 1-362.
- DISTANT, W. L. 1916. *Ibid.* **6** : 1-248.
- DISTANT, W. L. 1918. *Ibid.* **7** : 1-210.
- GOOT. P. VANDER. 1917. Notes on some Indian Aphides. *Rec. Indian Mus.*, **13**(4) : 175-183.

- PANDA, U. C. AND BEHURA, B. K. 1956. Further observations on the biology of the common 'Tree hopper'. *Otinotus oneratus* Walk. (Homoptera : Membracidae). *J. Bombay nat. Hist. Soc.*, **54**(1) : 160-163.
- PANDA, U. C. AND BEHURA, B. K. 1957. Notes on three common tree hoppers (Membracidae : Hemiptera) in Orissa. *J. Bombay nat. Hist. Soc.*, **54**(4) : 958-960.
- SENGUPTA, G. C. AND BEHURA, B. K. 1957. Annotated list of crop pests in the State of Orissa. *Mem. Ent. Soc. India*, No. 5 : 1-44.
- SENGUPTA, G. C., DAS, J. N. AND BEHURA, B. K. 1962. A preliminary account of the aphids of Orissa. *J. Utkal Univ. J. Sci.*, **2**(1) : 33-39.
- SENGUPTA, G. C. AND DAS, J. N. 1960. Aphids of economic plants of Orissa. *Proc. 47th Indian Sci. Congr., Calcutta* : 461.
- VARSHNEY, R. K. 1987. Insecta : Homoptera : Coccoidea. *Fauna of Orissa : State Fauna Series* No. 1, pt. 1 : 161-181 (Publ. Zool. Surv. India).

APPENDIX

List of species so far recorded from Orissa

The species recorded from Orissa for the first time are marked with asterisk.

Order HEMIPTERA

Suborder HOMOPTERA

Family ALEURODIDAE

- Genus 1. **Aleurolobus** Quaintance & Baker
1. *Aleurolobus (Aleurodes) borodensis* Mask
Genus 2. **Dialeurodes** Cockerell
2. *Dialeurodes citri* Ashm.

Family APHIDIDAE

- Genus 3. **Aphis** Linnaeus
3. *Aphis asclepiadis* Passerini
4. *A. craccivora* Koch
5. *A. gossypii* Glover
6. *A. malvae* Koch
7. *A. nerii* B.d.F.
8. *A. pomi* (de Geer)
9. *Aphis* sp.
Genus 4. **Brachysiphoniella** van der Goot
10. *Brachysiphoniella* van der Goot
Genus 5. **Greenidea** Schouteden
11. *Greenidea artocarpi* (Westwood)
Genus 6. **Hysteroneura** Davis
12. *Hysteroneura setariae* (Thomas)
Genus 7. **Lipaphis** Mordvilko
13. *Lipaphis erysimi* (Kaltenbach)
Genus 8. **Longiunguis** van der Goot
14. *Longiunguis sacchari* (Zehntner)
15. *Longiunguis* sp.
Genus 9. **Maerosiphoniella** del Guercio
16. *Macrosiphoniella sanborni* (Gillette)

- Genus 10. **Macrosiphum** Passerini
17. *Macrosiphum pisi* Kaltenbach
- Genus 11. **Myzus** Passerini
18. *Myzus persicae* (Sulzer)
- Genus 12. **Oregma** Buckton
19. *Oregma panicola* Takahashi
- Genus 13. **Pemphigus** Hartig
20. *Pemphigus bursarius* (Linnaeus)
- Genus 14. **Pentalonia** Coquerel
21. *Pentalonia nigronervosa* Coquerel
- Genus 15. **Rhopalosiphum** Koch
22. *Rhopalosiphum maidis* (Fitch)
23. *R. nymphaeae* (Linnaeus)
24. *R. rufiabdominalis* (Sasaki)
- Genus 16. **Schizaphis** Börner
25. *Schizaphis graminum* Rondani
- Genus 17. **Toxoptera** Koch
26. *Toxoptera aurantii* Boyer
27. *T. citricidus* Kirkaldy
28. *T. odinae* (v. d. Goot)

Family CERCOPIDAE

- Genus 18. **Clovia** Stål
29. *Clovia bipunctata* Kirby
30. *C. puncta* Walker

Family CICADELLIDAE

- Genus 19. **Amritodus** Anufriev
31. *Amritodus atkinsoni* (Lethierry)
- Genus 20. **Cicadella** Dumeril
32. *Cicadella spectra* (Distant)
- Genus 21. **Empoasca** Walsh
33. *Empoasca devastans* Fabricius
34. *Empoasca* sp.
- Genus 22. **Exitianus** Dallas
35. *Exitianus indicus* (Distant)

Genus 23. **Idiocerus** Lewis36. *Idiocerus clypealis* (Lethierry)37. *Idiocerus maculatus* DistantGenus 24. **Nephotettix** Matsumura38. *Nephotettix apicalis* Motschulsky39. *N. bipunctatus* Fabricius40. *N. nigropicta* (Stal)Genus 25. **Parabolocratus** Fieber41. **Parabolocratus albomaculatus* (Distant)Genus 26. **Tettigoniella** Jacobi42. *Tettigoniella ferruginea* Fabricius

Superfamily COCCOIDEA

Genus 27. **Aclerda** Signoret43. *Aclerda tokionis* (Cockerell)44. *Aclerda* sp.Genus 28. **Antonina** Signoret45. *Antonina graminis* (Maskell)Genus 29. **Aonidiella** Berlese & Leonardi46. *Aonidiella aurantii* (Maskell)47. *Aonidiella orientalis* NewsteadGenus 30. **Anomalococcus** Green48. *Anomalococcus indicus* GreenGenus 31. **Aspidiella** Leonardi49. *Aspidiella hartii* (Cockerell)Genus 32. **Aspidiotus** Bouche50. *Aspidiotus* sp.Genus 33. **Aulacaspis** Cockerell51. *Aulacaspis vitis* (Green)Genus 34. **Brevennia** Goux52. *Brevennia rehi* (Lindinger)Genus 35. **Cerococcus** Comstock53. *Cerococcus indicus* (Maskell)

- Genus 36. **Ceroplastes** Gray
54. *Ceroplastes rubens* Maskell
55. *Ceroplastes actiniformis* Green
56. *Ceroplastes pseudoceriferus* Green
- Genus 37. **Ceroplastodes** Cockerell
57. *Ceroplastodes cajani* (Maskell)
58. *Ceroplastodes* sp.
- Genus 38. **Cerostegia** De Lotto
59. *Cerostegia floridensis* (Comstock)
- Genus 39. **Chloropulvinaria** Borchsenius
60. *Chloropulvinaria polygonata* (Cockerell)
61. *Chloropulvinaria psidii* (Maskell)
- Genus 40. **Coccidohystrix** Lindinger
62. *Coccidohystrix insolita* (Green)
- Genus 41. **Coccus** Linnaeus
63. *Coccus* sp.
64. *Coccus hesperidum* Linnaeus
65. *Coccus longulus* (Douglas)
66. *Coccus viridis* (Green)
- Genus 42. **Crypticerya** Cockerell
67. *Crypticerya* sp.
- Genus 43. **Dactylopius** O. G. Costa
68. *Dactylopius* sp.
69. *Dactylopius indicus* (Green)
70. *Dactylopius tomentosus* (Lamarck)
- Genus 44. **Diaspis** Costa
71. *Diaspis* sp.
72. *Diaspis echinocacti* (Bouche)
- Genus 45. **Dysmicoccus** Ferris
73. *Dysmicoccus brevipes* (Cockerell)
- Genus 46. **Ferrisia** Fullaway
74. *Ferrisia virgata* (Cockerell)
- Genus 47. **Greenaspis** MacGillivray
75. *Greenaspis decurvata* (Green)

Genus 48. **Hemiberlesia** Cockerell

- 76.
- Hemiberlesia lataniae*
- (Signoret)

Genus 49. **Icerya** Signoret

77. *Icerya aegyptiaca* (Douglas)
78. *Icerya formicarum* Newstead
79. *Icerya purchasi* Maskell
80. *Icerya seychellarum* (Westwood)
81. *Icerya* sp.

Genus 50. **Indococcus** Ali

82. *Indococcus pipalae* Ali
83. *Indococcus* sp.

Genus 51. **Kerria** Targioni-Tozzetti

84. *Kerria lacca lacca* (Kerr)
85. *Kerria* sp.

Genus 52. **Labioproctus** Green

- 86.
- Labioproctus poleii*
- (Green)

Genus 53. **Lecanium** Burmeister

- 87.
- Lecanium*
- sp.

Genus 54. **Lepidosaphes** Auct.

- 88.
- Lepidosaphes*
- sp.

Genus 55. **Lindingaspis** MacGillivray

- 89.
- Lindingaspis ferrisi*
- McKenzie

Genus 56. **Maconellicoccus** Ezzat

- 90.
- Maconellicoccus hirsutus*
- (Green)

Genus 57. **Melanaspis** Cockerell

91. *Melanaspis glomerata* (Green)
92. *Melanaspis* sp.

Genus 58. **Nipaecoccus** Sulc

- 93.
- Nipaecoccus viridis*
- (Newstead)

Genus 59. **Odonaspis** Leonardi

- 94.
- Odonaspis saccharicaulis*
- (Zehntner)

Genus 60. **Pedroniopsis** Green

- 95.
- Pedroniopsis beelsoni*
- Green

Genus 61. **Planococcoides** Ezzat & McConnell

- 96.
- Planococcoides robustus*
- Ezzat & McConnell

Genus 62. **Planococcus** Ferris

- 97.
- Planococcus lilacinus*
- (Cockerell)

Genus 63. **Pseudococcus** Westwood

- 98.
- Pseudococcus corymbatus*
- (Green)
-
- 99.
- Pseudococcus*
- sp.

Genus 64. **Pulvinaria** Targioni-Tozzetti

- 100.
- Pulvinaria maxlma maxima*
- Green
-
- 101.
- Pulvinaria psidii*
- Maskell

Genus 65. **Quadraspidotus** MacGillivray

- 102.
- Quadraspidotus perniciosus*
- Comstock

Genus 66. **Rastrococcus** Ferris

- 103.
- Rastrococcus iceryoides*
- (Green)
-
- 104.
- Rastrococcus mangiferae*
- (Green)
-
- 105.
- Rastrococcus ?spinosus*
- (Robinson)

Genus 67. **Saccharicoccus** Ferris

- 106.
- Saccharicoccus sacchari*
- Ckll.

Genus 68. **Xenococcus** Silvestri

- 107.
- Xenococcus annandalei*
- Silvestri

Family FULGORIDAE

Genus 69. **Dichoptera** Spinola

- 108.
- Dichoptera hyalinata*
- Fabricius

Genus 70. **Nilaparvata** Distant

- 109.
- Nilaparvata lugens*
- Stal

Family MEMBRACIDAE

Genus 71. **Anchon** Buckton

- 110.
- Anchon echinatum*
- Distant

Genus 72. **Cocceasterphus** Stal

- 111.
- *Cocceasterphus minutus*
- Fabricius

Genus 73. **Leptocentrus** Stal

- 112.
- *Leptocentrus leucaspis*
- (Walker)
-
- 113.
- Leptocentrus obortus*
- Distant
-
- 114.
- Leptocentrus taurus*
- (Fabricius)

Genus 74. **Otinotus** Buckton

- 115.
- Otinotus elongatus*
- Distant
-
- 116.
- Otinotus oneratus*
- (Walker)

Genus 75. **Oxyrachis** Germar117. *Oxyrachis tarandus* Fabricius118. *Oxyrachis* sp.Genus 76. **Tricentrus** Stal119. *Tricentrus gibbosulus* Walker120. *Tricentrus brevis* Frunkhouser

Suborder HETEROPTERA

Family CAPSIDAE

Genus 77. **Disphinctus** Stal121. *Disphinctus politus* Walker

Family COREIDAE

Genus 78. **Clavigralla** Spinola122. *Clavigralla gibbosa* SpinolaGenus 79. **Leptocorisa** Latrellie123. *Leptocorisa acuta* ThunbergGenus 80. **Riptortus** Stal124. *Riptortus linearis* Fabricius

Family LYGAEIDAE

Genus 81. **Dinomachus** Distant125. *Dinomachus rhacinus* DistantGenus 82. **Graptostethus** Stal126. *Graptostethus servus* (Fabricius)Genus 83. **Lygaeosoma** Spinola127. **Lygaeosoma bipunctata* (Dallas)Genus 84. **Oxycarenum** Fiber128. *Oxycarenum hyalipennis* CostaGenus 85. **Spilostethus** Stal129. *Spilostethus hospes* (Fabricius)130. *Spilostethus pandurus* (Scopoli)Genus 86. **Pachybrachius** Usinger131. **Pachybrachius nietneri* (Dohrn)

Family PENTATOMIDAE

- Genus 87. **Agonoscelis** Spinola
132. *Agonoscelis nubila* (Fabricius)
- Genus 88. **Asopus** Burmeisler
133. *Asopus malabaricus* (Fabricius)
- Genus 89. **Bagrada** Stal
134. *Bagrada picta* Fabricius
- Genus 90. **Canthecona** Amy. & Serv.
135. *Canthecona furcellata* Wolff.
- Genus 91. **Dolycoris** Stal
136. *Dolycoris indicus* Stal
- Genus 92. **Eusarcocoris** Hahn
137. **Eusarcocoris guttiger* (Thunberg.)
138. **Eusarcocoris montivagus* Fabricius
- Genus 93. **Menida** Motschulsky
139. **Menida histrio* Fabricius
- Genus 94. **Nezara** Amy. & Serv.
140. *Nezara viridula* Linnaeus
- Genus 95. **Piezodorus** Fieber
141. *Peizodorus rubrofasiatus* Fabricius
- Genus 96. **Plautia** Stal
142. **Plautia fimbriata* (Fabricius)

Family PLATASPIDAE

- Genus 97. **Coptosoma** Laporte
143. *Coptosoma cribrerium* Fabricius

Family SCUTELLERIDAE

- Genus 98. **Chrysocoris** Hahn
144. *Chrysocoris purpureus* Westwood
145. *Chrysocoris stolli* Wolff.

Family TESSAROTOMIDAE

- Genus 99. **Aspongopus** Laporte
146. *Aspongopus janus* (Fabricius)

Family PYRRHOCORIDAE

Genus 100. **Antiloehus** Stal

147. *Antilochus coqueberti* (Fabricius)

Genus 101. **Dysdercus** Amy. & Serv.

148. *Dysdercus cingulatus* (Fabricius)

Family LARGIDAE

Genus 102. **Physopelta** Amy. & Serv.

149. **Physopelta schlanbuschi* (Fabricius)

Family REDUVIIDAE

Genus 103. **Ectomocoris** Mayr

150. *Ectomocoris quadriguttatus* (Fabricius)

Genus 104. **Pirates** Serv.

151. **Pirates atromaculatus* Stal

Genus 105. **Harpactor** Laporte

152. **Harpactor fuscipes* Fabricius

153. *H. marginatus* Fabricius

AQUATIC HEMIPTERA

Family BELOSTOMATIDAE

Genus 106. **Lethocerus** Lundblad

154. *Lethocerus indicus* (Lep. & Serv.)

Genus 107. **Shhaerodema** Laporte

155. *Sphaerodema annulatum* Fabricius

Family CORIXIDAE

Genus 108. **Corixa** Geoffr

156. *Corixa annandalei* Paiva & Dover

157. *Corixa rambhaensis* Paiva & Dover

Genus 109. **Micronecta** Kirkaldy

158. **Micronecta proba* Distant

Family GERRIDAE

Genus 110. **Cylindrostethus** Fieber

159. **Cylindrostethus productus* Spinola

Genus 111. **Metrocoris** Mayr

160. **Metrocoris compar* Buch.

Genus 112. **Ptilomera** Amy. & Serv.

161. **Ptilomera laticaudata* Hardwicki

Family HYDROMETRIDAE

Genus 113. **Rhagovelia** Mayr

162. **Rhagovelia nigricans* Burmiester

Family NEPIDAE

Genus 114. **Laccotrephes** Stal

163. *Laccotrephes griseus* (Guerim)

164. *Laccotrephes ruber* (Linnaeus)

Genus 115. **Ranatra** Fabricius

165. *Ranatra elongata* Fabricius

Family PELOGONIDAE

Genus 116. **Pelogonus** Latrellie

166. *Pelogonus marginatus* (Latrellie)

DIGENETIC TREMATODES OF VERTEBRATES

M. HAFEEZULLAH

*Zoological Survey of India, Nizam Palace Campus,
234/4 A. J. C. Bose Road,
Calcutta.*

INTRODUCTION

The coastal Orissa was surveyed by the author in May-June 1972 to collect helminth parasites of marine fishes from the coastal towns of Chandipur, Paradip, Gopalpur, Konarak and Puri. As the survey was conducted in unsuitable season and the collection made was meager and poor, it was repeated in November-December, 1973 visiting Gopalpur, Puri, Konarak and Chandbali. Simultaneously, helminth parasites of amphibians (frogs and toads) and reptiles (lizards and snakes) were also collected. Collections were also made in March, 1979 from freshwater fishes from the river Indravati at Nowrangpur.

Of the material thus collected from Orissa, most of the flukes from fishes and amphibians have already been reported by the author in his various papers (1975, 1978, 1980a, 1980b, 1981, 1984 & 1985). These papers include one new genus, viz., *Atheria* Hafeezullah (1975), 3 new species, viz., *Lecithocladium chauhani* Hafeezullah (1975), *Atheria zakiae* Hafeezullah (1975) and *Paracryptogonimus sootai* Hafeezullah (1980b) and 12 already known species, besides other flukes collected from freshwater elsewhere. The remaining of the digenetic trematodes of fishes, amphibians and reptiles form the basis of the present study and belong to 7 families, 9 genera and 10 species. The positions in respect of the different genera and species examined are very much called for and therefore discussed in detail. A complete list of the digenetic trematodes reported by various authors from Orissa is out of scope of this communication. However, a list of the species already reported by the present author from Orissa is appended in the beginning of the paper.

LIST OF DIGENETIC TREMATODES FROM MARINE FISHES,
AMPHIBIANS AND REPTILES ALREADY REPORTED
FROM COASTAL ORISSA.

Family I. HEMIURIDAE Lühe, 1901

1. *Lecithocladium chauhani* Hafeezullah, 1975, from the stomach of *Hilsa ilisha* (Clupeidae) from Konarak coast (Bay of Bengal).
2. *Atheria zakiae* Hafeezullah, 1975, from the stomach of *Therapon jarbua* (Theraponidae) from Gopalpur coast (Bay of Bengal). (Type species of the genus *Atheria* Hafeezullah, 1975).
3. *Stomachicola muraenesocis* Yamaguti, 1934, from the stomach of *Muraenesox cinereus* (Muraenidae) from Chandipur coast (Bay of Bengal).

Family II. LECITHASTERIDAE Odhner, 1905

4. *Trifoliovarium triacanthi* Bilquees, 1973, from the stomach of *Triacanthus brevirostris* (Triacanthidae) from Puri coast (Bay of Bengal).

Family III. ACCACOELIIDAE Odhner, 1911

5. *Tetrochetus aluterae* (Hanson, 1955) Yamaguti, 1958, from the stomach of *Balistis capistratus* (Balistidae) from Gopalpar and Paradip coasts (Bay of Bengal).

Family IV. CRYPTOGONIMIDAE Ciurea, 1933

6. *Paracryptogonimus sootai* Hafeezullah, 1980, from the intestine of *Lutjanus* sp. (Lutjanidae) from Gopalpur coast (Bay of Bengal).

Family V. ACATHOCOLPIDAE Lühe, 1909

7. *Stephaanostomoides tenuis* (Manter, 1963) Hafeezullah, 1980 from the intestine of *Chirocentrus dorab* (Chirocentridae) from Gopalpur coast (Bay of Bengal).
8. *Acanthocolpus liodorus* Srivastava, 1939, from the intestine of *Chirocentrus dorab* (Chirocentridae) from Gopalpur coast (Bay of Bengal).
9. *Acanthocolpus caballeroi* Gupta, A. N. and Sharma, P. N., 1972, from the intestine of *Chirocentrus dorab* from Chandipur and Konarak (Bay of Bengal).

Family VI. MONORCHIIDAE Odhner, 1911

10. *Opisthomonorchoides karwarensis* Karyakarte & Yadav, 1976, from the intestine of *Formio niger* (Formionidae) from Gopalpur coast (Bay of Bengal).

Family VII. FELLODISTOMIDAE Nicoll, 1905

11. *Monascus filiformis* (Rud., 1819) Looss, 1907, from the intestine of *Formio niger* (Formionidae) from Gopalpur coast (Bay of Bengal)

Family VIII. PLAGIORCHIIDAE Lühe, 1901

12. *Tremiorchis ranarum* Mehra and Negi, 1926, from the intestine of *Rana cyanophlyctis* (Ranidae) from Chandbali.

Family XI. LECITHODENDRIIDAE

13. *Pleurogenoides solus* (Johnston, 1912), from the intestine of *Rana cyanophlyctis* (Ranidae) from Chandbali.

14. *Pleurogenoides gastroporus* Lühe, 1901, from the intestine of *Rana cyanophlyctis* (Ranidae) from Chandipur, Chandbali, Gopalpur, Konarak and Puri.

15. *Ganeo korkei* Bhalerao, 1963, from the intestine of *Rana Cyanophlyctis* (Ranidae) from Konarak.

SYSTEMATIC ACCOUNT

Family I. ALLOCREADIIDAE LOOSS, 1902

Subfamily ORIENTOCREADIINAE Yamaguti, 1958

Genus I. *Orientocreadium* Tubangui, 1931

1. *Orientocreadium batrachoides* Tubangui

(Fig. 1)

1931. *Orientocreadium batrachoides* Tubangui, *Philipp. J. Sci.*, 44 : 417.

1934. *Orientocreadium indicum* Pande, *Proc. Indian Acad. Sci.*, 4(1) : 107.

1958. *Orientocreadium raipurensis* Saksena, *Proc. natn. Acad. Sci.*, 28(1) : 58.

1958. *Orientocreadium dayalai* Saksena, *Proc. natn. Acad. Sci.*, 28(1) : 60.

1960. *Orientocreadium umadasi* Saksena, *Proc. natn. Acad. Sci.*, 30 : 83.

1961. *Orientocreadium lazeri* Khalil, *J. Helminth.*, 35(3/4) : 259.

1966. *Orientocreadium otto* Gupta, V., *Indian J. Helminth.*, 18(1) : 62.

Material examined : 5 exs. on one slide ; host—*Clarias batrachus* (Clariidae) ; location-intestine ; locality-Nowrangpur, 30.3.1979.

Remarks : The genus *Orientocreadium* Tubangui, 1931 has species

of intestinal flukes, largely of freshwater fishes. Only two species of the genus have been reported from lizards, viz., *Orientocreadium aspinosum* (Simha, 1958) Yamaguti, 1971 (syn. *Neoganada aspinosum* Simha,

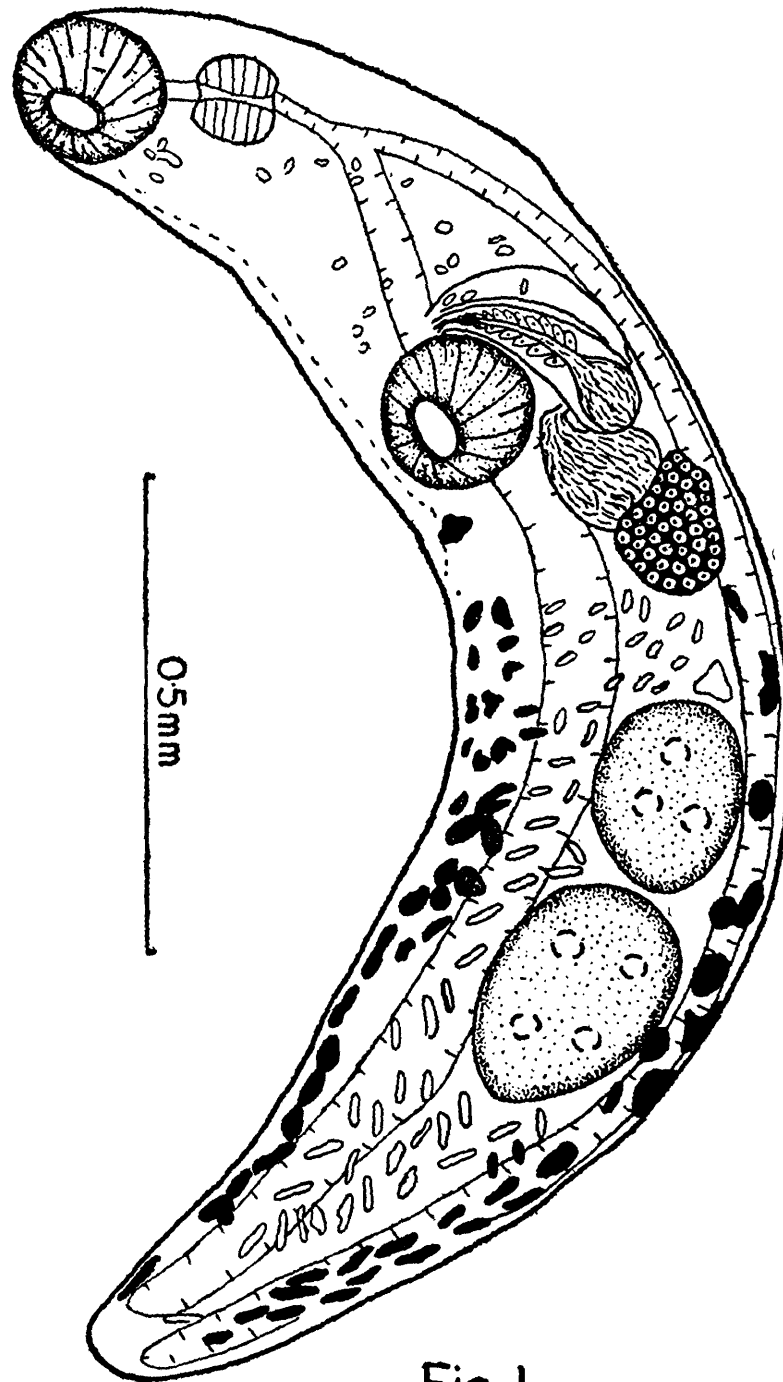


Fig. 1

Fig. 1. *Orientocreadium batrachoides* Tubangui.

1958, from the intestine of *Chaemeleon zelanicus* at Hyderabad) and *Orientocreadium otto* Gupta, V., 1966, from the intestine of *Uromastix hardwickii* at Lucknow. The excretory vesicle in the various species has been reported to be tubular or tubular with short arms.

There are altogether six genera which are very closely allied to *Orientocreadium* Tubangui, 1931. They are *Ganada* Chatterji, 1933, *Neoganada* Dayal, 1938, *Nizamia* Dayal, 1938, *Ganadotrema* Dayal, 1949, *Paratormopsolus* Bychowsky and Dubinina, 1954, and *Macrotrema* Gupta, 1951. Yamaguti (1958) synonymised five of them with *Orientobreadium*, treating *Macrotrema* Gupta, 1951 as a distinct genus in the subfamily Orientocreadiinae Yamaguti, 1958. Gupta, S. P. (1961), however, considered that *Neoganda*, *Nizamia* and *Ganadotrema* are distinguishable from *Orientocreadium*. Khalil (1961) described *Orientocreadium lazeri* from the intestine of a freshwater fish, *Clarias lazera*, in the Sudan, and accepted Yamaguti's (1958) action of synonymising five genera with *Orientocreadium*. Beverley-Burton (1962) studied variations in the species of *Orientocreadium* and the five allied genera. As a result he also endorsed the action of Yamaguti (1958) and considered *O. indicum* Pande, 1934, *O. mahendrai* (Gupta, 1951) Yamaguti, 1958 (Syn. *Ganadotrema mahendrai* Gupta, 1951), *O. phillipai* (Gupta, 1951) Yamaguti, 1958 (syn. *Ganadotrema phillipai* Gupta, 1951), *O. secundum* (Dayal, 1949) Yamaguti, 1958 (syn. *Neoganada secunda* Dayal, 1949), *O. dayali* Yamaguti, 1958 (syn. *Ganadotrema* Dayal, 1949, nec *O. indicum* Pande, 1934), and *O. raipurensis* Saksena, 1958 as synonyms of *Orientocreadium batrachoides*.

Fischthal and Kuntz (1963) did not endorse Yamaguti's (1958) action. They considered that all the species with tubular or saccular excretory bladder should be grouped under the genus *Orientocreadium* Tubangui, 1931, and the remaining species with Y-shaped excretory bladder should be categorised under the genus *Ganada* Chatterji, 1933. The authors further synonymised *Macrotrema* Gupta, 1951 with *Ganada*. They recognised only three species as valid in the genus *Orientocreadium*, viz., *O. batrachoides* Tubangui, 1931, *O. indicum* Pande, 1934 and *O. paeudobagri* Yamaguti, 1934, but Gupta, V. (1964) considered *O. indicum* also as a synonym of *O. batrachoides*. I agree to this synonymy. While reporting *O. batrachoides* from an Egyptian fish, *Clarias lazera*, Fischthal and Kuntz (1963) noted some important variations in this species on the basis of which they considered *O. dayalai* Saksena, 1958, *O. raipurensis* Saksena, 1958, *O. umadasi* Saksena, 1960, and *O. lazeri* Khalil, 1961 as synonyms of *O. batrachoides*. On the basis of the study of the present material, these synonymies are also acceptable. Pandey, K. C. (1972) reported *Orientocreadium batrachoides*

Tubangui, 1931 from the freshwater fish *Channa punctatus* at Lucknow and considered *Orientocreadium otto* Agrawal, V., 1966 from the lizard *Uromastix hardwickii* at Lucknow as its synonym, and I agree to it. Thus the genus *Orientocreadium* is left with only two valid species, viz., *O. batrachoides* and *O. pseudobagri*.

Family II. BRACHYCOELIIDAE Johnston, 1912

Subfamily MESOCOELIINAE Faust, 1924

Genus 2. *Mesocoelium* Odhner,

2. *Mesococlium sociale* (Lühe)

(Fig. 2)

1901. *Distoma sociale* Lühe, *Centralbl. Bakteriolog.*, 1 Abt, 30(4) : 171.
 1910. *Mesocoelium sociale* : Odhner, *Res. Swedish zool. Exped. Egypt & White Nile* 1901. pt. 4, no. 23A : 88.
 1920. *Mesocoelium sociale* : Sewell, *Rec. Indian Mus.*, 19(3) : 81.
 1927. *Mesocoelium megitti* Bhalerao, *Ann. Mag. nat. Hist.*, 20(9) : 611.
 1956. *Mesocoelium varunae* Baugh, *Proc. natn. Acad. Sci. India, Sect. B*, 26(6) : 421.

Material examined : 7 exs. on 3 slides ; host—*Calotes versicolor* (Family Agamidae) ; location-intestine ; locality-Konarak, 8.6.1972.

Remarks ; The species of *Mesocoelium* have been reported from hosts like toads, frogs, lizards and snakes. Only one species, *M. scatophagi* Fischthal and Kuntz, 1965, has been described from the marine fish, *Scatophagus argus*, from North Borneo.

Mesocoelium sociale (Lühe 1901) Odhner, 1910 has an oral sucker larger than the ventral sucker, testes are larger than the ventral sucker, vitellarium is well developed and extends from about the level of posterior margin of oral sucker to about the ends of caeca, and the genital pore is median and bifurcal. The position of genital pore may be pre-or post-bifurcal and submedian also depending upon the state of contraction at the time of fixation. The present material conforms to these diagnostic characters of *M. sociale*.

M. sociale (Lühe, 1901), *M. varunae* Baugh, 1956, *M. burdwanense* Mukherjee, 1967 and *M. thapari*, Gupta, V. & Jalan 1976 have been reported from India whereas *M. megitti* Bhalerao, 1927 has been described from an adjacent country, Burma (Rangoon). While *M. burdwanense* and *M. thapari* have obvious differences with *M. sociale*,

M. varunae and *M. megitti* have been pointed out by Frietas (1967) to be identical to it.

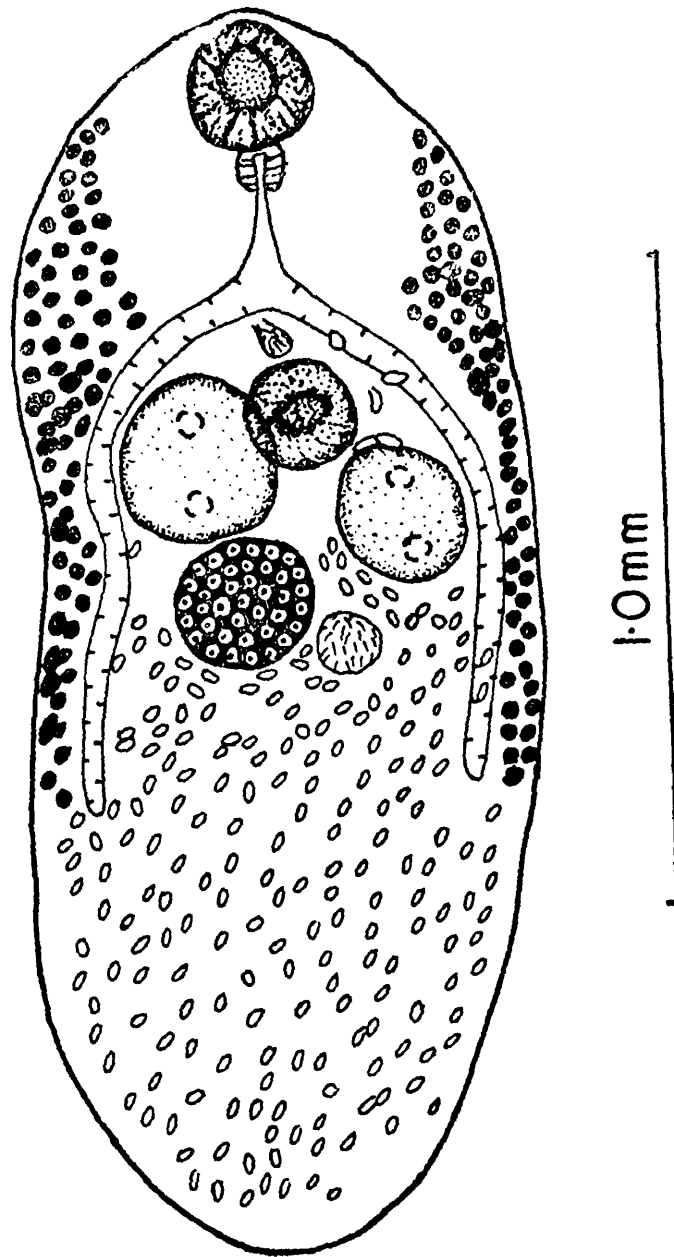


Fig 2

Fig. 2. *Mesocoelium sociale* (Lühe) ; Dorsal view.

Mesocoelium sociale is widely accepted as the type species of the genus *Mesocoelium* Odhner, but the studies of Frietas (1967) reveal that the two Indian species, *M. sociale* and *M. varunae* as well as the Burmese species, *M. megitti*, are synonyms of *M. monas* (Rud., 1819) Frietas, 1958. If this synonymy is taken to be correct, *M. sociale* loses

its status of type species of *Mesocoelium*, but Yamaguti (1971) maintains this status of *M. sociale*.

3. *Mesocoelium thapari* Gupta, V. and Jahan
(Fig. 3)

1976. *Mesocoelium thapari* Gupta, V. and Jahan, *Indian J. Helminth.*, 28(2) : 144.

Material Examined : 3 exs. on 2 slides ; host—*Bufo melanostictus*

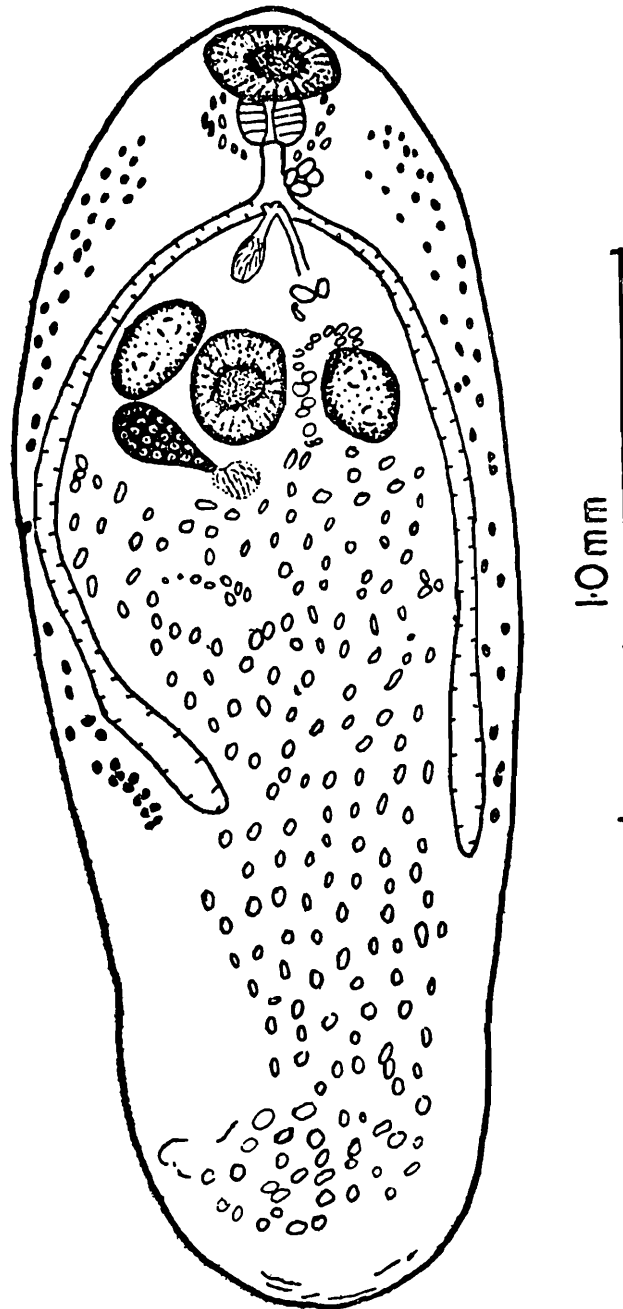


Fig. 3

Fig. 3. *Mesocoelium thapari* Gupta, V. and Jahan.

(Family Bufonidae) ; location-Intestine ; locality-Konarak, 17. 12. 1972.

Remarks ; This species was originally described from *Rana tigrina* from Lucknow, Uttar Pradesh, India. It is characterised by having an oral sucker larger than the ventral sucker, testes smaller than the ventral sucker, poorly developed vitelline follicles and immediately postbifurcal position of the genital pore. The present specimens possess these characteristic features of *M. thapari*. This species differs from *M. sociale* mainly in the poor development of vitellarium and testes smaller than the ventral sucker. On the whole *M. thapari* appears to be a stage of *M. sociale* in the process of the development of various systems and organs. The position of the genital pore with respect to that of the caecal bifurcation is variable in the specimens of these two species in the present collection.

Family III. DICROCOELIIDAE Odhner, 1910

Subfamily DICROCOELINAE Looss, 1899

Genus 3. *Paradistomum* Kossack, 1910

Syn. *Paradistomoides* Travassos, 1944

4. *Paradistomum orientalis* (Narain and Das) Travassos (Fig. 4)

- 1929. *Dicrocoelium orientalis* Narain and Das, *J. Bombay nat. Hist. Soc.*, 33 : 250.
- 1936. *Paradistomum orientalis* : Bhalerao, *J. Helminth.*, 14 : 173.
- 1936. *Paradistomum moghei* Bhalerao, *J. Helminth.*, 14 : 170.
- 1944. *Paradistomoides orientalis* : Travassos, *Mem. Inst. Oswaldo Cruz*, 2 : 271.
- 1957. *Paradistomum banarasensis* Baugh, *Proc. natn. Acad. Sc. India.*, Sect. B, 26(6) : 417.
- 1958. *Paradistomoides orientalis* : Simha, *Z. Parasitenkd.*, 18 : 196.
- 1960. *Paradistomum orientalis* : Arora and Agarwal, *Bull. zool. Soc. College Sci. Nagpur*, 3 : 43, 51.
- 1962. *Paradistomum orientalis* : Arora, Agarwal and Agarwal, *Indian J. Holminth.*, 14(1) : 5.
- 1973. *Paradisomoides medius* Nama and Khichi, *Z. Angew. Zool.* 60 : 258. (n. syn.)
- 1973. *Paradistomoides brevis* Nama and Khichi, *Z. Angew. Zool.* 60 : 259. (n. syn.)

Material examined : 3 exs. on the slide ; host—*Calotes versicolor* (Family Agamidae) ; location-Gall-bladder ; locality-Chandbali, 22.12.1973.

Remarks : Arora and Agarwal (1960) have studied intraspecific variations in *Paradistomum orientalis* (Narain and Das, 1929). They

have noted marked variations in body shape (broad and leaf-like, slender, elongated), size of the body, width of intestinal caeca (extremely broad to narrow), length of oesophagus in broad to narrower

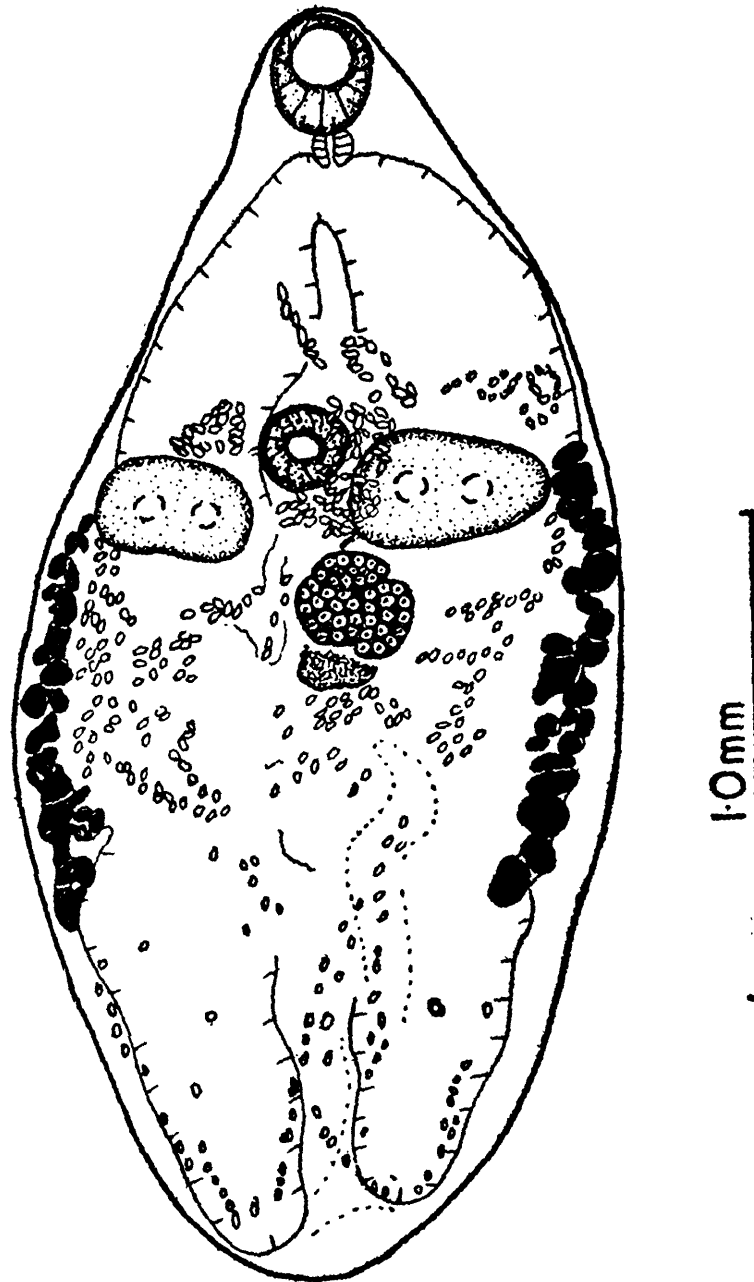


Fig. 4

Fig. 4. *Paradistomum orientalis* (Narain and Das) ; entire worm.

forms, lobation of testes (ovoid to indented), positions of ovary and genital pore, etc., etc., in specimens recovered from a single gall-bladder. The most significant variation they have noted is in the anterior extent of vitellaria with respect to the level of the anterior

margin of testes or the ventral sucker. They have found intergrading variations in the distribution of vitelline follicles in gravid individuals collected from the same gallbladder. Based on this scientific evidence, they do not accept the separation of *Paradistomoides* Travassos, 1944 from *Paradistomum* Kossack, 1910. Krishnaswamy and Anantaraman (1956) also studied variations in *Paradistomum orientalis* recovered from the gall-bladder of *Calotes versicolor*. On the basis of this study, they considered that *P. moghei* is just one stage of growth of *P. orientalis*. Therefore, they synonymised the former with the latter. Arora, Agarwal and Agarwal (1962) considered that *P. moghei* and *P. banarasensis* are both synonyms of *P. orientalis*. Nama and Khichi (1973), apparently unaware of the above studies on variations in *Paradistomum orientalis*, described two species, namely, *Paradistomoides medius* and *Paradistomoides brevis*, from Jodhpur. They also fall within the aforesaid variations. Hence, they are also synonyms of *Paradistomum orientalis*.

Family IV. ACANTHOTOMIDAE Poche, 1962

Subfamily ACANTHOSTOMINAE Nicoll, 1914

Genus 4. *Acanthostomum* Looss, 1899

Syn. *Acanthochasumus* Looss, 1900

Gymnatrema Morozov, 1955

Proctocaecum Baugh, 1957

5. *Acanthostomum (Atrophocaecum) burminis* (Bhalerao)

(Fig. 5)

- 1926. *Acanthochasmus burminis* Bhalerao, *Parasitology*, 18(1) : 10.
- 1929. *Acanthochasmus burminis* : Thapar and Ali, *J. Helminth.*, 7(4) : 251.
- 1936. *Acanthostomum burminis* : Bhalerao, *J. Helminth.*, 14 : 148.
- 1940. *Atrophocaecum burminis* : Bhalerao, *Indian J. vet. Sci.*, 10(1) : 94.
- 1957. *Atrophocaecum hindustanensis* Baugh, *Proc. natn. Acad. Sci. India*, (1956), 26(5) : 298.
- 1958. *Acanthostomum burminis* : Yamaguti, *Systema Helminthum*. Vol. I. Parts I & II. *The Digenetic Trematodes Of Vertebrates*. Interscience publisher, New York, 245.
- 1958. *Atrophocaccum indicum* Simha, *Z. Parasitenkd.*, 18 : 184.
- 1958. *Haplocaecum asymmetricum* Simha, *Z. Parasitenkd.*, 18 : 187.
- 1963. *Acanthostomum (Atrophocaecam) simhai* Khalil (for *Acanthostomum indicum* (Simha, 1958) nec Sinha, 1942), *J. Helminth.*, 37(3) : 211.
- 1963. *Acanthostomum (Atrophocaecum) burminis* : Khalil, *J. Helminth.*, 37(3) : 211.
- 1963. *Acanthostomum (Haplocaecum) symmetricum* : Khalil, *J. Helminth.*, 37(3) : 211.

1966. *Haplocaecum proctophorum* Dwivedi, *Rev. Biol. Trop., Univ. Costa Rica*, 13(1) : 87.
1971. *Acanthostomum (Atrophocaecum) proctophorum* : Yamaguti, *Synopsis of Digenetic Trematodes of Vertebrates*. Vol. I. Keigaku Publishing Co., Tokyo, Japan, 444.

Material examined : 1 ex. on slide in two broken pieces ; host—*Natrix piscator* (Family Calubridae) ; location-intestine ; locality-Konarak, 14.12.1973.

Remarks : The species of the genus *Acanthostomum* Looss, 1899 are the intestinal parasites of fishes and reptiles. Karyakarte's (1968) species, *Acanthostomum (Gymmatrema) pambanense*, from the intestine of a marine fish, *Therapon puta*, has been accommodated in a new genus *Karyakartia* [type species *Karyakartia pambanense* (Karyakarte, 1968)] by Hafeezullah (1979) in the family Enenteridae Skrjabin and Koval, 1966. There is no other report of any species in *Acanthostomum* from fish in India. Out of the ones from reptiles, *Acanthostomum indicum* Sinha, 1942, has been reported from a crocodile, while the remaining Indian species, viz. *Acanthostomum bnrminis* (Bhelerao, 1926), *Acanthostomum hindustanensis* (Baugh, 1957), *Acanthostomum simhai* Khalil, 1963 [for *Acanthostomum indicum* (Simha, 1958) nec *Acanthostomum indicum* Sinha, 1942], *Acanthostomum asymmetricum* (Simha, 1958), *Acanthostomum proctophorum* (Dwivedi, 1966), and *Acanthostomum (Atrophocaecum) alii* Karyakarte, 1967 have been reported from snakes.

There are two distinct groups of the species of *Acanthostomum* Looss, 1899. In one group the two caeca are symmetrical, equal (right caecum neither reduced nor completely atrophied) and usually communicating to the exterior near the posterior end of the body, while in the other the two caeca are asymmetrical, the right one being reduced (unequal) or completely atrophied (single) and the left caecum usually opening to the exterior. To accommodate these conditions of caeca, six genera were proposed from time to time, namely, *Acanthostomum* Looss, 1899, *Acanthochasmus* Looss, 1900, *Atrophocaecum* Bhalariao, 1940, *Gymnatrema* Morozov, 1955, *Proctocaecum* Baugh, 1957 and *Haplocaecum* Simha, 1958. Of these, only *Acanthostomum* Looss, 1899 is now considered as valid. The synonymy of *Proctocaecum* Baugh, 1957 to *Acanthostomum* was pointed out by Fischthal and Kuntz (1965). Yamaguti (1958) did not accept the validity of *Atrophocaecum* Bhalariao, 1940 and transferred *Atrophocaecum*

burminis (Bhalerao, 1926) back to the genus *Acanthostomum*. Similarly, Yamaputi (1971) did not accept the validity of *Gymnatrema* Morozov, 1955 and transferred *Gymnatrema gymnarchi* (Dollfus, 1950) back to the

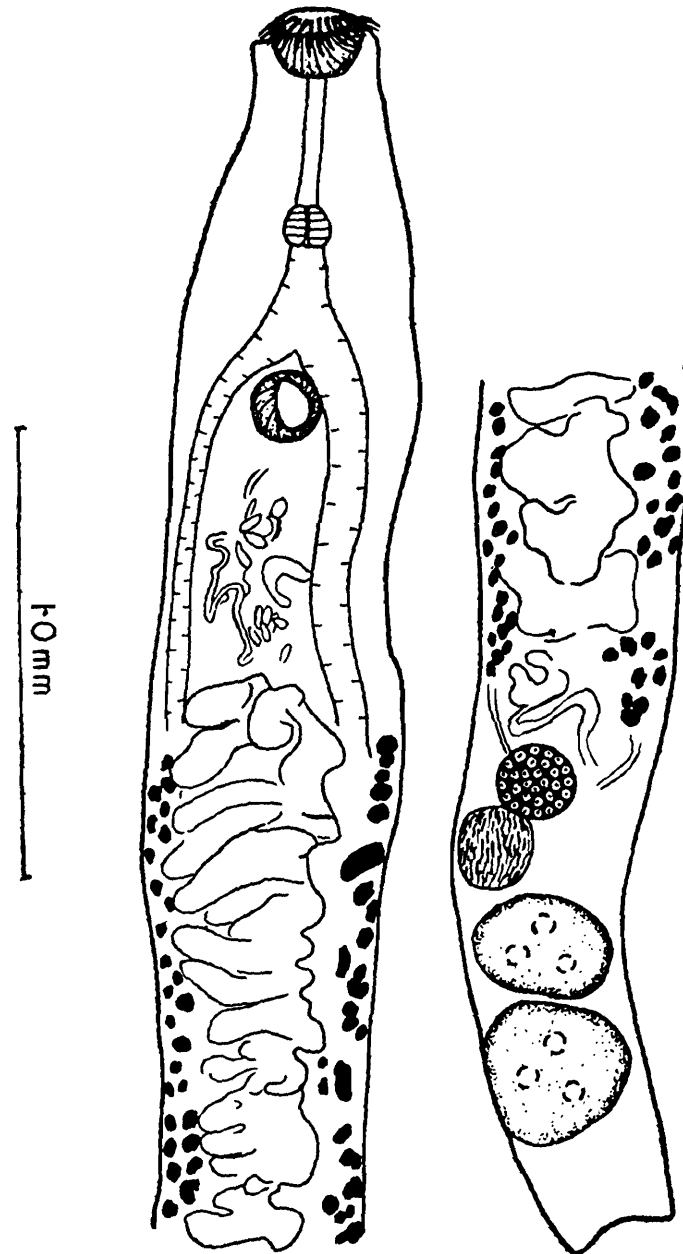


Fig. 5

Fig. 5. *Acanthostomum (Atrophecaecum) burminis* Bhalerao ;
entire worm in two fragments.

genus *Acanthostomum*. Khalil (1963) considered *Acanthostomum*, *Atrophecaecum*, *Gymnatrema* and *Haplocaecum* as subgenera of *Acanthostomum* Looss, 1899 and Karyakarte (1967) concurred. Yamaguti (1971)

gave a different treatment to these closely allied genera. He considered *Acanthostomum* Looss, 1899 as the only valid genus and divided all the species of the four genera into two subgenera under it, viz., (i) subgenus *Acanthostomum* (*Acanthostomum*), with species having normal two caeca, the type species being *spiniceps* (Looss, 1896) and (ii) subgenus *Acanthostomum* (*Atrophocaecum*) having species with reduced or completely atrophied right cecum, type species being *burminis* (Bhalerao, 1926), [*Haplocaecum* Simha, 1958 being the synonym of the subgenus *Atrophocaecum* Bhalerao, 1940]. This arrangement of the various species of the six allied genera into two subgenera of *Acanthostomum* appears to be more convenient and convincing.

Agrawal, V. (1966) redescribed *Acanthostomum* (*Atrophocaecum*) *burminis* (Bhalerao, 1926) and observed that *Acanthostomum* (*Atrophocaecum*) *simhai* Khalil, 1963 [for *Acanthostomum indicum* (Simha, 1958) nec *Acanthostomum indicum* Sinha, 1942] falls within the range of variations shown by *A. (A.) burminis*. Thus, these two species are synonyms of *Acanthostomum burminis*. Dwivedi (1966 b) described *Haplocaecum proctophorum*. Yamaguti (1971) transferred it to the subgenus *Acanthostomum* (*Atrophocaecum*). Srivastava (1982) synonymised *Acanthostomum* (*Atrophocaecum*) *alii* Karyakarte, 1967 with *A. (A.) burminis* but the former seems to be distinguishable from the latter in the longer excretory vesicle, the smaller eggs, absence of the oesophagus and more elongated pharynx.

Family V. OMMATOBREPHIDAE Poche, 1926

Subfamily OMMATOBREPHINAE Dubois and Mahon, 1959

Genus 5. *Ommatobrephus* Nicoll, 1914

6. *Ommatobrephus lobatum* Mehra

(Figs. 6, 7)

- 1928. *Ommatobrephus lobatum* Mehra, *Proc. Indian Sci. Congr.*, Abstr. No. 15 : p. 199.
- 1929. *Ommatobrephus folium* Thapar and Farzand Ali, *J. Helminth.*, 77 : 248.
- 1931. *Ommatobrephus lobatum* : Mehra, *Allahabad. Univ. stud.*, 7 : 31.
- 1931. *Ommatobrephus lobatum najii* Mehra, *Allahabad. Univ. stud.*, 7 : 38.
- 1954. *Ommatobrephus nicolli* Gupta, N.K. *Res. Bull. Punjab Univ.*, 54 : 121.
- 1965. *Ommatobrephus prosechorchis* Deblock, Capron and Brygoo, *Bull. Mus. natn. Hist. nat., Paris*, 37(3) : 513.
- 1966. *Ommatobrephus lobatum madagascariense* Richard, *Bull. Mus. natn. Hist. nat., Paris*, 38(5) : 693.
- 1972. *Ommatobrephus piscator* Dandotia, *Proc. natn. Acad. Sci. India*, B. 42 : 100.

Material examined : 5 exs. on 4 slides, 1 mature and 4 immature ; host—*Natrix piscator* (family Calubridae) ; location-intestine ; locali-

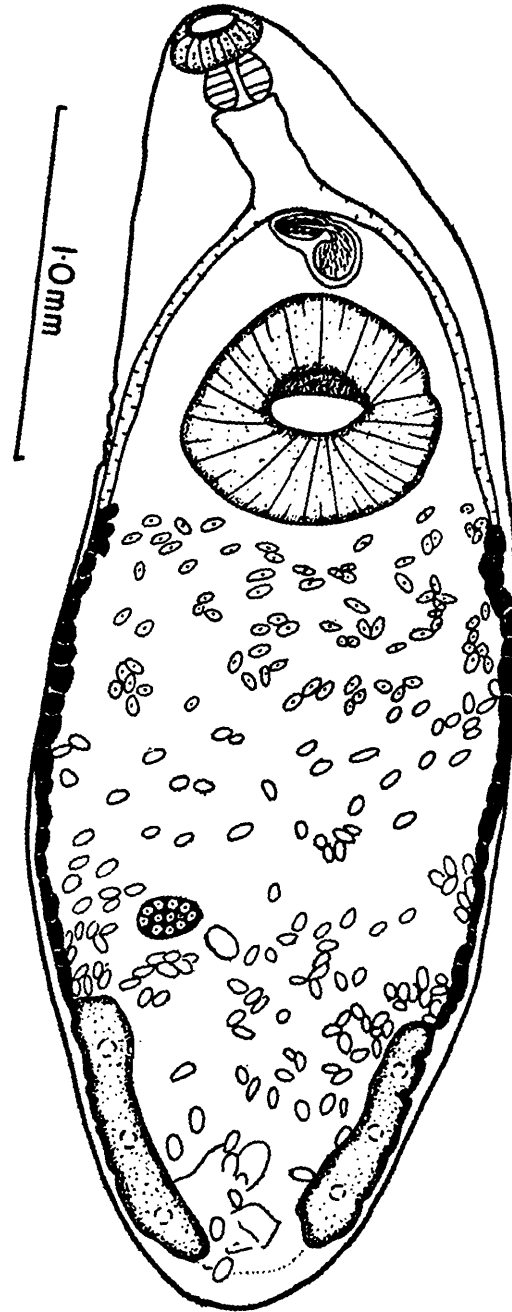


Fig. 6

Fig. 6. *Ommatobrephus lobatum* Mehra ; entire adult worm.

ties-Puri (1 ex.) and Konarak (4 exs.), 5.6.1972 and 14.12.1973. respectively.

Remarks : Mehra (1928) presented the description of *Ommatobrephus lobatum* from the snake, *Zamenis mucosus* from Allahabad in

the Proceedings of the Indian Science Congress. Thapar and Ali (1929) described *O. folium* from *Tropidonotus piscotor* from Lucknow. Mehra (1931) synonymised it with his species *O. lobatum*, besides des-

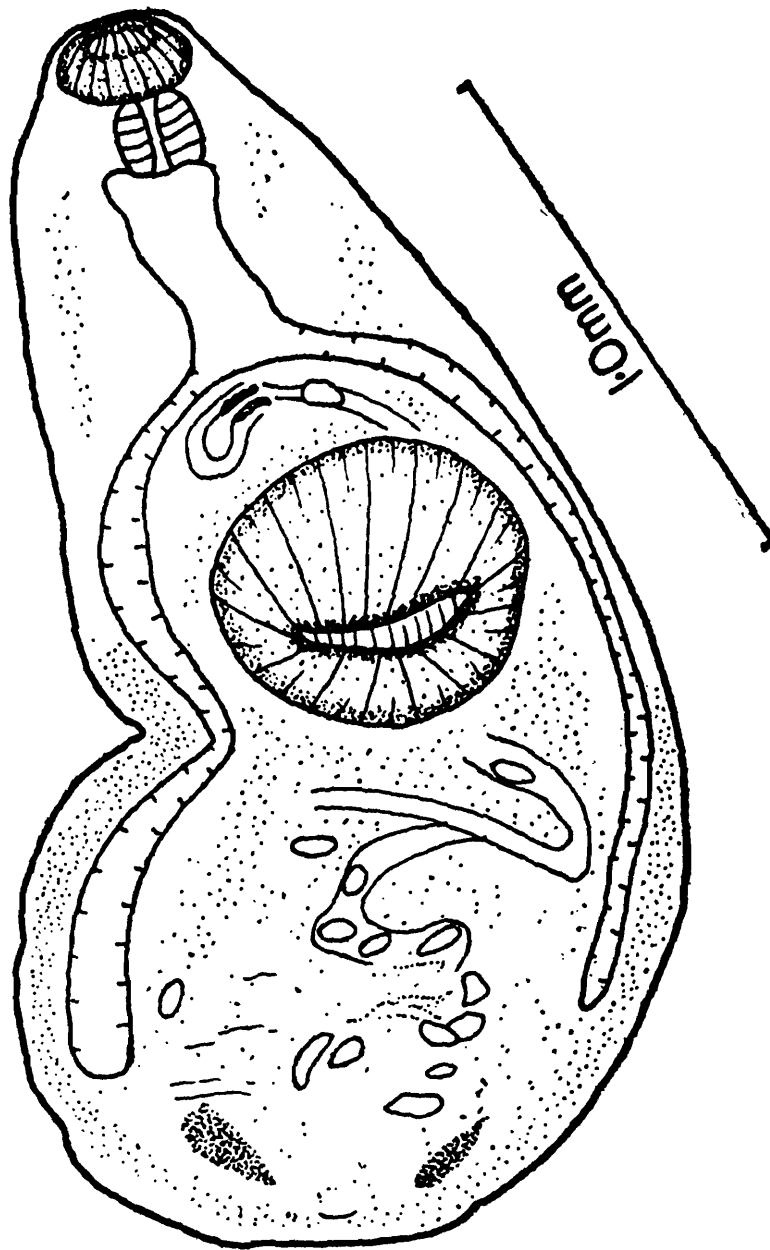


Fig 7

Fig. 7. *Ommatobrephus lobatum* Mehra ; entire immature worm

cribing *O. lobatum najii* from the snake *Naja naja* at Allahabad. Agarwal, V. (1966) considered it a synonym of *O. lobatum* Mehra, 1928. Gupta,

N. K. (1954) reported *O. nicolli* from *Tropidonotus pictator* from Ludhiana. Simha (1958) synonymised it with *O. lobatum*, besides describing *O. megacetabulus* from *Tropidonotus piscator* at Hyderabad. Dwivedi (1967) described *O. chauhani* from the same host at Jabalpur. Mukherjee and Ghosh (1968) gave a key to the valid species of *Ommatobrephus*, besides describing a new species, *Ommatobrephus bengalensis*, with unlobed testes from the snake, *Natrix stolata* (Linn.), from Bhasna (West Bengal) and synonymised *O. chauhani* Dwivedi, 1967 with *O. lobatum* Mehra, 1928. They recognise only four valid species in *Ommatobrephus*, viz. *O. singularis* Nicoll, 1914, *O. lobatum* Mehra, 1928, *O. megacetabulus* Simha, 1958 and *O. bengalensis* Mukherjee and Ghosh, 1968. Pandey (1969) considered *O. bengalensis* as a synonym of *O. lobatum*, but Mukherjee, Ghosh and Deblock (1971) contested this synonymity and argued to revalidate *O. bengalensis*. They further preferred to retain the key to the species of *Ommatobrephus* as given by Mukherjee and Ghosh (1968) recognising only four valid species in the genus as mentioned above, and giving the list of synonymies of *O. lobatum* Mehra, including *O. prosechorchis* Deblock, Capron and Brygoo, 1965 from *Zonosaurus* sp. However, they did not give opinion about the validity of *O. pulmonicola* Richard, 1966 and *O. minutum* Dwivedi. Dwivedi and Chauhan (1970) do not accept the synonymity of *O. chauhani* Dwivedi, 1967 to *O. lobatum* as considered By Mukerjee and Ghosh (1968). They tend to retain it against *O. lobatum* on the basis of vitelline follicles arranged in 4-5 bunches, each bunch being made up of 4-6 follicles and a number of other counts. Dandotia (1972) reported still another species, *O. piscator*, from the usual snake host, *Tropidonotus piscator*, from Gwalior. Pandey (1975) and Srivastava (1982) considered *O. piscator*, *O. minutum* and *O. chauhani* as synonyms of *O. lobatum*. As a matter of fact, Pandey (1975) considered all the Indian species of *Ommatobrephus* and all the species of *Singhiatrema* Simha, 1954 as synonyms of *O. singularis*, the type species of the genus *Ommatobrephus* Nicoll, 1914, expressly synonymising *Singhiatrema* with *Ommatobrephus*. This extreme view is not contributed by Srivastava (1982) and the present author shares his opinion. Further, he broadly concurs with Mukherjee and Ghosh (1968), Mukherjee, Ghosh and Deblock (1971) and Srivastava (1982) except for the synonymity of *O. chauhani* Dwivedi, 1967 and *O. minutum* Dwivedi and Chauhan, 1970 with *O. lobatum* Mehra, 1928.

Family VI. CYATHOCOTYLIDAE Poche, 1926

Subfamily SZIDATIINAE (Dubois, 1938)

Genus 6. *Gogatea* Lutz, 19357. *Gogatea serpentum* (Gogate) Lutz.

(Fig. 8)

1932. *Prohemistomum serpentum* Gogate, *Parasitology*, 24(3) : 318.
 1935. *Gogatea serpentum* : Lutz, *Mem. Inst. Oswaldo Cruz*, 30(2) : 166.
 1947. *Gogatea serpentum* var. *indicum* Mehra, *Proc. natn. Acad. Sc. India*, 17 : 8.
 1958. *Gogatea serpentum* var. *indicum* : Simha, *Z. Parasitenkd.*, 18 : 199.
 1958. *Gogatea incognitum* Baugh, *Proc. natn. Acad. Sc. India*, 28 : 218.
 1966. *Gogatea serpentum* : Agrawal, V., *Indian J. Helminth.*, 18(1) : 72.
 1966. *Gogatea incognitum* : Agrawal, V., *India J. Helminth.*, 18(1) : 74.
 1967. *Gogatea serpentum* : Gupta, N.K., *Res. Bull. Punjab Univ.*, 17(3-4) : 319.
 1969. *Gogatea serpentum* var. *indicum* : Dubois, *Ann. Parasitol.*, 44(5) : 551.
 1969. *Gogatea incognitum* : Dubois, *Ann. Parasitol.*, 44(5) : 551.
 1970. *Gogatea mehri* Dwivedi and Chauhan, *J. zool. Soc. India*, 21(1) : 145.
 1970. *Gogatea indicum* Chattopadhyaya, *Helminthologia*, 11(1-4) : 63.

Material examined : 15 exs. on 3 slides ; host—*Natrix piscator* (fam. Calubridae) ; location-intestine ; locality-Konarak, 14.12.73.

Remarks : The details of these specimens broadly conform to the descriptions of *Prohemistomum serpentum* as given by Gogate (1932), *Gogatea scrpentum* (Gogate, 1932) Lutz, 1935 as given by Gupta, N. K. (1967) and Gupta, V. (1966) and *Gogatea serpentum* var. *indicum* as given by Mehra (1947). Baugh (1958) added another species, *Gegatea incognitum* from an unidentified snake. Agrawal, V. (1966 a) considered it as a synonym of *G. serpentum*.

Simha (1958), Dwivedi and Chauhan (1970) and Chattopadhyaya (1970) considered *Gogatea serpentum* var. *indicum* Mehra, 1947 distinguishable from *Gogatea serpentum* (Gogate, 1932) Lutz, 1935. The latter two authors independently raised it to full-fledged species status and gave it new names, *Gogatea mehri* and *Gogatea indicum* respectively. Almost simultaneously, Dubois (1969) considered both, *Gogatea serpentum* var. *indicum* Mehra, 1947 and *Gogatea incongnitum* Baugh, 1958 as synonyms of *Gogatea serpentum*. In the opinion of the author, the conclusion of Dubois (1969) is more acceptable. Thus, *Gogatea serpen-*

tum var. *indicum* Mehra, 1947, *G. incongitum* Baugh, 1958, *G. mehri*

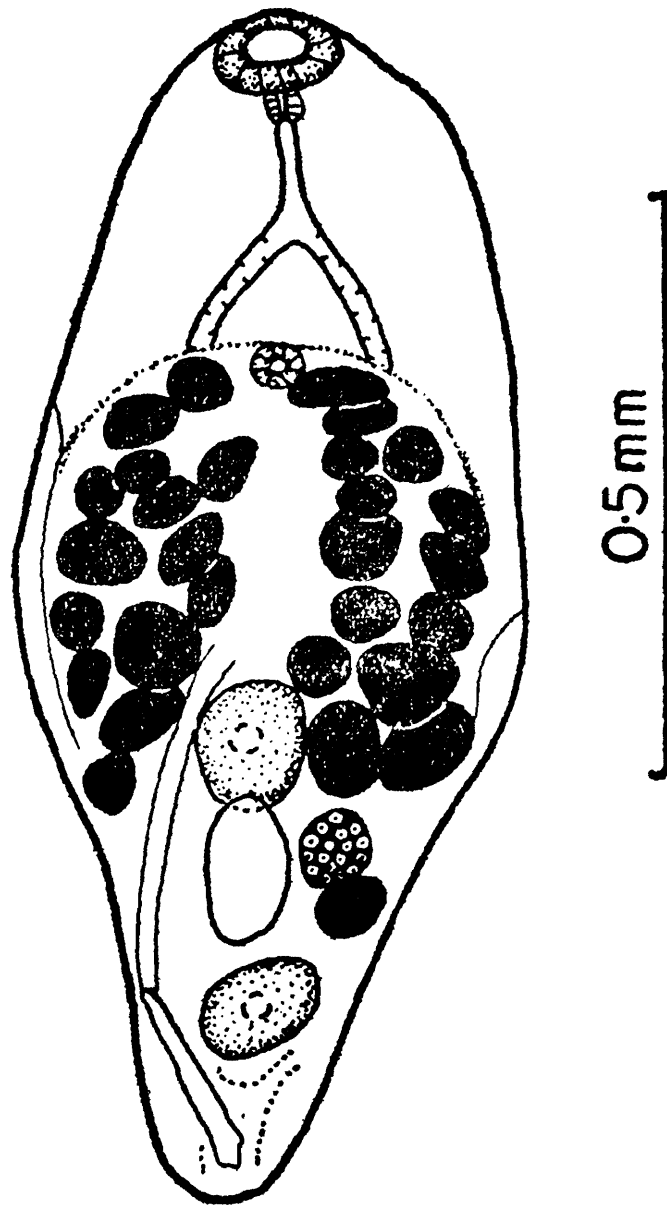


Fig. 8

Fig. 8. *Gogatea serpentum* (Gogate) ; entire worm.

Dwivedi and Chauhan, 1970 and *G. indicum* Chattopadhyaya, 1970, all become synonyms of *Gogatea serpentum* (Gogate, 1932) Lutz, 1935.

Family VII. LECITHODENDRIIDAE Lühe, 1901

Subfamily PROTHODENDRIINAE Yamaguti, 1958

Genus 7. **Prosthodendrium** Dollfus, 1931

8. **Prosthodendrium ovatum** Simha,

(Fig. 9)

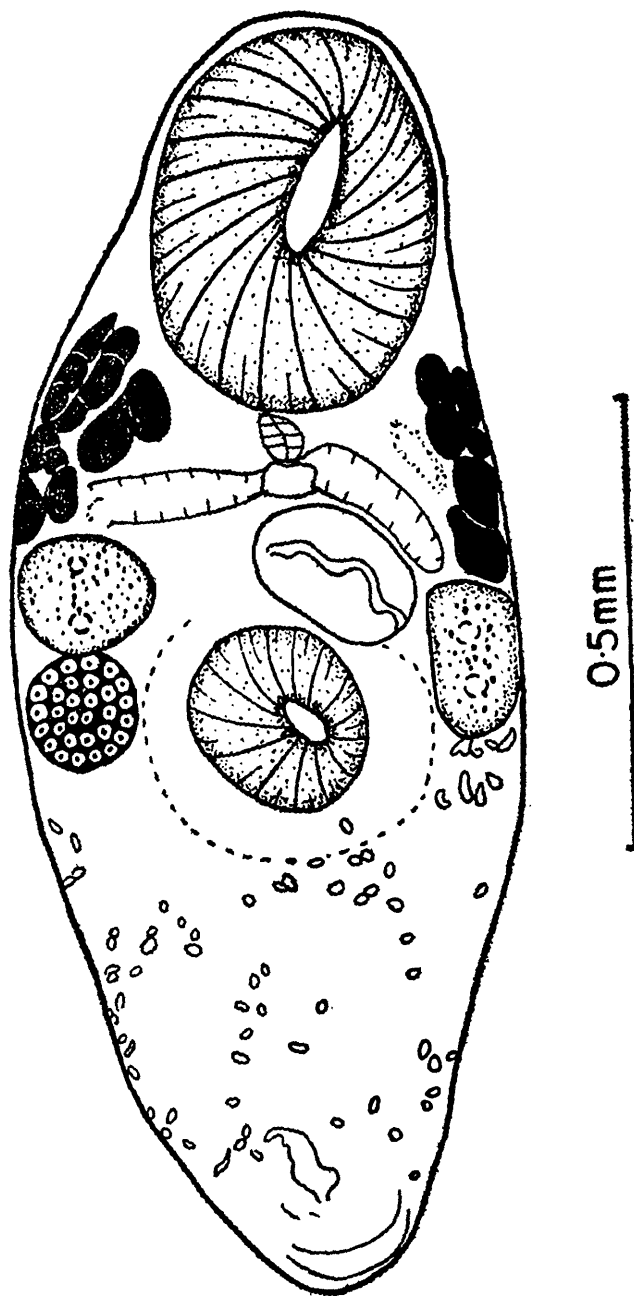


Fig.9

Fig. 9. *Prosthodendrium ovatum* Simha ; entire worm.

1958. *Prosthodendrium ovatum* Simha, *Z. Parasitenkd.*, 18 : 181.
1958. *Prosthodendrium dollfusi* Simha, *Z. Parasitenkd.*, 18 : 183.
1960. *Prosthodendrium* (*Prosthodendrium*) *ovatum* : Dubois, *Rev. Suiss. Zool.*, 67(1) : 41, 44.

Material examined : 4 exs. on one slide ; host-*Calotes versicolor* (Family Agamidae) : location-intestine ; locality-Konarak, 12.12.1973.

Remarks : Simha (1958) described two new species, *Prosthodendrium ovatum*, from the Rock Lizard, *Calotes numericola*, and *Prosthodendrium dollfusi*, from the tree-lizard, *Calotes versicolor*, from Hyderabad. Dubois (1960) considered that *P. dollfusi* is a synonym of *P. ovatum*.

The present four specimens come very close to the description of *P. ovatum* except differences in various body measurements and insignificant variations in relative positions of ovary and cirrus sac with respect to the ventral sucker. The shape of the body is not exactly as shown by Simha (1958). It is a bit elongated rather than oval. One specimen is almost spindle-shaped. In three specimens oesophagus is not seen but in the fourth specimen there seems to be the presence of a very short oesophagus. The vitelline follicles seem to occupy an intermediate position between those described in *P. ovatum* and *P. dollfusi* being distributed at the level of the posterior region of oral sucker as well as behind it. Thus, there seems to be some justification in the action of Dubois (1960) in considering *P. dollfusi* as a synonym of *P. ovatum*.

Subfamily GANEONINAE Yamaguti, 1958

Genus 8. *Ganeo* Klein, 1905

9. *Ganeo tigrinum* Mehra and Negi

1928. *Ganeo tigrinum* Mehra and Negi, *Allahabad Univ. Stud.*, 4 : 66.
1933. *Ganeo gastricus* Srivastava, *Bull. Acad. Sci. U.P. Allahabad*, 3(2) : 103.
1937. *Ganeo kumaoensis* Pandey, *Proc. Indian Acad. Sci.*, 6(2) : 116.
1938. *Ganeo lingnanensis* Li, *Ling. Sci. J.*, 17(2) : 221.
1954. *Ganeo panjabensis* Gupta, N.K., *Res. Bull. Panjab. Univ.*, No. 55 : 125.
1978. *Ganeo lucknowensis* Gupta, V. and Jahan, *Indian J. Helminth* ; 28(2) : 142.

Material examined : 20 exs. on 10 slides ; host—*Rana cyanophlyctis* (Family Ranidae) ; location-intestine ; localities-Puri (5.6.1972), Gopalpur (25.5.1972), Konarak (13.12.1973 and 17.12.1973) and Chandbali (26.12.1973).

Remarks : These specimens are referred to *Geneo tigrinum* Mehra and Negi, 1928. Mukherjee (1977) opines that *Ganeo gastricus* Srivastava, 1933 and *Ganeo panjabensis* Gupta, N. K., 1954 were differentiated from *G. tigrinum* on the basis of variable characters. Fotedar (1956) showed that *G. kumaoensis* Pande, 1937 and *G. lingnanensis* Li, 1938 are synonyms of *G. tigrinum* as they have been distinguished from the latter on variable characters. The study of Mukherjee (1977) on the variations in *G. tigrinum* confirms this. On the basis of the studies of Ghosh and Srivastava (1979) on abnormal development of male genitalia in digentic trematodes, Hafeezullah and Dutta (1985) considered *G. lucknowensis* Gupta, V. and Jahan, 1978 as a synonym of *G. tigrinum*.

Subfamily PROSOTOCINAE Yamaguti, 1958

Genus 9. **Mehraorchis** Srivastava, 1934

10. **Mehraorchis ranarum** Srivastava

- 1934. *Mehraorchis ranarum* Srivastava, *Bull. Acad. Sci. U.P. Allahad*, 3(4) : 239.
- 1936. *Mehraorchis ranarum* : Bhalerao, *J. Helminth.*, 14(4) : 211.
- 1954. *Mehraorchis tigrinarum* Gupta, N.K., *Res. Bull. Panjab. Univ. Zool.*, 53 : 117.
- 1958. *Mehraorchis chamaeleonis* Simha, *Z. Parasitenkd.*, 18 : 178.
- 1966. *Mehraorchis chamaeleonis* : Dwivedi, *Indian J. Helminth.*, 18(1) : 1, 29.
- 1966. *Mehraorchis tigrinarum* : Agrawal, V., *Indian J. Helminth.*, 18(1) : 86.
- 1966. *Mehraorchis tigrinarum* : Gupta, S.P. and Agrawal, V., *Proc. natn. Acad. Sci.*, 36(4) : 530-536.
- 1970. *Mehraorchis tigrinarum* : Mukherjee and Ghosh, *Indian J. Helminth.*, 22(1) : 72, 74.
- 1970. *Mehraorchis chamaeleonis* : Mukherjee and Ghosh, *Indian J. Helminth.*, 22(1) : 72, 74.

Material examined : 1 ex. on slide ; host—*Rana cyanophlyctis* (Family Ranidae) : location-Intestine ; locality-Konarak, 17.12.1973.

Remarks : The present single specimen is identified as *Mehraorchis ranarum* Srivastava, 1934. It (including its synonyms) has been reported from *Rana cyanophlyctis*, *Rana tigrina*, *Bufo* sp. and *Chamaeleon zeylanicus*. Dwivedi (1966 a) considered *Mehraorchis tigrinarum* Gupta, N. K., 1954 as valid and Agrawal, V. (1966 b) redescribed it but Gupta, S. P. and Agarwal, V. (1966) considered it as a synonym of *M. ranarum* Srivastava, 1934, and Mukherjee and (1970) concurred. Dwivedi (1966 a) synonymised *M. chamaeleonis* Simha, 1958 with *M. ranarum*, and Mukherjee and Ghosh (1970) accepted this view,

Bharadwaj (1963) described *Mehraorchis jainiformis* on the basis of a single testis and other supporting characters. Mukherjee and Ghosh (1970) consider its validity as doubtful and opine that it has been erected on the basis of abnormal (single testis) and variable characters, but they did not synonymise it. Thus, *Mehraorchis* Srivastava, 1934 seems to be a monotypic genus so far. Simha and Rao (1972), however, consider *M. chamaeleonis* as a valid species after observing a number of histological sections and whole mounts of *M. ranarum* and *M. chamaeleonis*.

SUMMARY

A part of the digenetic trematode material, belonging to 9 families, 13 genera and 15 species including one new genus and 3 new species, collected from the Orissa coastal area has already been reported in various papers. Of these, some have already been published during 1975-85 and others are still in press. A list of such material is appended in the beginning of the present paper which deals with the remaining part of the material comprising another 9 families, 9 genera and 10 known species.

ACKNOWLEDGEMENTS

The author is thankful to the Director, Zoological Survey of India, Calcutta, for facilities.

REFERENCES

- AGRAWAL, V. 1964. On some new trematodes from fresh water fishes of Lucknow. *Indian J. Helminth.*, **16** (2) : 82-99.
- AGRAWAL, V. 1966a. Studies on some reptilian trematodes from Lucknow. *Indian J. Helminth.*, **18** (1) : 62-76.
- AGRAWAL, V. 1966b. Studies on some trematode parasites of frogs from Lucknow. *Indian J. Helminth.*, **18** (1) : 82-90.
- ARORA, S. AND AGARWAL, S. M. 1960. Studies on some intraspecific variations in *Paradistomum orientalis* Narain and Das collected from the gall bladder of *Calotes versicolor* Daud. Part I. (Dicrocoelidae : Trematoda). *Bull. zool. Soc. College Sci.*, Nagpur, **3** : 43-52.

- ARORA, S., AGARWAL, M. M. AND AGARWAL, S. M. 1962. Studies on some intra-specific variations in *Paradistomum orientatts* Narain and Das collected from the liver and intestine of *Calotes versicolor* Daud. Part II. (Dicrocaelidae : Trematoda). *Indian J. Helminth.*, **14** (1) : 5-15,
- BAUGH, S. C. 1957. Contributions to our knowledge of digenetic trematodes. II. *Proc. natn. Acad. Sc. India*, B, (1956), **26** (5) : 295-313.
- BAUGH, S. C. 1958. Contributions to our knowledge of digenetic trematodes. III. *Proc. natn. Acad. Sc. India*, **28** : 206-226.
- BEVERLY-BURTON, M. 1962. Some trematodes from *Clarias* spp. in the Rhodesia, including *Allocreadium mazoensis* n. sp. and *Eumaseia bangwevlensis* n. sp. and comments on the species of the genus *Orientocreadium* Tubangui, 1931. *Proc. helminth. Soc. Wash.*, **29** (2) : 103-115.
- BHALERAO, G. D. 1926. On the trematode parasites of water-snake, *Tropidonotus piscator*. *Parasitology*, **18** (1) : 4-13.
- BHALERAO, G. D. 1936. Studies on the helminths of India. Part I. Trematoda. *J. Helminth.*, **14** : 161-180.
- BHALERAO, G. D. 1940. Observation on the anatomy of *Acanthostomum burminis* (Bhalerao, 1926). *Indian J. vet. Sci.*, **10** (1) : 94-97.
- BHARDWAJ, O. N. 1963. Morphology and taxonomy of three new species belonging to the subfamily Prosotocinae Yamaguti, 1958 (Family : Lecithodendriidae : Trematoda). *Proc. natn. Acad. Sc. India*, **33** (3) : 345-354.
- CHATTERJI, R. C. 1940. Helminth parasites of the snakes of Burma, I. Trematoda. *Philippine J. Sci.*, **17** : 381-401.
- CHATTOPADHYA, D. R. 1970. Studiea on the trematode parasites of reptiles found in India. *Helminthologia*, **11** (1-4) : 63-75.
- DANDOTIA, M. R. 1972. On a new species of the genus *Ommatobrephus* Nicoll, 1914 from Gwalior. *Proc. natn. Acad. Sc. India.*, B, **42** : 100-103.
- DUBOIS, G. 1960. Contrihution a letude des trematodes de chiropteris. Revision des sous-genre *Prosthodendrium* Dollfus, 1931, *Lecithodendrium* Looss, 1896 et *Pycnporus* Looss, 1899. *Rev, Suiss, Zool.*, **67** (1) : 1-80.

- DUBOIS, G. 1969. Sur trois cyathocotylides (Trematoda : Strigeata). *Ann. Parasitol.*, **44** (5) : 547-554.
- DWIVEDI, M. P. 1966a. Studies on the intra-specific variations in *Mehraorchis ranarum* Srivastava, 1934. *Indian J. Helminth.*, **18** (1) : 25-31.
- DWIVEDI, M. P. 1966b. On a new species of *Haplocaecum* Simha, 1958 from a water snake, *Tropidonotus piscator*. *Rev. Biol. Trop., Univ. Costa Rica.*, **13** (1) : 87-91.
- DWIVEDI, M. P. AND CHAUHAN, B. S. 1973. On some digenetic trematodes, Part I. *J. zool. Soc. India*, (1969), **2** (1) : 141-148.
- FISCHTHAL, J. H. AND KUNTZ, R. E. 1963. Trematode parasites of fishes from Egypt. Part VII. *Orientocreadium batrachoides* Tubangu, 1931 (Plagiorchioidea) from *Clarias lazera*, with a review of the genus and related forms. *J. Parasit.*, **49** (3) : 451-464.
- FISCHTHAL, J. H. AND KUNTZ, R. E. 1965. Digenetic trematodes of amphibians and reptiles from North Borneo (Malayasia) *Proc. helminth. Soc. Wash.*, **32** (2) : 124-136.
- FOTEDAR, D. N. 1959. On a new species of the genus *Ganeo* Klein, 1905 and some note on the genus. *J. Helminth.*, **33** (2) : 153-160.
- FREITAS, J. F. T. 1967. Notas sobre trematodeos mesocoeliideos. *Bolm. Mus, Biol. Prof. Mello-Leitao, Zool.* No. 30 : 11 PP.
- GEOSH, R. K. AND SRIVASTAVA, C. B. 1979. On abnormal development of male genitalia in digenetic trematodes. *Bull. zool. Surv. India*, **2** (1) : 115-118.
- GOGATE, B. S. 1932. On a new species of trematode (*Prohemistomum serpentum* n. sp.) from a snake, with a note on an immature species of *Heterechinostomum* Odhner from the cat. *Parasitology*, **24** (3) : 318-390.
- GUPTA, S. P. 1961. A reference list of trematode parasites of fresh water fishes of India, with a discussion on their systematic position. *Indian J. Helminth*, **13** (1) : 35-60.
- GUPTA, S. P. and AGRAWAL, V. 1966. Two trematode parasites from *Rana cyanophylctis* from Udaipur (Rajasthan) *Proc. natn. Acad. Sci.*, **36** (4) : 530-536.

- HAFEEZULLAH, M. 1975. Two new trematodes (Digenea : Hemiuridae) of marine fishes from east coast of India. *Dr. B. S. Chauhan Comm. Vol.*, pp. 203-210.
- HAFEEZULLAH, M. 1978. Acanthocolpid trematodes of marine fishes of India, with considerations on synonymies in the group. *Bull. zool. Surv. India*, 1 (1) : 29-36.
- HAFEEZULLAH, M. 1979. A new digenean genus from a marine fish from east coast of India. *Riv. Parassit.*, XI (3) : 327-332.
- HAFEEZULLAH, M. 1980a. On the status of some genera of the subfamilies Stomachicolinae Yamaguti, 1988, Dinurinae Loose, 1907 and Prolecithinae Yamaguti, 1971 (Digenea : Hemiuridae). *Bull. zool. Surv. India*, 3 (1 & 2) : 69-76.
- HAFEEZULLAH, M. 1980b. A new cryptogonimid trematode (Digenea : Cryptogonimidae) of marine fish from Orissa coast, with a brief review of the genus *Paracryptogonimus* Yamaguti, 1934. *J. mar. biol. Ass. India*, (1975), 17 (2) : 49-55.
- HAFEEZULLAH, M. 1984. On the status of some digenetic trematodes of marine fishes of India. *Bull. zool. Surv. India*, 6 (1-3) : 209-218.
- HAFEEZULLAH, M. AND DUTTA, I. B., 1981. On the monotypy of the genera *Anchitrema* Looss, 1899 and *Tremiorchis* Mehra and Negi, 1926 with a note on *Pleurogenes*—*Indopleurogenes*—*Alloindopleurogenes* complex. *Bull. zool. Surv. India*, 4 (2) : 165-171.
- HAFEEZULLAH, M AND DUTTA, I. B. 1984. Studies on some trematodes (Digenea : Lecithodendriidae) of Pisces and Amphibia from east coast of India. *Bull. zool. Surv. India*, 7 (1) : 69-82.
- KARYAKARTE, P. P. 1967. *Acanthostomum* (*Atrophocaecum*) *alii*. sp. n. (*Acanthostomidae*) from the snake *Elaphe helena* in India, *J. Parasit.*, 53 (3) : 287-588.
- KARYAKARTE, P. P. 1968. *Acanthostomum* (*Gymnatrema*) *pambanense* sp. n. (Trematoda : Acanthostomidae) from the fish *Therapon puta* (Cuv. and Vov.) in India, *Riv. Parassit.*, 29 (3) : 185-189.
- KHALIL, L. F. 1961. On a new trematode, *Orientocreaduim lazeri* sp. nov., from a freshwater fish, *Clarias lazera*, in the Sudan. *J. Helminth.*, 35 (3/4) : 259-262.

- KHALIL, L. F. 1963. On *Acanthostomum gymnarchi* (Dollfus, 1950) with notes on genera *Acanthostomum* Looss, 1899, *Atrophocaecum* Bhalerao, *Gymnatrema* Morosov, 1955 and *Haplocaecum* Simha, 1958. *J. Helminth.*, 37 : 107-214.
- KRISHNASWAY, S. K. AND ANANTARAMAN, M. 1956. Parasites of reptiles. I. *Paradistomum* in Indian lacertilians. *Ann. Mag. nat. Hist.*, 9 : 181-887.
- MEHRA, H. R. 1928. On the bionomics and structure of a trematode *Ommatobrephus lobatum* n. sp. from *Zamenis mucosus*. *Proc. Indian Sci. Congr.*, 15 : p. 199.
- MEHRA, H. R. 1931. Two distome trematodes from Indian reptiles. *Allahabad Univ. Stud.*, 7 : 31-32.
- MEHRA, H. R. 1957. Studies on the family Cyathocotylidae Poche. Part I. A contribution to our knowledge of the subfamily Prohemistominae Lutz, 1935, with a discussion on the classification of the family. *Proc. natn. Acad. Sci. India*, 17 : 1-52.
- MUKHERJEE, R. P. 1977. The variability of certain structures in *Ganeo trigrinum* Mehra and Negi, 1928 and their taxonomic importance. *Excerta Parasitologica en doctor Eduardo Caballero Y Coballero*. Institute de Biologia Publicaciones Expeciales, No. 4 : 255-260.
- MUKHERJEE, R. P. AND GHOSH, R. K. 1968. On a new trematode parasite from a common snake, *Natrix stolato* (Linn.). *Proc. Indian Acad. Sci., Sect. B.* 67 (3) : 114-118.
- MUKHERJEE, R. K. and Ghosh, R. K. 1970. Studies on some amphibian taematodes from Uttar Pradesh and West Bengal (Part-1). *Indian J. Helminth.*, 22 (1) : 61-28.
- MUKHERJEE, R. P., GHOSH, R. K, AND DEBLOCK, S. 1971. Revision of the genus *Ommatoprephus* Nicoll, 1971. *Proc. Indian Acad. Sci., Sec. B.* 63 (6) : 303-310,
- Nama, H. S. AND KHICHI, P. S. 1973. New records of the genus *Paradistomoides* (Trematoda : Dicrocoeliidae) from India. *Z. Angew. Zool.*, 60 : 257-268.
- PANDEY, K. C. 1969. A redescription of *Ommatobrephus lobatus* Mehra, 1928, with a note on validity of some species. *Proc. Indian Acad. Sci.* 70 : 198-126.

- Pandey, K. C. 1972. Studies on trematode parasite of fishes of Lucknow (India). *Indian J. Zoot.*, **11** (3), 1970 ; 145-148.
- Pandey, K. C. 1975. Further observations on genus *Ommatobrephus* Nicoll, 1914 (= *Singhiatrema* Simha, 1954). *Indian J. Zoot.*, **14** (3), 1973 : 191-196.
- Simha, S. S. 1958. Studies on the trematoda parasites of reptiles found in Hyderabad State. *Z. Parasitenkd.* **18** : 161-218.
- SIMHA, S. S. AND RAO, L. N. 1972. Observations on *Mehraorchis ranarum* Srivastava, 1934. *Zool. Anz.*, Leipzig, **189** (1-2) : 61-64.
- SRIVASTAVA, C. B. 1982. *Fauna of India and the Adjacent Countries. Platyhelminthes. Vol. I. (Supplement). Trematoda-Digeneo.* Published by the Director, Zoological Survey of India, Calcutta, pp-1-ix+1-163.
- THAPAR, G. S. AND Ali. F. 1929. On the trematodes of the digestive tract of *Tropidonotus piscator* from Lucknow. *J. Helminth.*, **77** : 247-252.
- YAMAGUTI. S. 1958. *Systema Helminthum. Vol. I. Parts 1 and 2. The digenetic trematodes of Vertebrates.* Interscience Publishers. Pp. 1-979.
- YAMAGUTI, S. 1971. *Synopsis of digenetic trematodes of vertebrates, Vols. 1 & II.* Keigaku Publishing Co., Tokyo, Japan, Pp. 1-1074.

MOLLUSCA (TERRESTRIAL)

N. V. SUBBA RAO, D. K. THAKUR and S. C. MITRA

*Zoological Survey of India,
New Alipur, Calcutta-700053*

INTRODUCTION

The state of Orissa, with the eastern ghats range extending over a part of it and having an average annual rainfall of over 120 cms., could afford an ideal habitat for terrestrial molluscs. Also, by virtue of its geographical position (81°27' and 87°29'E. longitude. 17°49' and 22°34'N. latitude) it occupies an intermediate zone between Peninsular India and the northern part of the country. Except for the *Fauna Brit. India*, Mollusca volumes (Blanford & Godwin-Austen, 1908, Gude, 1914 and 1921) and a few stray reports by Annandale & Prashad (1920) and Godwin-Austen (1917), till date there is no consolidated report on the land molluscs of the State.

The present report is based on the named and unnamed material present in the Zoological Survey of India. The records that are mentioned in various publications have also been taken into consideration.

LIST OF LAND MOLLUSCS RECORDED FROM ORISSA

Class GASTROPODA

Order MESOGASTROPODA

Family CYCLOPHORIDAE

1. *Cyclophorus polynema* Pfeiffer
2. †*Pterocyclus comatus* (Mollendorff)
3. **P. rupestris* var. *puriensis* Nevill
4. **Pearsonia beddomei* Blanford
5. †*Theobaldius stenostoma* (Sowerby)

Order SYLOMMATOPHORA

Family PUPILLIDAE

6. **Pupilla seriola* (Benson)

Family ENIDAE

7. *Rachis praetermissus* (Blanford)
8. **R. punctatus* (Anton)

Family GLESSULIDAE

9. **Glessula brevis* Pfeiffer
10. *G. amentum* Reeve
11. **G. ganjamensis* Gude
12. **G. gracilis* Beddome
13. **G. jeyporensis* Beddome
14. **G. scrutillus* Benson
15. **G. subjerdoni* Beddome
16. *G. praelustris* Benson

Family SUBULINIDAE

17. *Lamellaxis gracile* (Hutton)

Family ACHATINIDAE

18. *Achatina fulica fulica* Bowdich

Family STREPTAXIDAE

19. *Gulella (Huttonella) bicolor* Hutton
20. *G. (H.) rambhaensis* Ray
21. *G. (H.) planguncula* (Benson)

Family ARIOPHANTIDAE

22. *Ariophanta interrupta* Benson
23. †*A. kadapaensis* Nevill
24. *A. laidlayana* (Benson)
25. *Euplecta infausta* (Blanford)
26. *E. subdeccussata* (Pfeiffer)
27. **Cryptozona ligulata* (Férussac)
28. *Macrochlamys indica* Godwin-Austen
29. ‡*M. ganjamensis* Godwin-Austen
30. **M. lixa* (Blanford)
31. **M. subjecta* (Benson)

Family PLEURODONTIDAE

32. **Planispira contracta* (Benson)

* Species recorded from literature.

† Species recorded for the first time from Orissa.

‡ Species endemic to the state of Orissa.

Key to families of GASTROPODA

1. Shell operculate, aperture circular ...	CYCLOPHORIDAE
Shell non-operculate, aperture not circular ...	... 2
2. Shell cylindrical to turreted or ovately elongate, aperture ovate ...	... 3
Shell depressedly turbinate or conoid, aperture lunate or widely crescent shaped ...	ARIOPHANTIDAE
3. Shell umbilicate, whorls usually not more than 7 ...	... 7
Shell imperforate or very narrowly perforate, whorls usually more than 7 in adult shell ...	...
4. Shell strongly sculptured, aperture denticulate ...	STREPTAXIDAE
Shell usually smooth (never with strong sculpture), aperture simple without denticulations ...	... 5
5. Shell with straight columellar margin ...	SUBULINIDAE
Shell with strongly curved columellar margin which is truncate below ...	... 6
6. Shell large to very large (seldom less than 50 mm. in length), thick, usually brightly coloured ...	ACHATINIDAE
Shell small to moderately large (seldom reaching 40 mm. in length), thin, usually drab-coloured ...	GLESSULIDAE
7. Shell small, body-whorl scarcely wider than penultimate whorl, aperture denticulate ...	PUPILLIDAE
Shell moderately large, body-whorl distinctly wider than penultimate whorl, aperture simple without denticulations ...	ENTIDAE

SYSTEMATIC ACCOUNT

Class GASTROPODA

Order MESOGASTROPODA

Family I. CYCLOPHORIDAE

Key to genera

1. Shell thicker, larger (usually above 30 mm in diameter), conically globose, spire distinctly raised	<i>Cyclophorus</i>
Shell thinner, smaller (usually less than 30 mm in diameter), depressed, spire low ...	... 2
2. Peristome interrupted to form a wing above, operculum convex outside ...	<i>Pterocyclus</i>
Peristome continuous with no such interruptions, operculum flat or concave outside ...	<i>Theobaldius</i>

Genus 1. **Cyclophorus** Montfort, 1880,

Subgenus **Litostylus** Kobelt and Moellendorff, 1897

1. **Cyclophorus (Litostylus) polynema** Pfeiffer

(Fig. 1)

1854. *Cyclostoma (Cyclophorus) polynema* Pfeiffer, *Proc. zool. Soc., Lond.* 1854 : 126.

1921. *Cyclophorus (Litostylus) polynema* : Gude, *Fauna Brit. India, Mollusca*, III : 53.

Material examined : Puri district : 6 exs., an island, 15 kms. E. of Balugaon, Chilka (coll. K. S. Misra 25.1.54) ; Cuttack district : 2 exs., Cuttack, (coll. ?) ; Ganjam district : 1 ex., Taptapani Camp (coll. D. P. Sanyal).

Measurements : Height of shell Width of shell Height of aperture
25.50-27.35 30.0-34.75 13.25-15.35 mm.

Distribution : INDIA : Orissa (as above), West Bengal, and Andhra Pradesh.

Remarks : Shell depressedly turbate, whorls $4\frac{1}{2}$, brown zig-zag

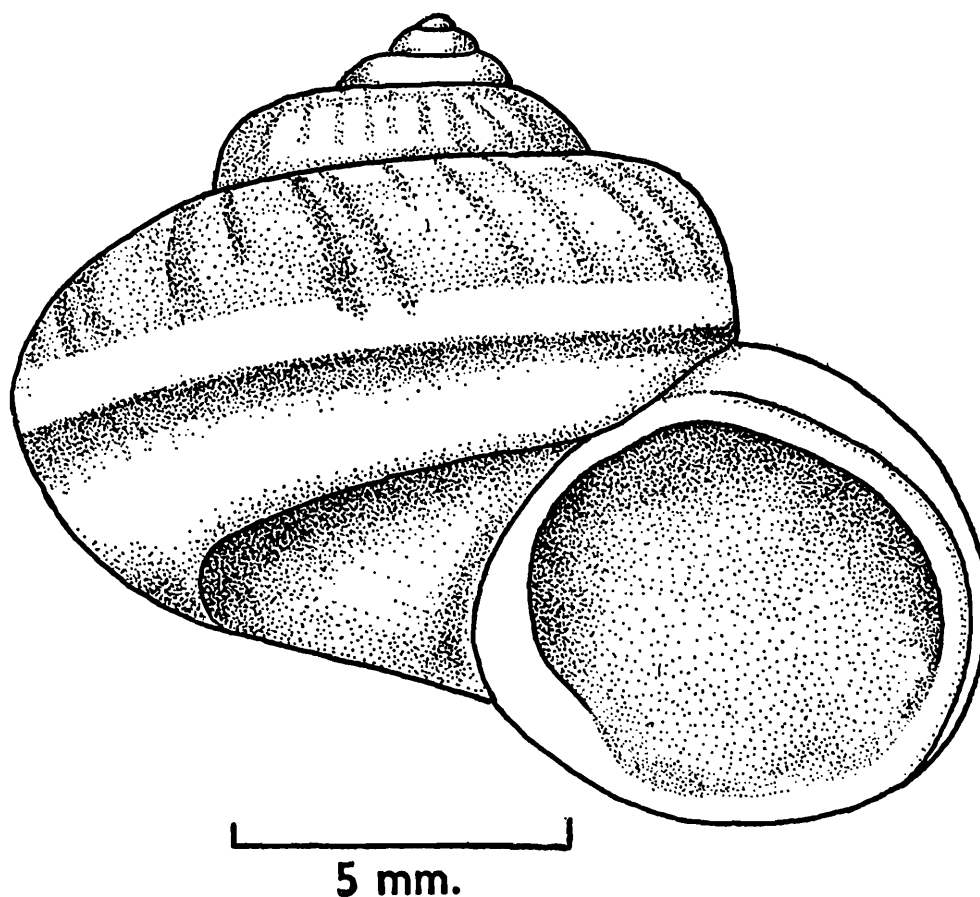


Fig. 1. *Cyclophorus (Litostylus) polynema* Pfeiffer

This species is often confused with *C. aurantiacus*, a species with a wide range of distribution, extending from Malay Peninsula through Burma to Tamil Nadu in India. But shells of the latter species are larger, more depressed with dilated peristome and bright orange lip.

(Fig. 2A)

- Nevill (1881), while describing *Pterocyclus cyclophoroideus*, added the following, "I may mention here that the Colonel has also found in the Anamullayas an allied, rather larger species, very strikingly streaked with 'tiger like' markings, with a somewhat similar operculum, but well characterized by the much more highly developed 'wing' to the peristome, for which he proposes the name *Pt. comatus* Beddome, n. sp." Though

Gude (1921) attributed the species to Mollendorff, since Nevill's (1881) was the first published account of the species, the authorship should go to Nevill.

Genus 3. **Theobaldius** G. Nevill, 1878

3. **Theobaldius stenostoma** (Sowerby)

1843. *Cyclostoma stenostoma* Sowerby, *Thes. Conchyl.*, 1 : 95, pl. 31 fig. 261.

1861. *Cyclophorus stenostoma* : Reeve, *Conch. Icon*, 13, pl. 17, fig. 82.

1921. *Theobaldius stenostoma* : Gude, *Fauna Brit. India*, Mollusca, 111 : 42.

Material examined : Ganjam district : 2 exs., Ganjam.

<i>Measurements</i> :	Height of shell	Width of shell	Height of aperture
	4.9	9.55	3.8 mm

Distribution : INDIA : Orissa (as above) and Tamil Nadu.

Remarks : Shell small, chestnut brown with whitish zig-zag marking, discoidal, deeply umbilicate, with fine transpiral striations, spire nearly flat with a scarcely raised apex, sutures deep, whorls $4\frac{1}{2}$, slightly depressed at the suture, aperture circular, oblique.

The present material, labelled as "*Cyclophorus orissaensis* Nev.," probably belong to the 10 exs. of *Theobaldius* from Ganjam, referred to by Nevill (1878), which he indicated as new without giving any name.

Order STYLOMMATOPHORA

Family II. GLESSULIDAE

Following Godwin-Austen (1920) the genus *Glessula* is placed under "a family of its own, the Glessulidae." Accordingly the range of distribution of the family is kept limited to the Oriental region only.

Genus 4. **Glessula** von Martens, 1860

4. **Glessula praelustris** (Benson)
(Fig. 2B)

1860. *Achatina praelustris* Benson, *Ann. Mag. nat. Hist.*, 5 : 462,

1909. *Glessula praelustris* : Pilsbry, *Man. Conch.*, 20 : 68.

Material examined : Phulbani district : 6 exs., Kalinga Coffee garden, 50 km. from Phulbani (coll. K.V.S, Rao, 17.i.72).

Measurements : Height of shell Width of shell Height of aperture
 8.4-18.2 5.5-9.85 4.8-7.9 mm.

Distribution : INDIA : Orissa (as above), Bihar and West Benga (Gude, 1914).

Remarks : Shell ovately elongate, very thin, fragile, with fine irregular striae, glossy, pale corneous. Spire conoid, sutures deep and sub-crenulate, whorls 7-8, fairly convex, body-whorl swollen, measuring

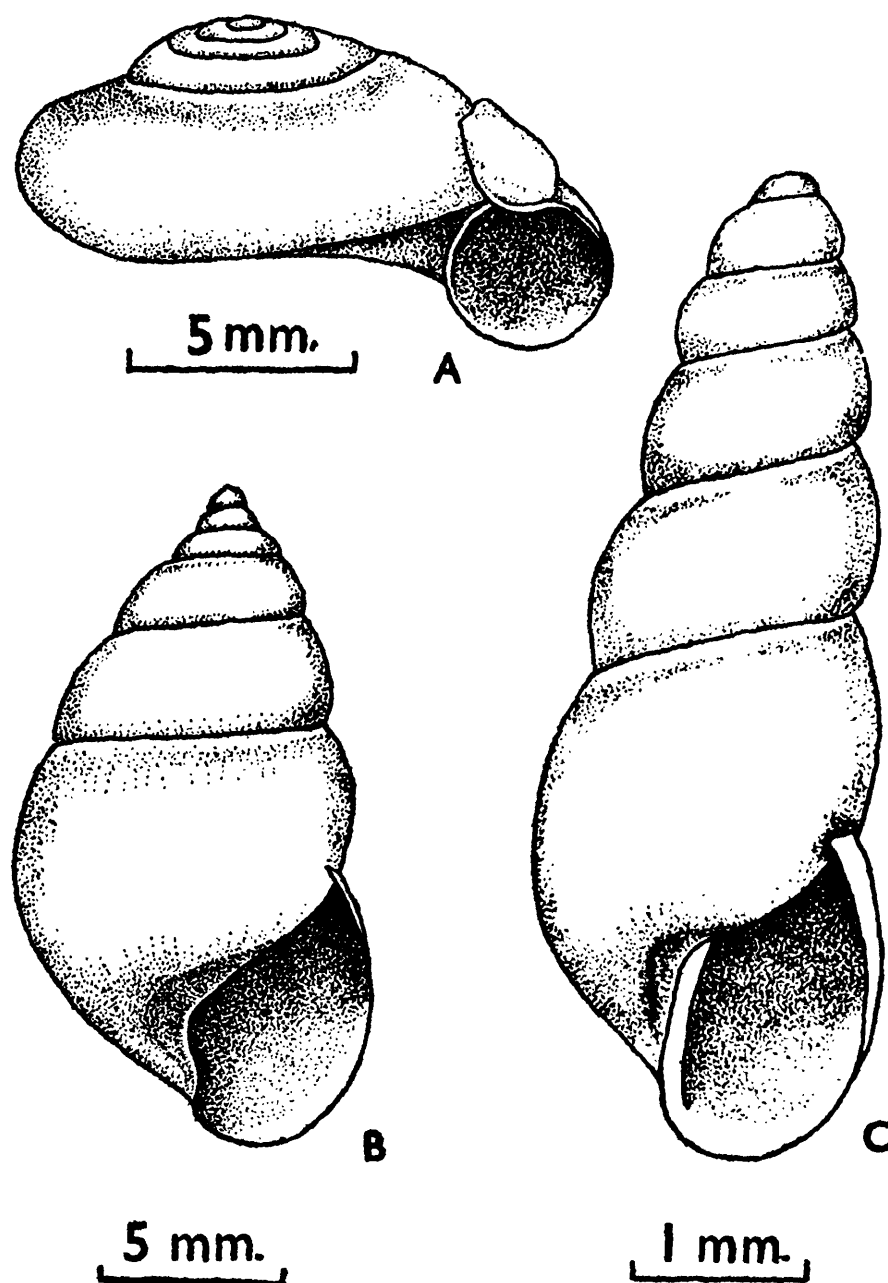


Fig. 2. A. *Pterocyclus comatus* Möllendorff
B. *Glessula praelustris* (Benson)
C. *Lamellaxis gracile* (Hutton)

1/3rd of the total length, aperture vertical, semi-oval or pear-shaped, wide, columella arched, truncate at the base, outer lip slightly thickened.

The present material probably belongs to the 'smaller race' referred to by Pilsbry (1909).

Family III. SUBULINIDAE

Genus 5. *Lamellaxis* Strebel, 1882.

5. *Lamellaxis gracile* (Hutton)

(Fig. 2C)

1834. *Bulimus gracile* ? (No. 5) Hutton, *J. Asiat. Soc. Beng.*, 3 : 84, 93.

1914. *Opeas gracile* ; Gude, *Fauna Brit. India*, Mollusca, p. 355.

1966. *Lamellaxis (Allopeas) gracile* ; Solem, *Spolia zool. Mus. Haun.*, 24 : 94.

Material examined : Ganjam district : 2 exs., Barkuda Island, Chilka, Ganjam, (coll. N. Annandale) ; Phulbani district : 11 exs. Coffee garden at Kalinga, 50 kms. from Phulbani (coll. K.V.S. Rao, 17.1.72).

<i>Measurements</i> :	Height of shell	Width of shell	Height of aperture
	4.5-10.9	1.5-2.55	1.19-2.9 mm

Description : INDIA : Common throughout, including Orissa (as above). Elsewhere : East Africa, Bangladesh, Pakistan, Sri Lanka, Burma, Malay Peninsula and Archipelago, Japan, China, Philippines and Polynesia.

Remarks : Animal light yellow, very commonly seen in freely moving condition in shady parts of the gardens, on moist walls etc., particularly during rainy season or just after it.

This species is one of the few land snails implicated as pestiferous (Raut & Ghose, 1984).

Godwin-Austen (1917) mentioned about one specimen of *Opeas gracile* from Barkuda island, Orissa, which he thought had 'points of differences' from the typical shells from Mirzapore. The present material from Barkuda island was also referred to by Annandale & Prashad (1920) without any comment on its identity. However, the shells do not show much difference from typical shells of *L. gracile*, except being eroded and worn out.

Family IV. ACHATINIDAE

Genus 6. *Achatina* Lamarck, 17996. *Achatina* (*Lissachatina*) *fulica fulica* (Bowdich)

(Fig. 3, A, B)

1821. *Helix fulica* Ferussac, *Table Syst. Limacons.* : 49 (No. 347). (nom. nud.)1822. *Achatina fulica* Bowdich, *Elements of Conchology*, 1, pl. 13, fig. 3.1950. *Achatina* (*Lissachatina*) *fulica fulica* ; Bequart, *Bull. Mus. Comp. zool. Harvard*, 105(1) : 1-216, pl. 8.

Material examined : Balasore district : 2 exs., Orissa (coll. ?) ;
2 exs., from a village, 6 kms. north of I. B., Chandipore (coll. ?) ;
Mayurbhanj district : 1 ex., Baripada. Orissa (coll. B. M. Patnaik ;
2 exs., Orissa, (coll. ?).

Measurements : Height of shell Width of shell Height of aperture
 46.9-70.75 27.7-41.25 29-41.85 mm

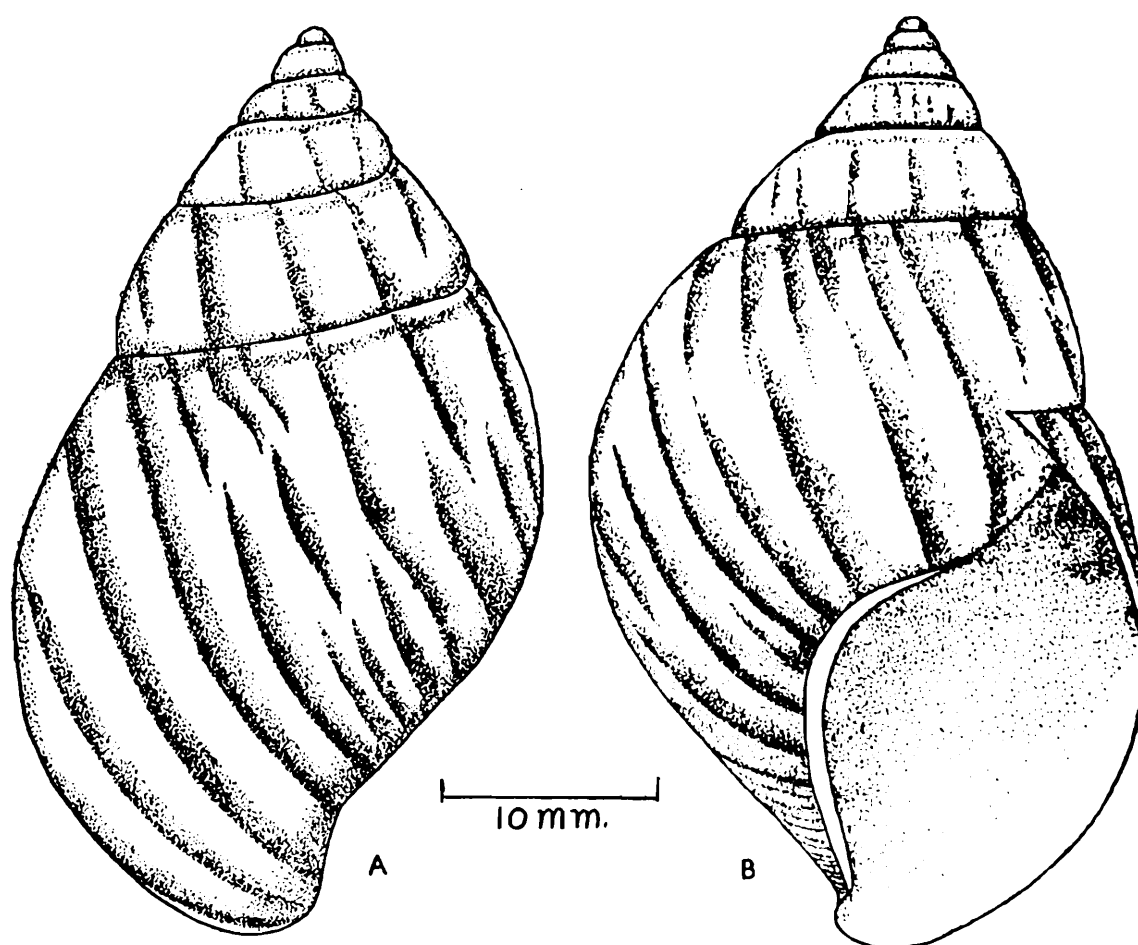


Fig. 3. A. *Achatina* (*Lissachatina*) *fulica fulica* (Bowdich) A-Dorsal view
B. *Achatina* (*Lissachatina*) *fulica* (Bowdich)-Apertural view. Juvenile

Distribution : INDIA : Orissa (as given above), Assam, Manipur, Mizoram, Nagaland, Tripura, Uttar Pradesh, Bihar, Maharashtra, Gujarat, West Bengal, Andhra Pradesh, Karnataka, Tamil Nadu, Kerala, Andaman and Nicobar islands. Elsewhere : Madagascar, Seychelles, Zanzibar, Mauritius, Singapore.

Remarks : Shell large, ovately conoid, strongly inflated, pale yellowish to whitish, with brown streaks all over, inside the aperture whitish to bluish white, whorls 8, rapidly increasing in width, body whorl large, equalling almost half the entire length of the body. Sutures deep, with short spiral striations just below, the striae are more distinct on lower whorls.

It is an universally known agri-horticultural pest, taking a rather serious proportion in many parts of the country, particularly in Eastern India.

As revealed by the surveys undertaken by ZSI parties, in connection with the studies on pestiferous snails of India, with special reference to *A. fulica*, this species commonly occurs in three district of Orissa ; Balasore, Mayurbhanj and Keonjhar. In Cuttak district, it is reported from a single place, Panikoil. Baripada town in Balasore district is worst infested with a population density of 32/m² (Raut & Ghose, 1984).

Family V. STREPTAXIDAE

Depending upon the shape of shells this family is divided into two subfamilies, Streptaxinae (helicoid shells) and Enneinae (turritiform shells). In Orissa it is represented by the subfamily Enneinae and a single genus *Huttonella*. Although the species *H. bicolor* was placed under *Sinoennea* by van Bruggen (1967), following Dance (1970) we are retaining it under *Huttonella*. This genus is represented by 3 species in Orissa.

Genus 7. *Huttonella* Pfeiffer, 1856.

Key to species

Shell turreted, whorls more than 7, aperture with 4 teeth	...	<i>bicolor</i>
Shell cylindrically ovate, whorls less than 7, aperture with 5-6 teeth	...	<i>planguncula</i>

7. *Huttonella bicolor* (Hutton)

(Fig. 4, A, B)

1834. *Pupa bicolor* Hutton, *J. Asiat. Soc. Beng.*, 3 : 86 & 93.
 1920. *Ennea bicolor* (Hutton) race *barkudensis* Annandale & Prashad, *Rec. Indian Mus.*, 19 : 191, text-fig. 1, 2, 3 & 3a.
 1950. *Gulella* (*Huttonella*) *bicolor* : Jutting, *Treubia*, 20(3) : 504.
 1970. *Huttonella bicolor* : Dance, *J. Conch.*, 27 : 153.

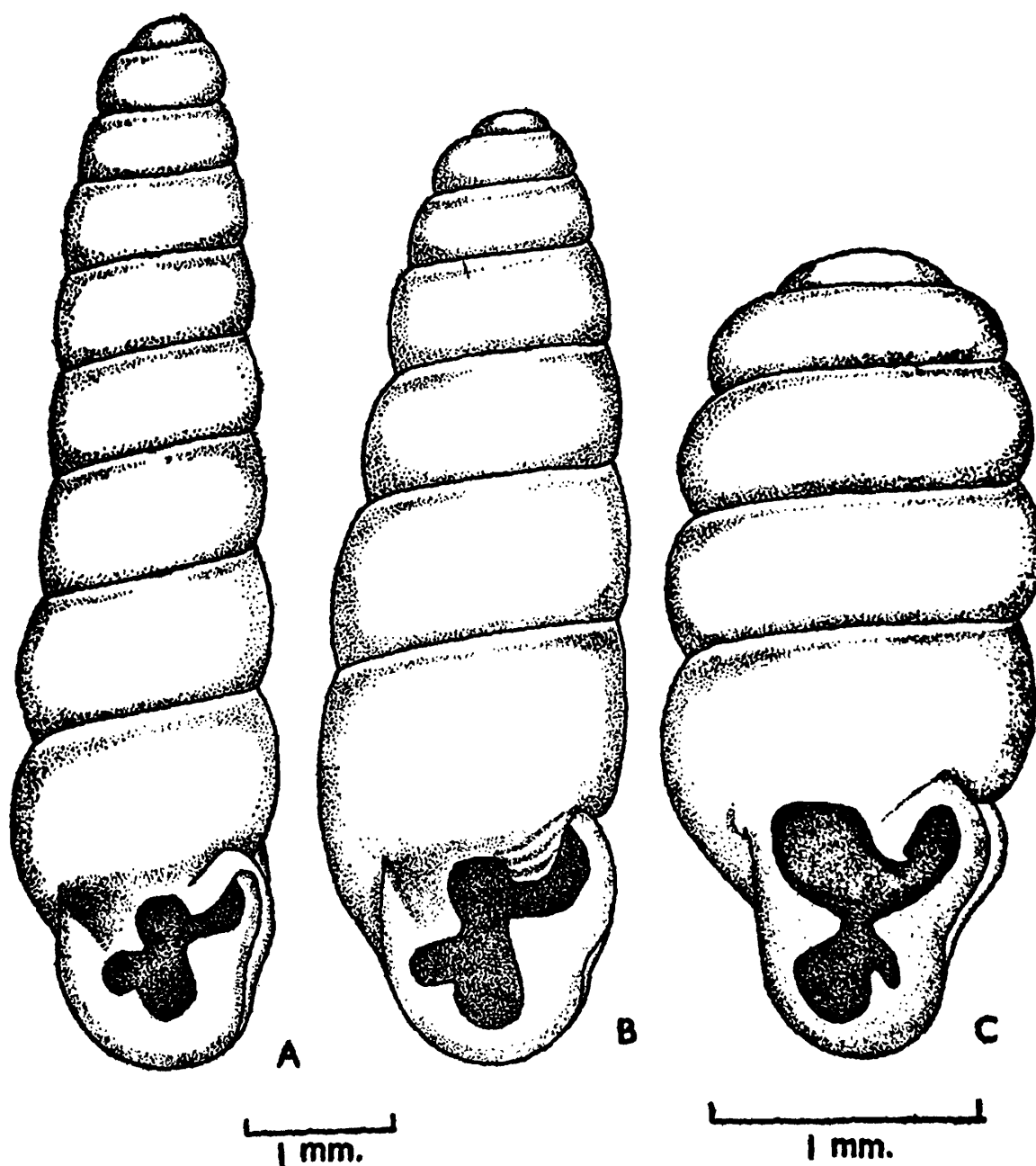


Fig. 4. A. *Huttonella bicolor* (Hutton) race *barkudensis* Annandale & Prashad
 B. *Huttonella bicolor* (Hutton) C. *Huttonella planguncula* (Benson)

Material examined : Ganjam district : 5 exs., Barkuda island, Chilka lake, Orissa (including type of *E. bicolor* race *barkudensis*), coll. N. Annandale and B. Prashad.

Measurements : Height of shell Width of shell Height of aperture
6.4-6.05 1.65-1.7 1.5-1.6 mm.

Distribution : INDIA : Common throughout, including Orissa (as above).

Elsewhere : Whole of South East Asia, Seychelles, Mascarene, West Indies. It is a tropical species.

Remarks : Shell small, slender, cylindrical, imperforate, apex blunt, nearly transparent (through which the orange coloured animal is visible), with fine striae, sutures crenulate, whorls 8, rather flatly convex, body-whorl rather laterally compressed forming two shallow pits behind the aperture. Aperture quadrate with 4 teeth. Peristome thickened, reflected.

The shells vary in length-breadth ratio, some shells being comparatively more slender and longer. The race *barkudensis*, described by Annandale & Prashad is synonymised with the typical form since, the shells entirely agreed with the typical shells except being a little narrower. But the five shells examined from Barkuda island do not show uniform slenderness. Blanford & Godwin-Austen (1908) also referred to the variations in the form of spire shown by this species.

It is a carnivorous species and there are several reports of this snail preying upon *Lamellaxis* sp. which very often occurs in association with it.

8. *Huttonella planguncula* (Benson)

(Fig. 4, C)

1863. *Pupa planguncula* Benson, *Ann. Mag. nat. Hist.*, (3) 12 : 426.

1880. *Ennea stenastoma* Blanford, *J. Asiat. Soc. Beng.*, 49 : 208, pl 2. fig. 17.

1908. *Ennea planguncula* ; Blanford & Godwin-Austen, *Fauna Brit. India*, Mollusca : 23.

Material examined ; 1 ex., Cuttack (coll. W. Theobald). Koraput district ; 3 exs., Jeypore (Coll. ?.)

Measurements : Height of shell width of shell Height of aperture
3.2-4.0 1.35-1.7 .9-1.2 mm,

Distribution : INDIA : Orissa (as above), Madhya Pradesh, and Andhra Pradesh.

Remarks : Shell small, thin, ovately cylindrical, rimate, very finely costulate, whorls 6, rather convex, sutures crenulate, body-whorl laterally compressed, deeply indented on both sides behind the peristome, aperture vertical, ovate, with a parietal fold above, with a bifid tubercular tooth on outer margin, two on columellar margin and two on basal margin. Peristome slightly expanded.

9. *Huttonella rambhaensis* Ray

1960. *Gulella (Huttonella) rambhaensis* Ray, *J. Bombay Nat. Hist. Soc.*, 57(3) : 691.

Material examined : Ganjam district : 1 ex., (Holotype), Reg. No. M 1653/2. Beach of Rambha bay, Ganjam (coll. H. C. Ray, 1955).

Distribution : Orissa (as above).

Remarks : The species was described on the basis of a beach-worn shell and which is also slightly damaged. It appears to be very close to *H. bicolor*, from which it was separated on some trivial characters. In our opinion it needs further study of fresh material. Since it is a doubtful species we have not included it in the key.

Family VI. ARIOPHANTIDAE

Key to genera

1. Shell dextral or sinistral, thick, medium-sized to large; spire distinctly raised, conspicuously striate or decussated above	...	...	2
Shell dextral, thinner, comparatively smaller, depressed; spire scarcely raised, smooth or finely striate above	...	<i>Macrochlamys</i>	
2. Shell large, sinistral	...	<i>Ariophanta</i>	
Shell of moderate size, dextral	...	<i>Euplecta</i>	

Genus 8 *Ariophanta* Desmoulins, 1829

Key to species

1. Shell thick, large (usually above 35 mm. in width), globose with convex bodywhorl	...	<i>kadapaensis</i>	
Shell thinner, smaller (seldom reaching 30 mm. in width) depressed with angulate bodywhorl	...	...	2

2. Shell with spiral chocolate band above, parietal wall of aperture with a patch ... *laidlayana*
 Shell without chocolate band above, parietal wall of aperture white ... *interrupta*

10. *Ariophanta interrupta* (Benson)
 (Fig. 5, A)

1834. *Helix interrupta* Benson, *Proc. zool. Soc. Lond.*, 1834 : 90.

1908. *Ariophanta interrupta* Blanford & Godwin-Austen, *Fauna Brit. India, Mollusca*, 31.

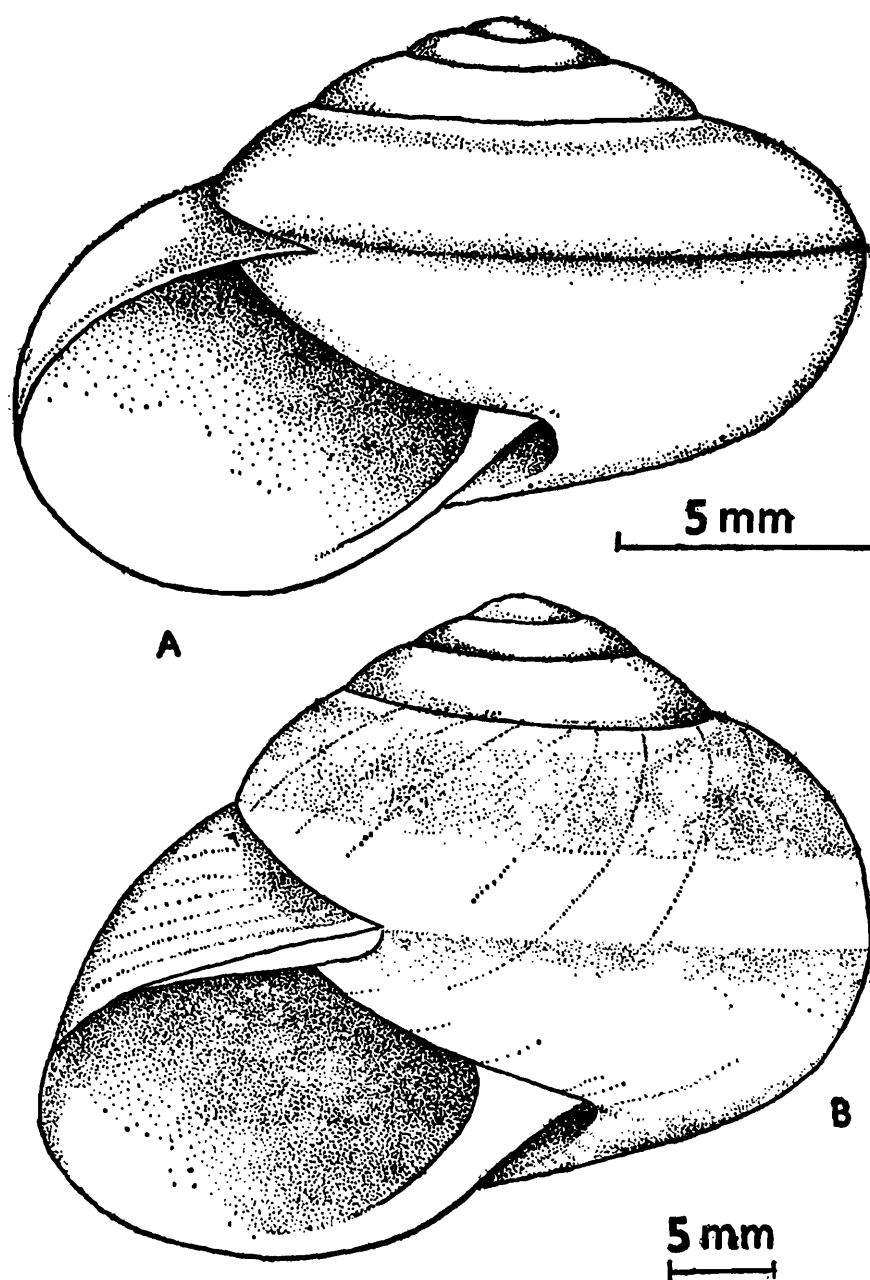


Fig. 5. A. *Ariophanta interrupta* (Benson)
 B. *Ariophanta kadapaensis* Nevill

Material examined : Cuttack district : 3 exs., Nandan Kanan, Cuttack (coll. D. P. Sanyal). Ganjam district : 2 exs., Ganjam, (Coll. Dr. Bali) ; 2 exs., Taptapani Camp (coll. D. P. Sanyal). Mayurbhanj district : 1 ex., Chahala nullah bank (Coll. ?). Puri district : 1 ex., Hill island, 3 miles from Balugaon (coll. B. S. Chauhan). Phulbani, district : 6 exs., Kalinga Coffee garden, 50 km. from Phulbani, (coll. K. V. S. Rao 17.1.72.) Keonjhar district : 3 exs., Ghatgaon (coll. J. K. Sen), Koraput district : 1 ex., Chapregaon from a garden (K. V. S. Rao, 23. 2. 72).

Measurements : Height of shell Width of shell Height of aperture
10-16.5 15.1-27.65 8.7-14.2 mm.

Distribution : INDIA : Orissa (as above) Bihar, Maharashtra, West Bengal, and Andhra Pradesh.

Remarks : Shell fairly thick, sinistral, depressedly convex with a blunt apex, coarsely and obliquely plicate, decussated by spiral striae which often become obsolete, body-whorl angulate at periphery, smooth and tumid below. Aperture widely crescent shaped, peristome slightly thickened, umbilicus narrow but deep.

11. *Ariophanta kadapaensis* Nevill

(Fig. 5B)

1795. *Helix nicobarica* Chemnitz, Martini and Chemnitz's *Syst. Conch. cab.*, 9 : 79, pl. 108, figs. 911-912.

1873. *Nanina (Ariophanta) kadapaensis* Nevill, *Hand List Moll. Indian Mus.*, 1 : 19.

Material examined : Balasore district : 1 ex., Chandipore, near Inspection Bungalow, (coll. ?). Phulbani district : 2 exs., 4 kms. N. E. of Kotgarh, (coll. D. P. Sanyal, 15.12.73).

Measurements : Height of shell Width of shell Height of aperture
26.2-29.7 36.3-40.1 20.0-22.85 mm.

Distribution : Orissa (as above), Andhra Pradesh, Tamil Nadu, Kerala.

Remarks : Shell solid, globosely conoid, with close-set oblique striae, chest-nut brown, with a narrow white band running along the suture, and a broad white band at the periphery, whitish below, body-whorl perfectly rounded. Aperture oblique, roundly lunate, umbilicus

deep and narrow, partly obliterated by reflected columella, parietal wall and umbilical region dark chest-nut.

12. *Ariophanta laidlayana* (Benson)

(Fig. 6 A)

1856. *Helix laidlayana* Benson, *Ann. Mag. nat. Hist.*, (2)18 : 253.

1908. *Ariophanta laidlayana* Blanford & Godwin-Austen, *Fauna Brit. India, Mollusca*, 1 : 30.

Material examined : Mayurbhanj district : 1 ex., Mayurbhanj (coll. S. K. Mitra). Phulbani district : 6 exs., Mango and Banyan tree trunk (D. P. Sanyal).

Measurements : Height of shell Width of shell Height of aperture
15.65-17.85 25.0-28.9 13.85-14.85 mm.

Distribution : Orissa (as above), Andhra Pradesh, Bihar, (Singbhum) and West Bengal.

Remarks : Shell depressedly conoid, lighter than in preceeding species, obliquely and rather finely striate, whitish with one or sometimes two chest-nut spiral bands (rarely without bands), body-whorl angulate, angulation disappearing near mouth. Aperture lunate, oblique, peristome simple above but slightly thickened below, umbilicus narrow. Parietal wall of the aperture and the umbilical region with chest-nut patches, but not as prominent as in the prebeeding species.

Some of the specimens were found aestivating on the trunk of trees like, mango and banyan. This confirms the passing remark made by Hora (1928), that snails of *Ariophanta* were observed to aestivate on Cactus trees.

A single shell of *A. laidlayana*, collected by F. Stoliczka, with a locality label "Assam" is present in the National Zoological Collections, but since the genus *Ariophanta* is not known from the north-eastern part of the country, this requires further confirmation.

Genus 9. *Euplecta* Semper, 1870

Key to the species

Shell with decussating sculpture more pronounced in apical whorls, body whorl sub-angulate ...	<i>E. infausta</i>
Shell with decussating sculpture throughout, body whorl distinctly angulate ...	<i>C. subdecussata</i>

13. *Euplecta subdecussata* (Pfeiffer)

(Fig. 6B)

1857. *Helix subdecussata* Pfeiffer, *Proc. zool. Soc. Lond.*, 1857 : 107.1908. *Euplecta subdecussata* : Blanford & Godwin-Austen, *Fauna Brit. India*, Mollusca, p. 55.

Material examined : Balasore district : 2 exs., Chandbally (coll. ?).
Puri district : 17 exs., From a garden near Bungalow, Gopalpur (coll. G. Ramakrishna, 27.11.62).

<i>Measurements</i> :	Height of shell	Width of shell	Height of aperture
	7.0-8.84	10.5-12.36	5.55-6.55 mm.

Distribution : INDIA : Orissa (as above), Maharashtra and Tamil Nadu.

Remarks : Shell thin, turbate, perforate, spirally plicate, decussated by fine striae above, smooth and convex at the base, whorls 6, flatly convex, body-whorl angulate, aperture oblique, widely lunate, columella slightly reflected.

There is some controversy regarding the position of *E. decussata* vis-a-vis *E. baconi* and *E. layardi*, a species from Sri Lanka. Blanford in his manuscript made all the three conspecific. In National Zoological Collections there are a number of shells from various localities, such as Calcutta, Orissa, Benaras, Kulu Valley etc. ; labels bearing the names *E. subdecussata* and *E. baconi* are found inside the same box. Nevill (1878) has treated these shells as *E. baconi*. But Blanford and Godwin-Austen (1908) while disagreeing to the idea of synonymising all the three species, expressed doubt regarding the authenticity of Nevill's identification of these shells. Though by external characters, these shells look like *E. subdecussata*, following Blanford & Godwin-Austen (loc. cit.) we are convinced that by shell characters alone, it is not possible to determine the specific identity of the material collected from such varying localities. Our studies show that *E. subdecussata* is restricted to Peninsular India only and the present record from Orissa is the northern most limit of the species. Moreover, since the genus *Euplecta* is not known from northern India, the generic position of the species *E. baconi* from Moradabad, is yet to be ascertained through anatomical investigation.

14. *Euplecta infausta* (Blanford)

(Fig. 6 C)

1866. *Nanina* (*Macrochlamys*) *infausta* Blanford, *J. Asiat Soc. Beng.*, 2 : 36.1908. *Macrochlamys infausta* Blanford & Godwin-Austen, *Rec. Indian Mus.*, 13 : 350.1917. *Ariophanta infausta* ; Godwin-Austen, *Rec. Indian Mus.*, 13 : 350.

Material examined : Ganjam district : 7 exs., Barkuda Island, Chilka Lake, (Coll. N. Anandale).

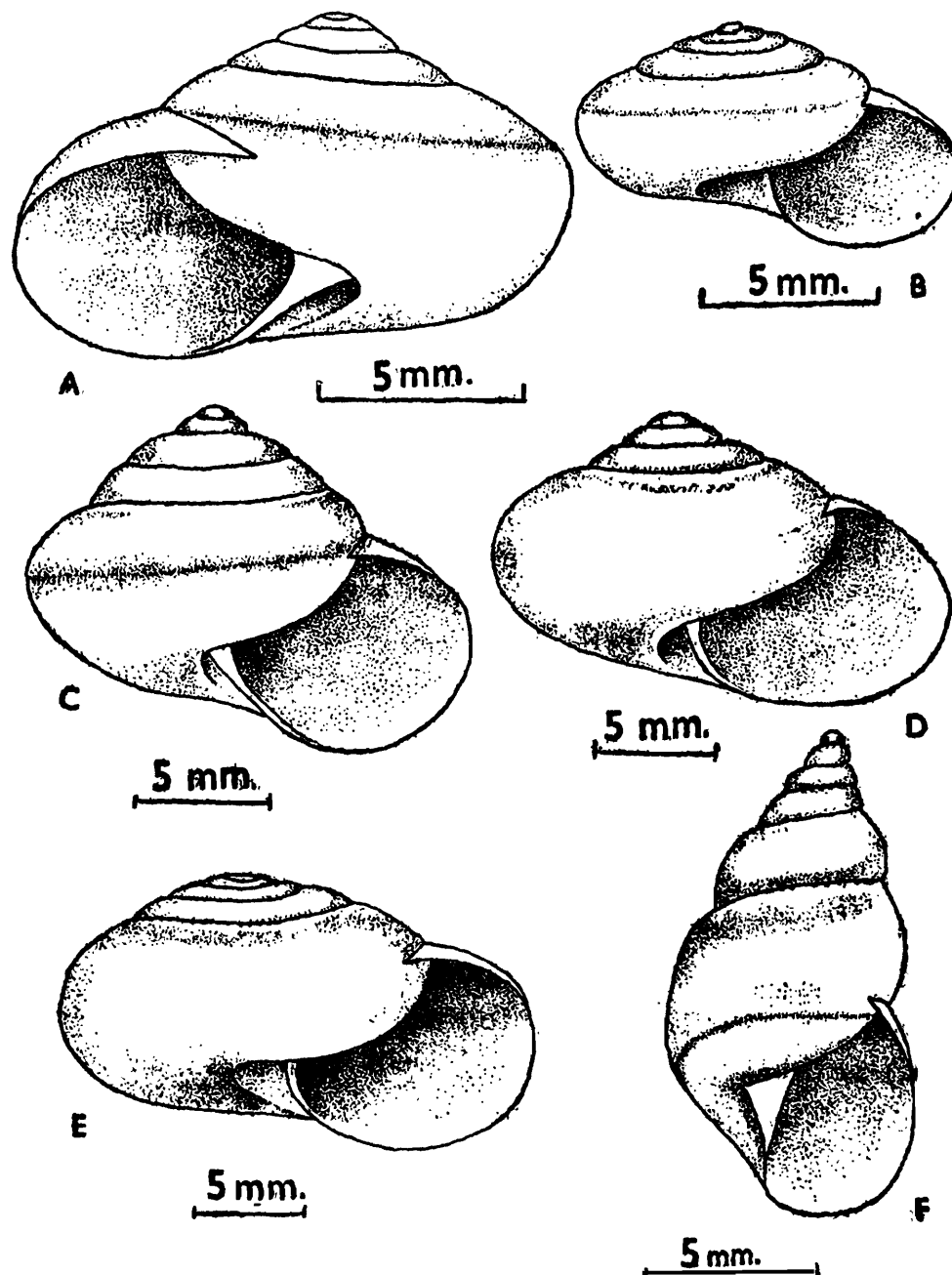


Fig. 6. A. *Ariophanta laidlayana* (Benson) B. *Euplecta subdecussata* (Pfeiffer)
 C. *Euplecta infausta* (Blanford) D. *Macrochlamys ganjamensis* Godwin-Austen
 E. *Macrochlamys indica* Godwin-Austen F. *Rachis praetermissus* (Blanford)

Measurements : Height of shell Width of shell Height of aperture
 10.1-13.5 15.35-18.15 7.95-9.54 mm.

Distribution : INDIA : Orissa (as above), Andhra Pradesh.

Remarks : Shell moderately large, perforate, sub-globosely conoid, thin, translucent, fairly conspicuously sculptured by spiral striae, decussated by close transpiral plications above, smooth shining below. Whorls 6-7, narrowly wound, body-whorl angulated at the periphery. Aperture roundly lunate, oblique, peristome thin, simple, columellar margin curved, slightly expanded.

The species was assigned to the genus *Macrochlamys* by Blanford & Godwin-Austen (1908), but was subsequently placed under *Ariophanta* by Godwin-Austen (1917) on the basis of anatomical character, which was more like as in Ariophantinae than in Macrochlamydinae. Since at present only sinistral species are retained under *Ariophanta*, it would have been proper to put this species under the genus *Cryptozona* along with other dextral species under the section *Nilgiria*. But, in consideration of its more conoid spire with more closely wound whorls, distinct decussating sculpture and fairly angulate body-whorl, it is tentatively placed under *Euplecta*, under the same sub-family Ariophantinae.

Genus 10. *Macrochlamys* Gray, 1847

Key to the species

Shell more depressed with scarcely raised spire and wider perforation	...	<i>M. indica</i>
Shell more globose a moderately raised spire and very narrow with perforation	...	<i>M. ganjamensis</i>

15. *Macrochlamys ganjamensis* Godwin-Austen (Fig. 6 D)

1910. *Macrochlamys ganjamensis* Godwin-Austen, *Land and freshwater mollusca of India*, 2(10) : 268, pl. 123, figs. 4, 5.

Material examined : Ganjam district : 10 exs., Ganjam, (coll. ?).
 Phulbani district : 2 exs., Satraguda, N:W. of Phulbani (coll. K. V. Surya Rao, 19.1.72).

Measurements : Height of shell Width of shell Height of aperture
 9.25-11.50 13.8-17.10 8-9.30 mm

Remarks : Shell thin, horny, moderately large, narrowly perforate, globosely turbinate, whorls 7, convex, body-whorl tumidly rounded, aperture widely lunate, peristome thin, simple.

16. *Macrochlamys indica* Godwin-Austen

(Fig. 6 E)

1883. *Macrochlamys indica* Godwin-Austen, *Land and freshwater mollusca of India* 1 : 97, pl. 18, fig. 1-8b.

1908. *Macrochlamys indica* : Blanford and Godwin-Austen, *Fauna Brit. India*, Mollusca : 95.

Material examined : Ganjam district : 3 exs., Ganjam, (coll. ?), Puri district : 7 exs., From a garden near Bungalow, Gopalpur (coll. G. Ramakrishna, 27.11.62).

Measurements : Height of shell Width of shell Height of aperture
 8.65-11.90 15.70-18.30 7.25-8.50 mm

Distribution : INDIA : Orissa (as above), Common throughout except in N.W. parts of the country. Elsewhere : Bangladesh.

Remarks : Shell comparatively thicker than in the preceeding species, a little more depressed and broad, body-whorl obsoletely sub-angulate, perforation a little more wide.

Family VII. ENIDAE

Genus 11. *Rachis* Albers, 1850

17. *Rachis praetermissus* (Blanford)

(Fig 6. F.)

1861. *Bulimus praetermissus* Blanford, *J. Asiat. Soc. Beng.*, 30 : 360.

1914. *Rachisellus praetermissus* : Gude, *Fauna Brit. India*, Mollusca, p. 275.

1960. *Rachis praetermissus* : Satyamurti, *Bull. Madras Govt. Mus.*, N. H. 6, No. 4 : 72 pl. 8, fig. 6.

Material examined : Ganjam district : 27 exs., Barkuda island, Chilka lake (coll. N. Annandale, Aug. 1919). Koraput district : From a shrub near Soil Conservation garden West of Koraput (coll. K.V. Surya Rao, 23.2.72).

Measurements : Height of shell Width of shell Heights of aperture
 13.80-21.25 6.50-10.10 6.55-9.10 mm

Distribution : INDIA : Orissa (as above), West Bengal, Andhra Pradesh, and Tamil Nadu.

Remarks : Shell moderately large, thin, ovately conical, perforate, smooth except for very close fine transpiral growth-markings. Pale yellowish-white or nearly transparent, with brown spiral bands, number of bands varying but usually not more than 3, rarely absent, sometimes with oblique markings. Whorls 7, rounded. Aperture oblique, wide, sub-oval, peristome simple, columellar margin straight, reflected near perforation.

Snails of *R. praetermissus* were reported to be abundant on leaves of shrubs on Barkuda island during rainy season (Godwin-Austen, 1917). During a survey in February the snails were collected from the lower surface of leaves of a shrub, where they were hanging in an aestivating condition.

GENERAL DISCUSSION

The common families of land molluscs are all more or less represented in the state, with a few exceptions, though the number of species is notably less (32) than that recorded from the neighbouring state of West Bengal (47). It is worth mentioning, that the family Succineidae (which is represented by 8 species in West Bengal) and some of the smaller forms like, vallonids and vertiginids are not represented in Orissa. But the absence of any collection of *Laevicaulis alie*, the commonest veronicellid tropical slug, is intriguing.

That out of a 32 species recorded, only 17 species could be studied points to the fact that land molluscs are not as easily collected as freshwater forms (this may again provide explanation for certain families having not been recorded). But at the same time, another point which deserves consideration, is that out of the 15 species which could not be studied, as many as 9 are accounted for by the two genera *Glessula* and *Macrochlamys*, under both of which a large number of species have been described by different authors basing on minor variations in shell characters. Many of such species, may in fact turn out to be conspecific when revisionary studies are made.

The barren and denuded slopes (mainly as a result of shifting cultivation by local tribes), of eastern ghats which extend over the six districts of the state (Koraput, Kalahandi, Ganjam, Phulbani, Dhenkanal and Sambalpur), apparently do not afford many suitable habitats for the land molluscs. However, there is concentration of

species in some of these districts, with Ganjam topping the list (19 spp.).

Judging by the distribution pattern, it is quite likely that further intensive surveys in these areas, with particular attention to land molluscs will result in the addition of a few more number of species, especially the widely distributed species like *Kaliella barrackporensis*, and *Laevicaulis alte*.

SUMMARY

A total of 32 species (9 families, 15 genera) of land molluscs are reported from Orissa. Out of this, specimens belonging to 17 species, under 7 families and 11 genera are physically examined. It includes 3 new records viz. *Pterocyclus comatus*, *Theobaldius stenostoma* and *Ariophanta kadapaensis*, and one endemic species, *Macrochlamys ganjamensis*.

ACKNOWLEDGEMENTS

The authors feel grateful to Dr. B. K. Tikader, Director, Zoological Survey of India for facilities to work, and to Dr. O. B. Chhotani, Scientist SF for encouragement and valuable suggestions.

REFERENCES

- ANNADALE, N. & PRASHAD, B. 1920. Observation on a carnivorous land snail. *Rec. Indian Mus.*, **19** : 189-194.
- BLANFORD, W. T. & GODWIN-AUSTEN, H. H. 1908. *Fauna British India. Mollusca*, Testacellidae and Zonitidae pp. 1-306, text figs. 1-90.
- DANCE, S. P. 1970. Non-marine molluscs of Borneo. I. Streptaxacea : Streptaxidae. *J. Conch.*, **27** : 149-159, pl. 6.
- GODWIN-AUSTEN, H. H. 1917. The land mollusca collected on the island of Barkuda in the Chilka lake, Ganjam. *Rec. Indian Mus.*, **13** : 345-351.
- GODWIN-AUSTEN, H. H. 1920. Land and freshwater mollusca of India Supplementary to Hanley and Theobald's *Conch. Indica*, **3(1)** : 1-65.

- GUDE, G. K. 1914. *Fauna British India, Mollusca—II* (Trochomorphidae-Janellidae). pp. 1-504, text figs. 1-164.
- GUDE, G. K. 1921. *Fauna British India, Mollusca*, Land operculates, pp. 1-370.
- HORA, S. L. 1928. Hibernation and aestivation in gastropod molluscs : On the habits of a slug from Dalhousie (Western Himalayas) with remarks on certain other species of gastropod molluscs. *Rec. Indian Mus.*, 30 : 357-373.
- NEVILL, G. 1878. Hand list of Mollusca in the Indian Mus., 1 : 1-338.
- NEVILL, G. 1881. New or little known Mollusca of the Indo-Malayan Fauna. *J. Asiat. Soc. Beng.*, 50 : 125-166, pls. V-VII.
- PILSBRY, H. A. 1909-1910. Manual of Conchology, (2nd series Pulmonata). 20 (*Caecilioides*, *Glessula* and Partulidae) : 1-320, pls. 1-43.
- RAUT, S. K. & GHOSE, K. C. 1984. Pestiferous land snails of India, *Tech. Monograph*, Zool. Surv. India, No. 11 : 1-151, pls. 1-17.
- THIELE, J. 1931. *Handbuch der Systematischen Weichtier Kunde*, pp. 1-1154, figs. 1-897.
- VAN BRUGGEN, A. C. 1967. An Introduction to the Pulmonate family Streptaxidae. *J. Conch. Lond.*, 26 : 181-188.

MOLLUSCA (FRESHWATER)

N. V. SUBBA RAO, S. C. MITRA and R. N. MANNA

Zoological Survey of India

New Alipur, Calcutta-700053

INTRODUCTION

In spite of the fact that the state of Orissa has been more or less thoroughly surveyed by a number of parties from the Zoological Survey of India at different times, till date, there is no consolidated report on the malacofauna of the State. So far as freshwater molluscs are concerned, reports by Hanley and Theobald (1876), Nevill (1884) and Preston (1915b) are the important major works which, while dealing with the freshwater molluscs of India in general, refer to the species occurring in Orissa. In addition to these, a few other reports were also made, most of them being on estuarine or brackish water forms. Noteworthy among these are by Preston (1914 and 1915a) and Annandale (1924). Some of the freshwater molluscs serve as intermediate hosts for certain helminth parasites. In this respect the studies by Patnaik (1968a, b, 1971), and Patnaik and Ray (1966, 1967, 1968) on *Lymnaea* of the region are quite significant.

The present report is based on the large collections of freshwater molluscs both named and unnamed available in the Survey. The material includes the old collections brought by N. Annandale, S. W. Kemp, F. H. Gravely, M. M. Bowie etc. and also the recent collections made by J. K. Sen (1972), K. V. Surya Rao (1972), D. P. Sanyal (1971 & 72), S. K. Mitra (1972), P. K. Maiti. (1971), S. Khera (1972), Y. Chaturvedi (1972), V. K. Premkumar (1972), G. Ramakrishna (1975) etc. In addition, literature records have been taken into consideration.

The classification followed here is that of Taylor and Sohl (1962) for gastropods and Newell (1965) for bivalves.

LIST OF FRESHWATER MOLLUSCS FROM ORISSA

Class **GASTROPODA**

Order **MESOGASTROPODA**

Family **PILIDAE**

1. *Pila globosa* (Swainson)

Family VIVIPARIDAE

- +2. *Bellamya bengalensis* f. *typica* (Lamarck)
- +3. " " f. *doliaris* (Gould)
- +4. " " f. *gigantea* (Reeve)
- +5. " " f. *eburnea* (Annandale)
- 6. " *crassa* (Benson)
- 7. " *dissimilis* (Mueller)

Family BITHYNIIDAE

- 8. *Gabbia orcula* (Benson)
- 9. " " var. *producta* (Nevill)
- 10. *Digoniostoma pulchella* (Benson)
- 11. " *cerameopoma* (Benson)

Family STENOTHYRIDAE

- 12. *Stenothyra blanfordiana* (Nevill)
- 13. " *minima* (Sowerby)
- 14. *Gangetia miliacea* (Nevill)

Family THIARIDAE

- 15. *Thiara (Melanoides) tuberculata* (Mueller)
- 16. " (*Tarebia*) *lineata* (Gray)

Order BASOMMATOPHORA

Family LYMNAEIDAE

- +17. *Lymnaea (Pseudosuccinea) acuminata* f. *typica* Lamarck
- +18. " " " f. *rufescens* Gray
- +19. " " " f. *chlamys* Benson
- +20. " " " f. *gracilior* Martens
- +21. " " *luteola* f. *typica* Lamarck
- +22. " " " f. *australis* Annandale &
Rao
- +23. " " " f. *ovalis* Gray
- +24. " " " f. *impura* Troschel

Family PLANORBIDAE

- 25. *Indoplanorbis exustus* (Deshayes)
- 26. *Gyraulus convexiusculus* (Hutton)

* Species known from literature.

+ Recorded as forms as given in literature since they need further study.

Family ANCYLIDAE

27. *Ferrissia baconi* (Bourguignat)
 *28. „ *verruca* Benson

Class Bivalvia

Order ARCOIDA

Family ARCIDAE

29. *Scaphula celox* Benson

Order UNIONOIDA

Family UNIONIDAE

30. *Parreysia (Parreysia) corrugata* var. *nagpoorensis* (Lea)
 31. *Parreysia (Parreysia) favidens* (Benson)
 32. „ „ „ var. *deltae* (Benson)
 33. „ „ „ var. *plagiosoma* (Benson)
 34. *Parreysia (Radiatula) caerulea* (Lea)
 35. „ „ „ var. *gaudichaudi* (Eydoux)
 36. „ „ *shurtleffiana* (Lea)
 37. *Lamellidens corrianus* (Lea)
 38. „ *marginalis* (Lamarck)

Order VENEROIDA

Family CORBICULIDAE

39. *Corbicula striatella* Deshayes
 40. *Geloina bengalensis* (Lamarck)

Key to the families of Mollusca of Orissa

1. Shell univalve	...	2(<i>Gastropoda</i>)
Shell with two valves	...	9(<i>Bivalvia</i>)
2. Shell operculate	...	3
Shell without an operculum	...	7
3. Shell moderately large to large, turbinate, body whorl inflated, operculum multispiral	...	4
Shell small, sub-globose to large, elongately turreted, operculum paucispiral	...	5

4. Shell large, globosely turbinate, with a large convex bodywhorl, operculum calcareous ...	<i>Pilidae</i>
Shell moderate, elongately turbinate, body whorl subangulate, operculum horny ...	<i>Viviparidae</i>
5. Shell thicker, elongately turreted, usually with nodules or tubercles, spire longer than bodywhorl ...	<i>Thiaridae</i>
Shell thinner, subglobosely conical to ovate, almost smooth, spire usually not longer than bodywhorl ...	6
6. Shell small (usually more than 5mm.) with perfectly convex whorls, primarily freshwater in habit ...	<i>Bithyniidae</i>
Shell minute (rarely more than 5mm) sub cylindrical, rather dorsoventrally compressed, estuarine in habit ...	<i>Stenothyridae</i>
7. Shell limpet-like without whorls ...	<i>Ancylidae</i>
Shell with spirally coiled whorls ...	8
8. Shell high with distinctly raised spire, columella twisted ...	<i>Lymnaeidae</i>
Shell discoidal, spire usually not raised ...	<i>Planorbidae</i>
9. Hinge with numerous minute teeth ...	<i>Arcidae</i>
Hinge with cardinal and lateral teeth ...	10
10. Shell sub-rhomboid to transversely elongate, without distinct concentric sculpture, ligament internal ...	<i>Unionidae</i>
Shell ovately sub-trigonal with distinct concentric ribs, ligament external ...	<i>Corbiculidae</i>

SYSTEMATIC ACCOUNT

Class GASTROPODA

Order MESOGASTROPODA

Family I. PILIDAE

Genus I. *Pila* (Bolten) Roeding, 1798

1. *Pila globosa* (Swainson)

(Fig. 1 A, B)

1822. *Ampullaria globosa* Swainson, *Zool. Illustr.*, (1) Vol. 2 : pl. 119.

1925. *Pila globosa* : Prashad, *Mem. Indian Mus.*, 8 : 70, pl. 13.

Material examined : Balasore district : 6 exs., Raigaon village, 4 kms. E. of Nilgiri ; 1 ex., Balasore Soil Conservation Centre ; 6 exs., Balasore Soil Conservation Centre ; 6 exs., Mirzapore, near Balaramgati, Chandipur. Bolangir district : 15 exs., Mahakhand, 3 kms. N. of Forest Rest House. Cuttack district : 1 ex., Bank of estuary at

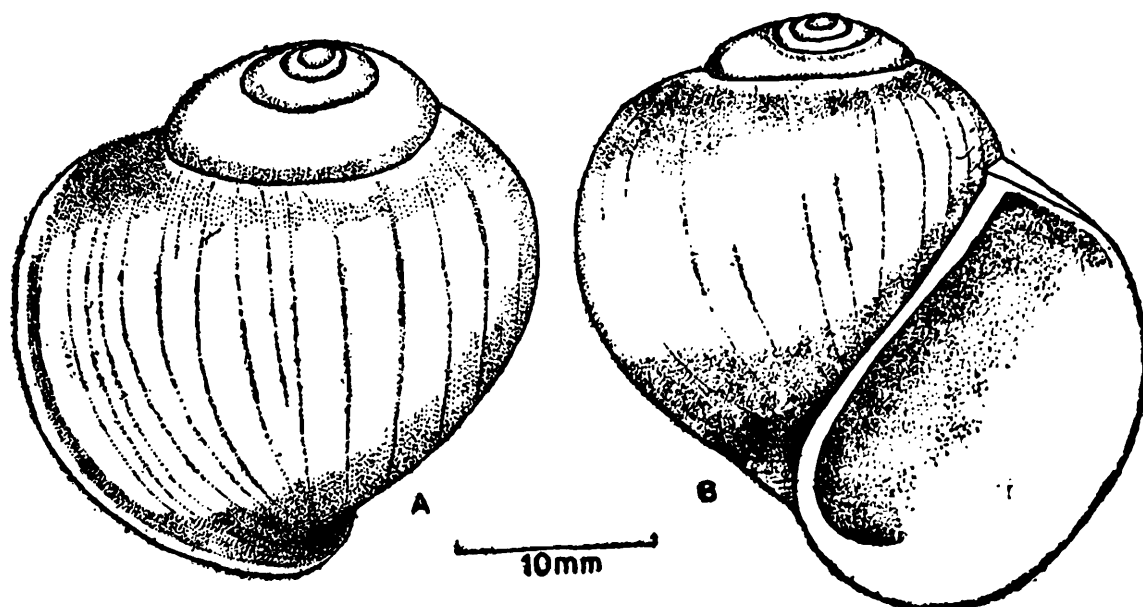


Fig. 1. A. *Pila globosa* (Swainson) Dorsal view
B. *Pila globosa* „ Apertural view

Paradip ; 7 exs., Cuttack. Ganjam district : 14 exs., Rice field, Rambha ; 2 exs., Gundapuli vill. ; 6 exs., Pond at Chatrapur ; 6 exs., University Campus, Berhampur. Kalahandi district : 9 exs., Pond at Malakangiri ; 19 exs., Stagnant pool at Madanpur ; 7 exs., Pond at Nawapara ; 15 exs. pond at Komna ; 2 exs., Paddy field at Bhawanipatna. Keonjhar district : 7 exs., Ghatgaon. Mayurbhanj district : 2 exs., Vicinity of Royal Palace, Baripada ; 2 exs., Deshbandhu reservoir, Joshipur. Phulbani district : 13 exs., Pond at Phulbani ; 14 exs., Masterpada Fisheries pond, Phulbani ; 3 exs., Baudh. Puri district : 1 ex., Konarak ; 18 exs., Balugaon ; 2 exs., Tikiapara. Sambalpur district : 1 ex., Badrama. Sundargarh district : 48 exs., Bonaigarh.

Measurements :	Length	Width	Height of aperture
	11.7-55.15	9.3-45.6	9.4-37.16 mm.

Distribution : INDIA : Common throughout including Orissa (as above), except peninsular region.

Remarks : Orissa may be the overlapping zone of *P. globosa* and *P. virens* of the south. A number of shells among the material studied, show variation from the typical forms. These appear to be intermediate between *P. globosa* and *P. virens* with a little less inflated body whorl, more conical spire and sub-canaliculate sutures. Perhaps prompted by these characters, Prashad (1925) inclined to *include* Orissa inside the range of distribution of the species *P. virens*. However, the present authors are inclined to treat these as *P. globosa*.

Biology, anatomy and reproductive process of the species were studied by Prashad (1925), Bahl (1928) and Ranjha (1942).

Family II. VIVIPARIDAE

Genus 2. *Bellamya* Jousseau, 1886

Of the three species of *Bellamya*, occurring in Orissa the shells of *B. bengalensis* show considerable variations and as a result a number of infraspecific forms have been named by different authors. These forms, though intergrading to one another to a certain extent, are fairly distinct in shell characters and pending further investigations we are inclined to retain them as such.

Key to species of Bellamya

1. Shell elongate, with dark spiral bands, sutures not greatly impressed	...	<i>bengalensis</i>
Shell globose or ovate, uniformly coloured without any bands in the adult shell, sutures greatly impressed	...	2
2. Shell ovate and thin, with deeply impressed sutures, body whorl subangulate or with a slightly elevated peripheral ridge	...	<i>dissimilis</i>
Shell globose and thick, body whorl gradually sloping at the periphery and without forming any ridge	...	<i>crassa</i>

2. *Bellamya bengalensis* f. *typica* (Lamarck) (Fig. 2 A, B)

1822. *Paludina bengalensis* Lamarck, *Hist. nat. Anim. sans. Vert.* 6(2) : 174.
 1921. *Vivipara bengalensis* race *bengalensis* : Annandale & Sewell, *Rec. Indian Mus.*, 22 : 270, pl. 1, figs. 1-3.
 1980. *Bellamya bengalensis* form. *typica* (Lamarck) : Subba Rao, Das & Mitra, *Rec. Zool. Surv. India*, 77 : 228, pl. 1, figs. 5.

Material examined : Ganjam district : 2 exs., pond, foot of a hill, Rambha ; 7 exs., Chatrapur. Kalahandi district : 89 exs., pond near college, Bhawanipatna ; 4 exs., Kesinga ; 34 exs., Ditch at Khariar ; 23 exs., Komna ; 9 exs., pond at Nowapara, Gotuma village, Khariar Rd. Koraput district : 9 exs., Jagannath Sagar, Jeypur ; 52 exs., Nowrangpur ; 38 exs., Stream, S. of Jeypur ; 19 exs., Teliguda, Jeypur. Phulbani district : 61 exs., Baudh ; 10 exs., South of Balliguda ; 45 exs., pond at Baraguda, W. of Balliguda. Sambalpur district : 6 exs., near Jharsuguda Rly. station ; 10 exs., ditch at Badrama.

Measurements :	Length	Width	Height of aperture
	14.1-34.8	7.85-24.2	5.5-18.3 mm.

Distribution : INDIA, common throughout including Orissa (as above).

Remarks : Whorls in typical forms are rather tumid, body whorl perfectly rounded with a conical spire, aperture sub-circular.

This form usually occurs in large ponds or marshes with ample vegetations.

***Bellamya bengalensis f. annandalei* (Kobelt)**

(Fig. 2 C, D)

1908. *Vivipara annandalei* Kobelt, *Nachr. Malak. Gesell.*, Frankfurt, 60 : 161-162.

1921. *Vivipara bengalensis* phase *annandalei* : Annandale & Sewell, *Rec. Indian Mus.*, Calcutta, 22 ; 276, pl. 2. figs. 5-8.

Material examined : Balasore district : 1 ex., Chandipur. Bolangir district : 3 exs., pond near Harishankar hill. Ganjam district : 1 ex., University campus pond, Berhampur. Kalahandi district : 21 exs., pond at Nowapara. Keonjhar district : 1 ex. Ghatgaon ; 9 exs., Tank at Khariar ; 10 exs., Mundrapali, Khariar Rd. Koraput district : 2 exs., Teliguda Jeypur ; 15 exs., Jagannath Sagar, Jeypore ; 11 exs., Ditch at Pratapgarh. Puri district : 21 exs., Balugaon.

Measurements :	Length	Width	Height of aperture
	14.55-31.4	10.5-19.15	7.7-14.9 mm

Distribution : INDIA : Orissa (as above), Rajasthan, Bihar, West Bengal, Andhra Pradesh and Tamil Nadu.

Remarks : Shell usually thinner, translucent, with gradually

increasing whorls, whorls are less rounded and with rather straight sides.

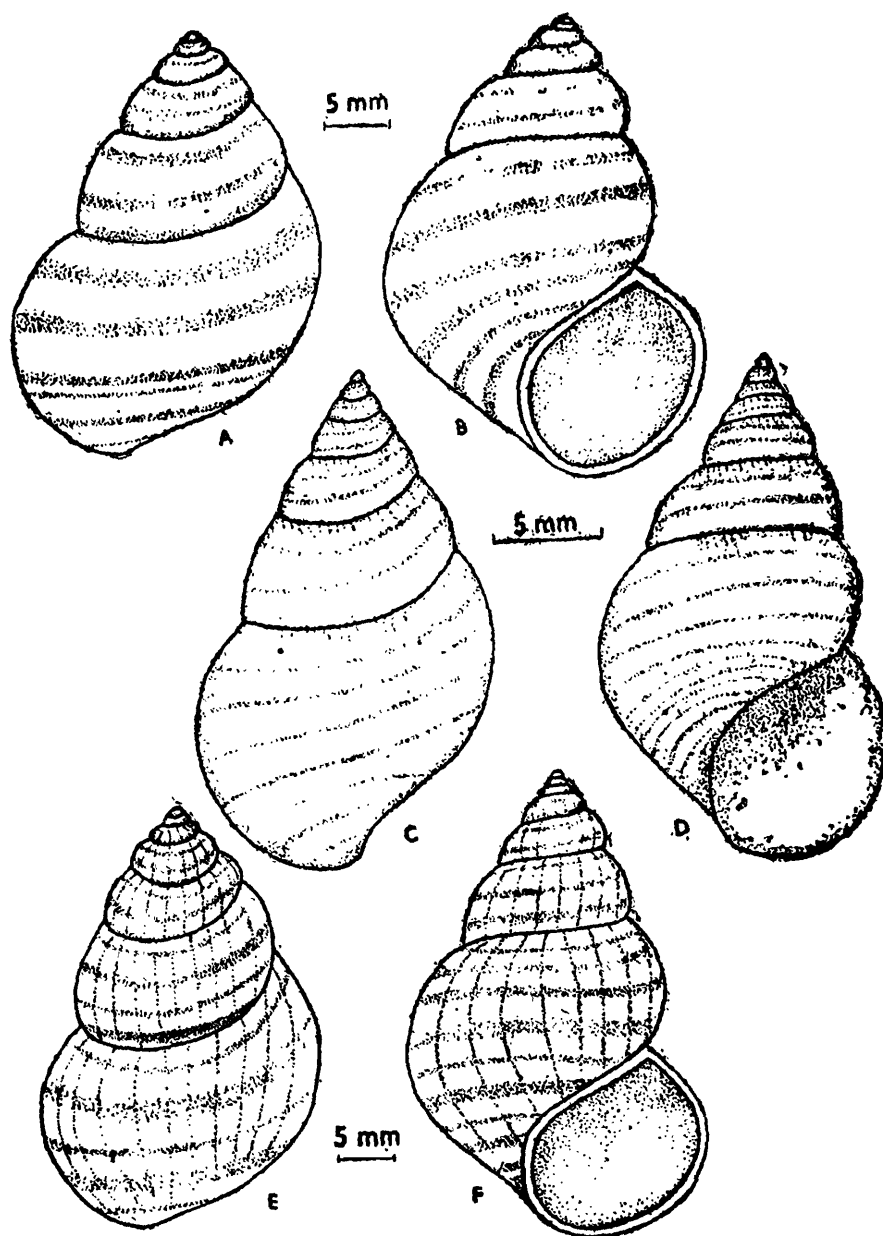


Fig. 2. A. *Bellamya bengalensis* f. *typica* (Lamarck) Dorsal view
 B. " " f. " " Apertural view
 C. " " f. *annandalei* (Kobelt) Dorsal view
 D. " " f. " " Apertural view
 E. " " f. *eburnea* (Annandale & Sewell) Dorsal view
 F. " " f. " " Apertural view

This form is more common in pools of rather foul water used for domestic purposes (Annandale & Sewell, 1921).

***Bellamya bengalensis f. doliaris* (Gould)**

1843. *Paludina doliaris* Gould, *Proc. Bost. Soc. Nat. Hist.*, 1 : 144.

1921. *Vivipara bengalensis* (Lamarck) race *doliaris* : Annandale & Sewell, *Rec. Indian Mus.*, 22 : 273-274, pl. 1, fig. 9.

Material examined : Kalahandi district : 10 exs., Mundrapali, N. W. of Khariar Rd. Keonjhar district : 6 exs., West of Ghatgaon. Koraput district : 13 exs., Jagannath sagar, Jeypore. Mayurbhanj district : 1 ex., Simlipal hill. Puri district : 2 exs., Pond at Balugaon.

Measurements :	Length	Width	Height of aperture
	12.7-20.35	10.0-14.65	7.6-11.24 mm.

Distribution : Orissa (as above), Madhya Pradesh, Maharashtra, West Bengal. Elsewhere : Burma.

Remarks : Shell usually smaller and more conical with a large aperture. A biangulation on the body whorl, resulted by the presence of two distant spiral ridges, makes it distinct from other forms.

***B. bengalensis f. eburnea* (Annandale & Sewell)**

(Fig. 2 E, F)

1921. *Vivipara bengalensis* race *eburnea* Annandale & Sewell, *Rec. Indian Mus.*, 22 : 274-275, pl. 2, figs. 1-2.

Material examined : Sambalpur district ; 7 exs., Sambalpur.

Measurements :	Length	Width	Height of aperture
	25.0-31.1	17.9-19.31	13.45-15 mm.

Distribution : Orissa (as above), Madhya Pradesh, West Bengal, Andhra Pradesh and Tamil Nadu,

Remarks : Shell narrower with smaller aperture, whorls narrower and little flattened below the suture, body whorl not perfectly rounded.

This form commonly inhabits large reservoirs, specimens collected from ponds with congested growth of water hyacinths are of smaller size. (Annandale, 1921).

B. bengalensis f. gigantea (Reeve)

1862. *Paludina gigantea* (von dem Busch Mss) Reeve, *Conch. Icon.* 14 : pl. 11, fig. 7.
 1963. *Viviparus bengalensis* race *gigantea* : Ray and Mukherjee, *Rec. Zool. Surv. India*, 61 : 416-417, pl. 18, figs. 6, 6a.

Material examined : Puri district : 9 exs., Pond at Konarak.

<i>Measurements</i> :	Length	Width	Height of aperture
	24.7-50.00	18.2-33.4	14.0-24.5 mm.

Distribution : INDIA : Orissa (as above), Rajasthan, Bihar, West Bengal. Elsewhere : Pakistan.

Remarks : Shell gigantic in size, deeply umbilicated, sutures deep incised, whorls rounded, body whorl broad and large. Young shells thin, translucent with subangulate body whorl.

3. Bellamya crassa (Benson)

(Fig. 4A, B)

1836. *Paludina crassa* Benson, *J. Asiat. Soc. Beng.*, 5 : 745 (Refers to Hutton's MSS)
 1915. *Vivipara crassa* : Preston, *Fauna Brit. India Mollusca*, (Freshwater gastropoda & Pelecypoda) : 86.

Material examined : Balasore district : 2 exs., Chandbally, Orissa ; 7 exs., Orissa.

<i>Measurements</i> :	Length	Width	Height of aperture
	13.1-21.0	10.8-16.65	9.87-13.0 mm.

Distribution : INDIA : Orissa (as above), Assam, Uttar Pradesh, West Bengal, Elsewhere : Bangladesh.

Remarks : Shell thick, subglobose, yellowish green with fine transverse striations, umbilicus open, often canaliculate.

This species is reported to be burying inside mud or sand in shallow waters, often in large groups. (Preston, 1915b).

4. Bellamya dissimilis (Mueller)

(Fig. 3A, B)

1774. *Nerita dissimilis* Mueller, *Hist. Verm. Terr. Fluv.* 2 : 184.
 1960. *Viviparus dissimilis* : Satyamurti, *Bull. Madras Govt. Mus.*, 6(4) : 33-34.

Material examined : Balasore district : 2 exs., Balaramgundi, Chandipore. Bolangir district : 7 exs., Pond near Mahakhand Forest Rest House ; 14 exs., Harishankar hills. Ganjam district : 9 exs., Chatrapur ; 4 exs., Vicinity of Chilka. Kalahandi district : 36 exs., Ditch at

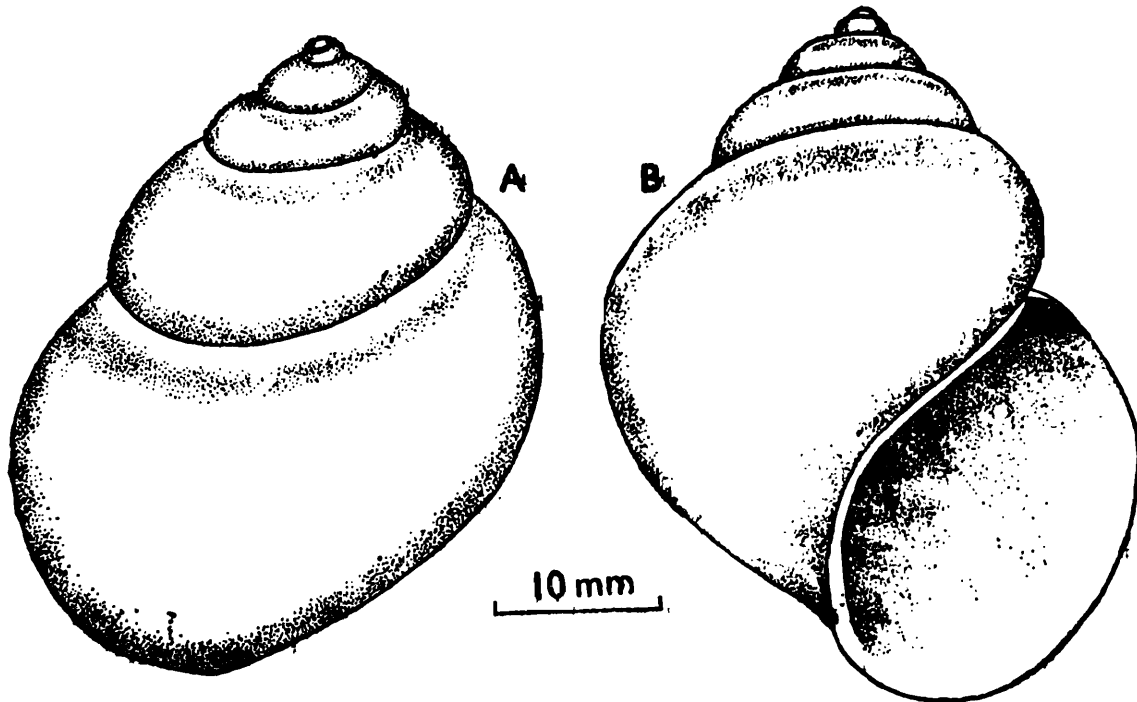


Fig. 3. A. „ *dissimilis* (Mueller) Dorsal view
B. „ „ „ Apertural view

Kesinga ; 4 exs., Pond at Komna ; 4 exs., pond at Khariar ; 44 exs., Paddy field at Nawapara. Koraput district : 4 exs., Nawrangpur. Phulbani district : 12 exs., Mahanadi bank, Baudh. Puri district ; 42 exs., Balugaon, Puri 52 exs., Konarak ; 16 exs., Small stream at Puri. Sambalpur district : 2 exs., Sambalpur. Sundargarh district : 5 exs., Dhutra Rly. station, Sundargarh ; 1 ex., Bank of Bramhani river, Sundargarh.

Measurements :	Length	Width	Height of aperture
	11.4-36.65	9.7-18.0	7.3-13.1 mm.

Distribution : INDIA : Common throughout including Orissa (as above). Elsewhere ; Bangladesh, Burma, Malaysia, Pakistan, Sri Lanka.

Remarks : Shell thin, broadly ovate, with very faint microscopic spiral striations, body whorl subangulate at the periphery.

Two varieties viz. *B. dissimilis* var. *obtusa* Troschel and *B. dissimilis*

var. *subobtusa* Nevill, are also recorded from Orissa. But the minor differences shown by the shells in these may well be within the range of variation seen in the species.

Family III. BITHYNIIDAE

Key to genera

Shell more elongate, outer lip slightly thickened, umbilicus open, usually with an oblique channel...	<i>Digoniostoma</i>
Shell smaller, subglobose, outer lip thin, umbilicus usually closed ...	<i>Gabbia</i>

Genus 3. *Digoniostoma* Annandale, 1920

5. *Digoniostoma pulchella* (Benson)

(Fig. 4 C, D)

1836. *Paludina pulchella* Benson, *J. Asiat. Soc. Beng.*, 5 : 746.

(Refers to No. 9 *Valvata* : Hutton. *J. Asiat. Soc. Beng.*, 3 : 90).

1921. *Digoniostoma pulchella* : Annandale, *Rec. Indian Mus.*, 22 : 541,

Material examined : Koraput district : 1 ex., Stream at Dimla vill. Jeypore. Puri district : 25 exs., freshwater pond near Inspection Bungalow, Konarak.

Measurements :	Length	Width	Height of aperture
	3.8-6.0	3.0-4.25	2.0-2.9 mm.

Distribution : INDIA : Common throughout, including Orissa (as above).

Remarks : Shell elongate, subumbilicate, with conical spire, whorls rounded, sutures impressed, aperture oval.

6. *Digoniostoma cerameopoma* (Benson)

(Fig. 4 G, H)

1830. *Paludina cerameopoma* Benson, *Gleanings in Science*, 2 : 125.

Material examined : Balasore district : 2 exs., Tank at Chandipore. Bolangir district : 1 ex., Pond at Bolangir.

Measurements ;	Length	Width	Height of aperture
	9.2-10.4	6.85-7.5	5.0-5.25 mm.

Distribution : INDIA : Orissa (as above), Assam, Madhya Pradesh, Punjab, Bihar and West Bengal. Elsewhere : Pakistan,

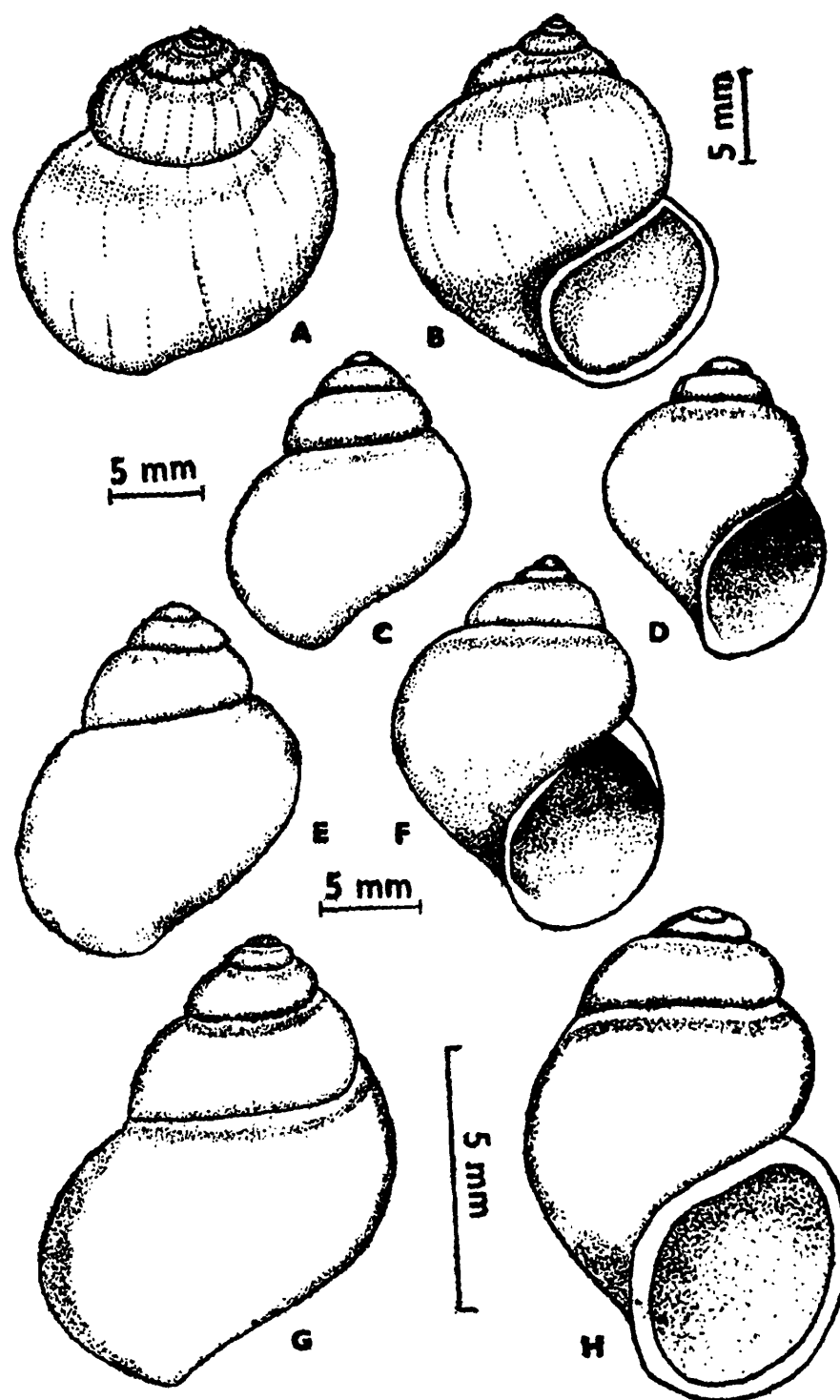


Fig. 4. A. „ *crassa* (Benson) Dorsal view
 B. „ „ „ Apertural view
 C. *Digoniostoma pulchella* (Benson) Dorsal view
 D. „ „ „ Apertural view
 E. *Gabbia orcula* (Frauenfeld) Dorsal view
 F. „ „ „ Apertural view
 G. *Digoniostoma cerameopoma* (Benson) Dorsal view
 H. „ „ „ Apertural view

Remarks : Shell oblong ovate, with rather rapidly increasing whorls, sutures well impressed, umbilicus deep with an oblique channel, peristome slightly reflected.

Genus 4. **Gabbia** Tryon, 1865

7. **Gabbia orcula** (Frauenfeld)

(Fig. 4, E, F)

1862. *Bithynia orcula* Frauenfeld, *Verhandle Zool. Bot. Geschaft*, p. 1154.

1921. *Amnicola (Alocinma) orcula* : Annandale, *Rec. Indian Mus.*, 22 : 540.

Material examined : Bolangir district : 8 exs., Pond near Rly. line, Bolangir. Ganjam district : 47 exs., S. end of Chilka lake. Kalahandi district : 18 exs., Pond at Kesinga.

<i>Measurements</i> :	Length	Width	Height of aperture
	5.4-5.65	4.3-4.8	2.9-3.15 mm

Distribution : INDIA : Orissa (as above), Assam, Punjab, Uttar Pradesh, Rajasthan, West Bengal and Maharashtra.

Remarks : Shell globosely conical, small, smooth, nearly imperforate, whorls 4, rounded.

8. **Gabbia orcula** var. **producta** (Nevill)

(Fig. 5. A, B)

1884. *Bithynia orcula* var. *producta* Nevill, *Hand list Moll. Indian Mus.*, 2 : 37.

1963. *Alocinma orcula* var. *producta* : Ray & Mukherjee, *Rec. zool. Surv. India*, 61 : 420, pl. 19, figs. 1 & 1a.

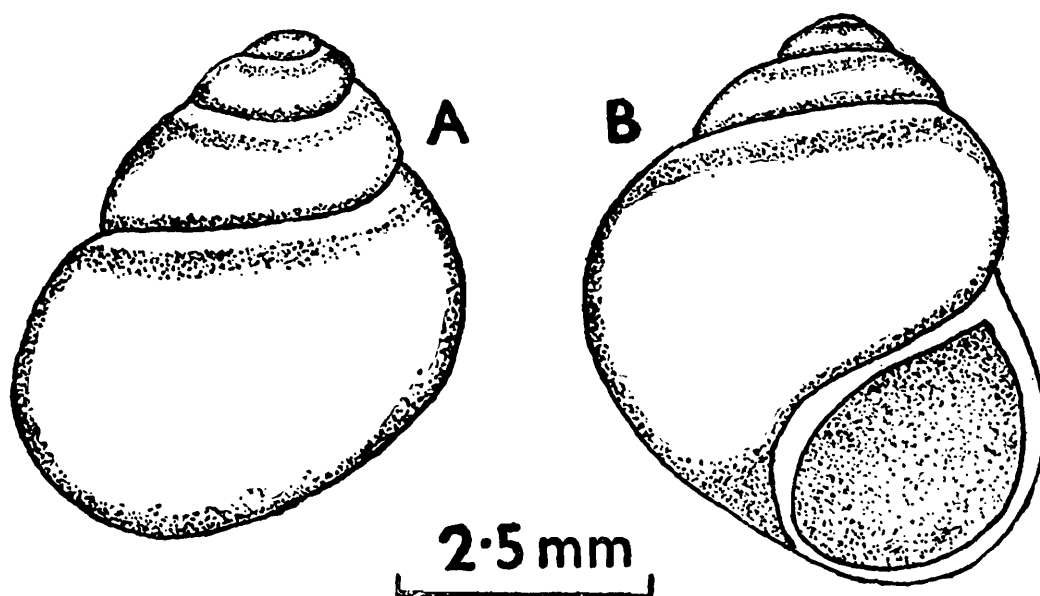


Fig. 5. A. *Gabbia orcula* var. *producta* (Nevill) Dorsal view
B. " " " " Apertural view

Material examined : Phulbani district : 8 exs., Pond near Fisheries office, Phulbani.

Measurements :	Length	Width	Height of aperture
	4.72-6	3.75-4.32	2.6-3.2 mm.

Distribution : INDIA : Orissa (as above), Assam, Punjab, Uttar Pradesh, Rajasthan, Bihar, West Bengal and Maharashtra.

Remarks : Shell narrower and a little more elongated than in typical form.

Family IV. STENOthyridae

Key to genera

Aperture proportionately smaller, subcircular, body whorl more inflated	...	<i>Stenothyra</i>
Aperture proportionately larger, more ovate, body whorl less inflated	...	<i>Gangetia</i>

Genus : 5. *Stenothyra* Benson, 1856.

9. *Stenothyra blanfordiana* (Nevill)

(Fig. 6. A, B)

1880. *Stenothyra blanfordiana* Nevill, *J. Asiat. Soc. Beng.*, 49(2) : 160.

1921. *Stenothyra blanfordiana* : Prashad, *Rec. Indian Mus.*, 28 : 129.

1914. *Stenothyra chilkaensis* Preston, *Rec. Indian Mus.*, 10 : 300, fig. 1.

1915. *Stenothyra obesula* Preston, *Rec. Indian Mus.*, 11 : 297, fig. 4.

Material examined : Ganjam district : 5 exs., Chilka lake, Orissa (Syntypes), 38 exs. Chilka lake. Puri district : 25 exs, Chilka lake near Balugaon.

Measurements :	Length	Width	Height of aperture
	2.62-3.35	1.3-2.15	1.0-1.5 mm.

Distribution : INDIA : Orissa (as above), West Bengal, Tamil Nadu.

Remarks : Shell sub-ventricose, whorls 4-5, increasing rather irregularly, body whorl tumid and subangulate.

10. *Stenothyra minima* (Sowerby)

(Fig. 6. C, D)

1837. *Nematura minima* Sowerby, *Ann. Mag. nat. Hist.*, 1 : 217, fig. 22b.

1914. *Stenothyra orissaensis* Preston, *Rec. Indian Mus.*, 10 : 300, fig. 2.

1921. *Stenothyra minima* : Annandale & Prashad, *Rec. Indian Mus.*,

Material examined : Ganjam district ; 3 exs., Off Satpara, Chilka lake, Orissa (Holotype & Paratype of *S. orissaensis* Preston) ; 32 exs., Chilka lake. Puri district : 23 exs., Off Balugaon, Chilka lake.

Measurements : Length Width
 1.2-2.65 0.75-1.6 mm.

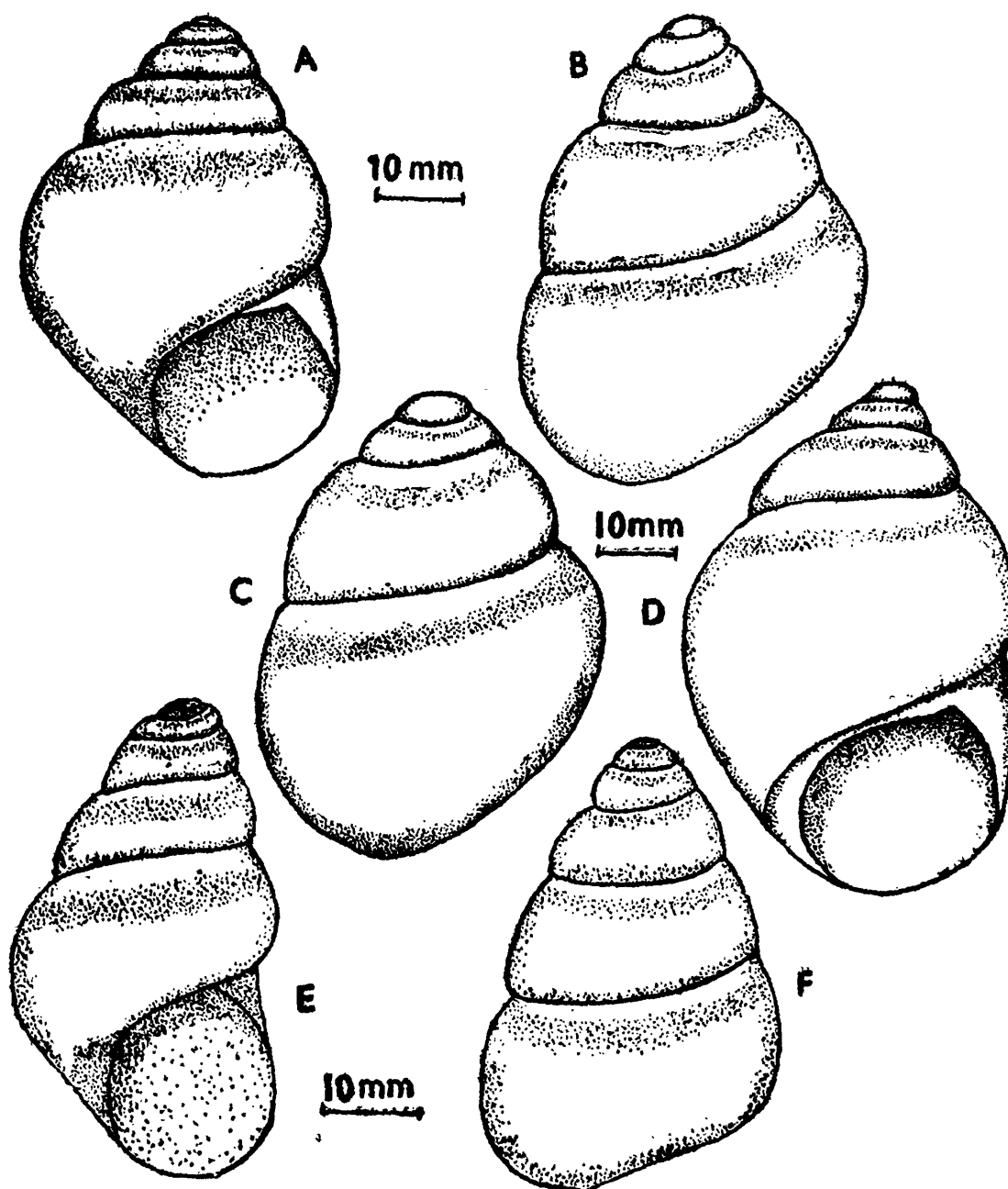


Fig. 6. A. *Stenothyra blanfordiana* (Nevill) Dorsal view
 B. " " " Apertural view
 C. " *minima* (Sowerby) Dorsal view
 D. " " " Apertural view
 E. *Gangetia miliacea* (Nevill) Dorsal view
 F. " " " Apertural view

Distribution : INDIA : Orissa (as above), Gujarat, Maharashtra.
Elsewhere : Sri Lanka.

Remarks : Distinguished from the preceeding species by its more regularly increasing whorls and also by a more convex body whorl.

Genus 6. *Gangetia* Ancey,
11. *Gangetia miliacea* (Nevill)
(Fig. 6 E, F)

1880. *Hydrobia* (*Belgrandia*) *miliacea* Nevill, *J. Asiat. Soc. Beng.*, 49 : 161
1921. *Stenothyra* (*Astenothyra*) *miliacea* : Annandale & Prashad, *Rec. Indian Mus.*, 22 : 134, text fig. 3.
1915. *Stenothyra trigona* Preston, *Rec. Indian Mus.*, 11 : 293.

Material examined : Ganjam district : 14 exs., Opposite Barkul Bungalow, Chilka. (Synrypes of *Stenothyra trigona* Preston) ; 38 exs., Chilka lake.

<i>Measurements ;</i>	Length	Width
	1.5-2.52	0.9-1.4 mm.

Distribution : Orissa (as above), West Bengal (Gangetic delta), Kerala (Cochin backwater).

Remarks : Shell minute, conically ovate, narrowly perforate with a pointed apex, whorls 4-5, convex, aperture well rounded, body whorl smooth.

Commonly occurs among weeds in brackishwater pools.

Family V. THIARIDAE
Genus 7. *Thiara* Roeding, 1798

Key to Subgenera

Shell less elongate (up to 9 whorls), strongly sculptured with elevated axial and spiral ridges, giving a granular appearance ...	<i>Tarebia</i>
Shell more elongate (upto 12 whorls), spiral and axial striae giving a tuberculate, appearance ...	<i>Melanoides</i>

12. *Thiara* (*Melanoides*) *tuberculata* (Mueller)
(Fig. 7 A)

1774. *Nerita tuberculata* Muller, *Hist. Verm. Terr. Fluv.*, 2 : 191.
1976. *Melanoides* (*Melanoides*) *tuberculata* : Starmuehlner. *Ann. Natur. Hist. Mus. Wien.*, 80 : 591.

Material examined : Balasore district : 4 exs., Canal near Forest Rest House, Lathore. Bolangir district : 2 exs., Stream near Hari-shankar. Cuttack district : 16 exs., Freshwater pond at Cuttack. Ganjam district : 1 ex., Rambha. Kalahandi district : 14 exs., Asha Sagar, Bhawanipatna ; 6 exs. Tank near Katabanji ; 54 exs., Tel river bed, Kesinga ; 33 exs., Jonk river bed, Khariar Rd ; 11 exs., Tank at Khariar ; 20 exs. Tank at Gotuma village, Khariar ; Sundari river bed, Komna. Koraput district : 12 exs., Jagannath Sagar, Jeypur ; 115 exs., Stream, N. E. of Jeypore ; 24 exs., Stream at Dimla village ; 9 exs., Canal at Badchindri village ; 57 exs., Stream at Ambodala ; 37 exs., Stream at Kanaipur, near Koraput ; 20 exs., Pond near Bagra water falls, S. E. of Jeypore. Mayurbhanj district : 2 exs., Baripada. Phulbani district : 3 exs., Fish farm at Baudh. Bani district : 4 exs., Pond near Balugaon. Sambalpur district : 3 exs., Badruma village ; 3 exs., Hirakund Dam area, Sambalpur. Sundargarh district : 31 exs., Brahmani river, Bonaigarh.

Measurements :	Length	Width	Height of aperture
	16.0-30.5	6.4-10	6.1-10

Distribution : INDIA : Orissa (as above) and Common throughout, except Kashmir. Elsewhere : North Africa, S. E. Asia and S. China. Malaysia, Malay Archipelago, N. Australia and various Pacific Islands.

Remarks : Shell rather narrowly elongate with well rounded whorls, distinctly sculptured with vertical ribs and spiral striae and also dark brown dots or streaks here and there.

Shell collected from ponds or tanks are typically narrowly elongate and distinctly sculptured, but those collected from sandy river beds are comparatively broader with worn out sculptures and are more prone to decollate with age.

13. *Thiara (Tarebia) lineata* (Gray)

(Fig. 7 B)

1828. *Helix lineata* Gray in *Wood's Index Test. Suppl.*, p. 24, fig. 68.

1915. *Tiara (Tarebia) lineata* : Preston, *Fauna Brit. India. Mollusca (Freshwater gastropoda and pelecypoda)* : 34.

Material examined : Cuttack district : 10 exs., Cuttack. Kalahandi district : 95 exs., Nullah at Bhawanipatna ; 71 exs. Tel river at Kesinga ; 6 exs., Tank at Katabanji ; 13 exs., Asha Sagar, Bhawanipatna.

Koraput district : 16 exs., pond at Jeypore. Phulbani district : 56 exs., S. bank of Mahanadi river. Puri district : 213 exs., Muddy shore at Chilka, Balugaon.

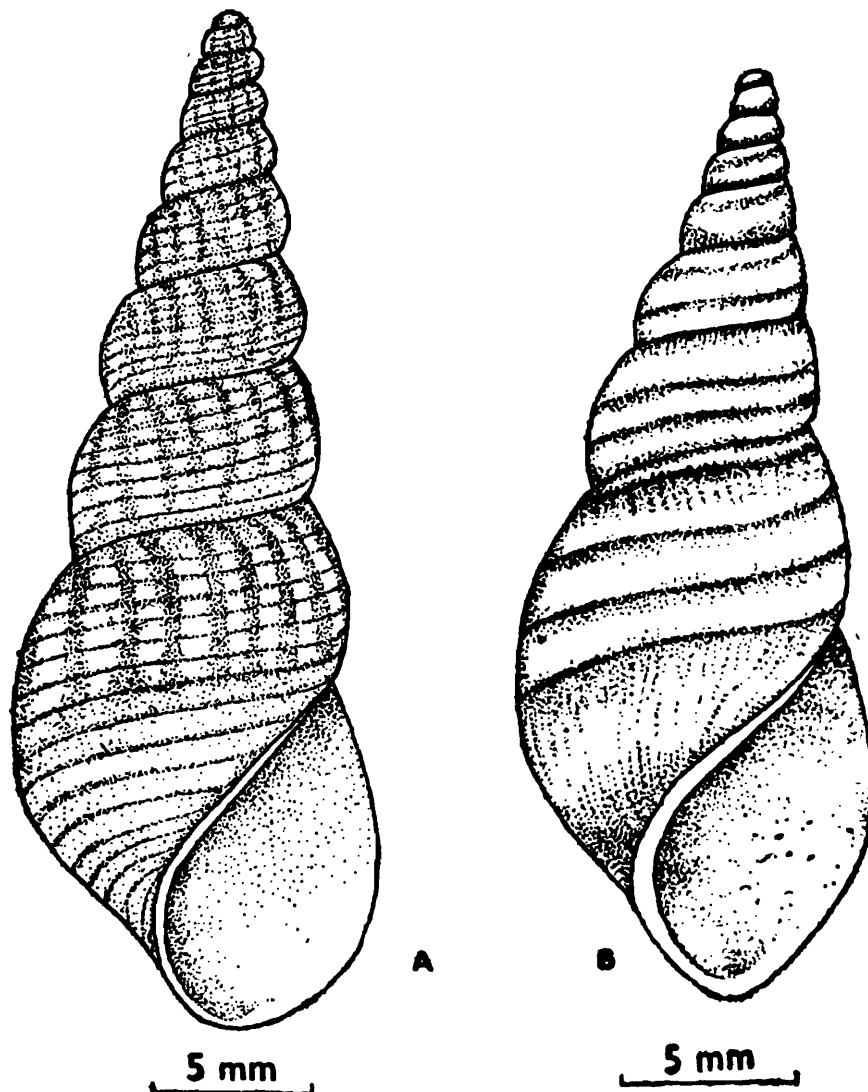


Fig. 7. A. *Thiara (Melanoides) tuberculata* (Mueller)
B. „ *(Tarebia) lineata* (Gray)

<i>Measurements :</i>	Length	Width	Height of aperture
	11.5-28.8	4.5-12.5	4.6-13.8 mm.

Distribution ; INDIA : Orissa (as above), Assam, Uttar Pradesh, Maharashtra, Madhya Pradesh, Bihar and West Bengal. Elsewhere : Bhutan, Burma and Sri Lanka.

Remarks : Distinguished from the preceeding species by broader

shell and a proportionately wider body whorl, also by dark, spiral, raised lines. Upper whorls are rather nodulose.

Order BASOMMATOPHORA

Family VI. LYMNAEIDAE

Genus 8. *Lymnaea* Lamarck, 1799

This genus is a known intermediate host of trematode parasites. Patnaik (1968, 1971) and Patnaik and Ray (1966, 1967, 1980) reported different larval stages of *Echinostoma revolutum* and *Fasciola gigantica* from both the species of *Lymnaea*, viz. *L. acuminata* and *L. luteola* from Orissa.

Shells in this genus are much variable and based on these variations a large number of infraspecific forms have been described under both the species by various authors. These forms are fairly constant and are retained here as such. The following forms have been identified in the material studied.

Key to species of Lymnaea

The outerlip very much expanded and convex in outline, spire acuminate	...	<i>acuminata</i>
The outerlip not very much expanded, spire less acuminate	...	<i>luteola</i>

14. *Lymnaea* (*Pseudosuccinea*) *acuminata*

14a. *Lymnaea* (*Pseudosuccinea*) *acuminata* f. *typica* Lamarck

(Fig. 8 A, B)

1822. *Lymnaea acuminata* Lamarck, *Hist. nat. Anim. sans. Vert.*, 6 Pt. 2 : 160.

1925. *Lymnaea* (*Pseudosuccinea*) *acuminata* ; Annandale & Rao, *Rec. Indian Mus.*, 27 : 177.

Material examined : Balasore district : 6 exs., Balasore. Ganjam district : 3 exs., Chatrapur. Kalahandi district : 13 exs., Malkangiri ; 4 exs., Pond at Jaypatna ; 63 exs., Pratap Sagar, Nowrangpur ; 17 exs., Paddy field at Khariar ; 49 exs., Pond at Bhawanipatna. Koraput district : 12 exs., Pond at Dimla village ; 11 exs., Paddy field near Jeypore ; 5 exs., Ditch at Koraput. Mayurbhanj district : 3 exs., Ditch at Mayurbhanj. Puri district : 15 exs., Pond at Konarak. Sambalpur district : 9 exs., Nullah at Sambalpur.

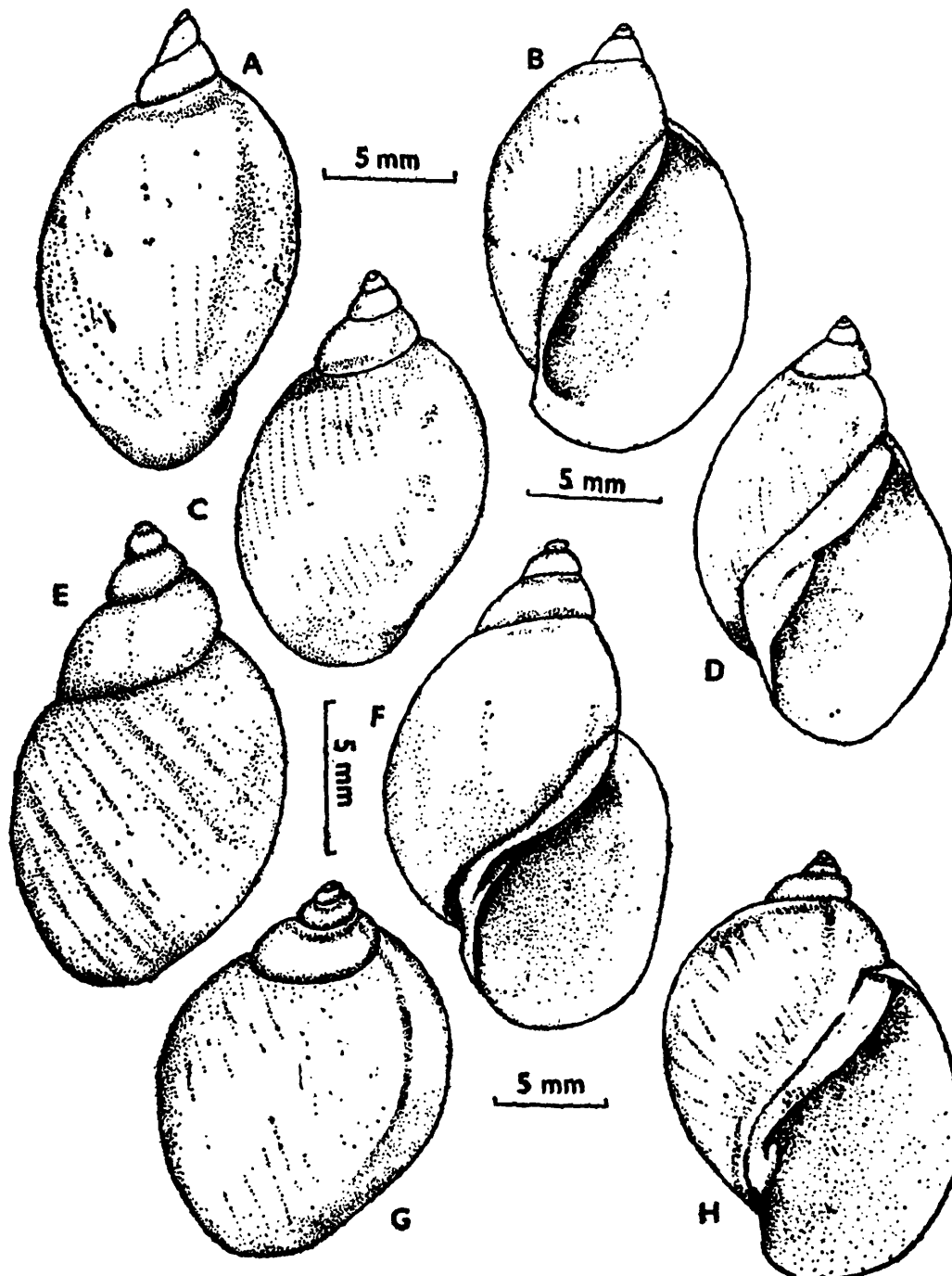


Fig. 8. A. *Lymnaea (Pseudosuccinea) acuminata* f. *typica* Lamarck Dorsal view
 B. " " " " Apertural view
 C. " " " f. *australis* Annandale & Rao Dorsal view
 D. " " " " Apertural view
 E. " " " f. *impura* Troschel Dorsal view
 F. " " " " Apertural view
 G. " " " f. *ovalis* Gray Dorsal view
 H. " " " " Apertural view

<i>Measurements :</i>	Length	Width	Height of aperture
	9.2-20.55	6.0-13.45	6.8-17.5 mm.

Distribution : INDIA : Common throughout, including Orissa (as above). Elsewhere : Bangladesh, Burma.

Remarks : Shell thin, oblong ovate, smooth, body whorl greatly inflated, spire short with an acuminate apex. Aperture wide, columellar lip distinctly twisted.

This species usually occurs in permanent water bodies.

14 b. *Lymnaea* (P.) *acuminata* f. *chlamys* Benson
(Fig. 9A, B)

1836. *Limnaea chlamys* Benson. *J. Asiat. Soc. Beng.*, 5 : 744.

Material examined : Kalahandi district : 7 exs., Paddy fields at Khariar.

<i>Measurements :</i>	Length	Width	Height of aperture
	13.4-22.75	7.75-14.3	10.0-18.95 mm.

Remarks : Spire in this form is a little larger but narrower than in *typica*, columella more strongly twisted.

14 c. *Lymnaea* (P.) *aeuminata* f. *gracilior* Martens
(Fig. 9C, D)

1881. *Limnaea acuminata* var. *gracilior* Martens. *Conch. Mithiel.*, 1 : 77.

Material examined : Ganjam district : 7 exs., Ganjam, Orissa.

<i>Measurements :</i>	Length	Width	Height of aperture
	10.0-17.25	4.0-7.9	7.5-11.9 mm.

Remarks : Shell in this form is narrowest with a comparatively long spire. Fresh shells are greyish to light pink in colour.

14 d. *Lymnaea* (P.) *acuminata* f. *rufescens* Gray
(Fig. 9E, F)

1820. *Limnaea rufescens* Gray, in Sowerby's *Genera of shells*, 1 : *Limnaea*, fig. 2.

Material examined : Kalahandi district : 29 exs., Pond at Katabanji, Bhawanipatna ; 42 exs., Asha Sagar, Bhawanipatna. Puri district : 6 exs., Sur Lake, Puri.

Measurements :	Length	Width	Height of aperture
	20.8-32.1	10.0-16.0	15.0-25.0 mm.

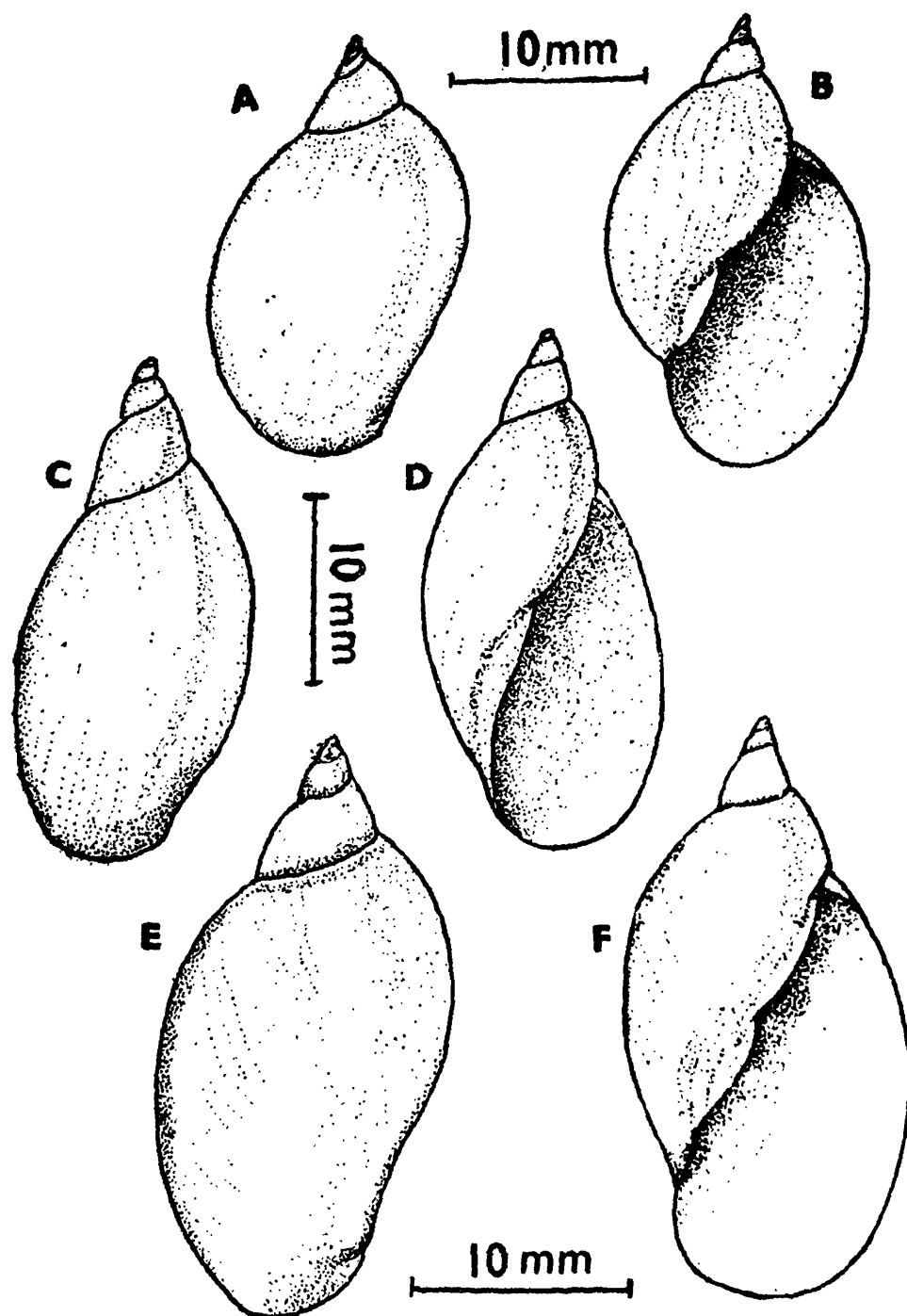


Fig. 9. A. *Lymnaea (Pseudosuccinea) acuminata* f. *chlamys* Benson Dorsal view
 B. " " " " Apertural view
 C. " " " f. *gracilior* Martens Dorsal view
 D. " " " " Apertural view
 E. " " " f. *rufescens* Gray Dorsal view
 F. " " " " Apertural view

Remarks : Shell uniformly narrowly-elongate with a long spire. Aperture shorter and uniformly less expanded.

15. *Lymnaea* (*Pseudosuccinea*) *luteola* Lamarck

15a. *Lymnaea* (P.) *luteola* f. *typica* Lamarck
(Fig. 10A, B)

1822. *Limnaea luteola* Lamarck, *Hist. nat. Anim. sans. Vert.*, 6 pt. 2 : 160.

1925. *Limnaea* (*Pseudosuccinea*) *luteola* : Annandale & Rao, *Rec. Indian Mus.* 27 : 183.

Material examined : Bolangir district : 5 exs., Mahakhand. Cuttack district : 11 exs., From a pond at Cuttack. Ganjam district : 7 exs.,

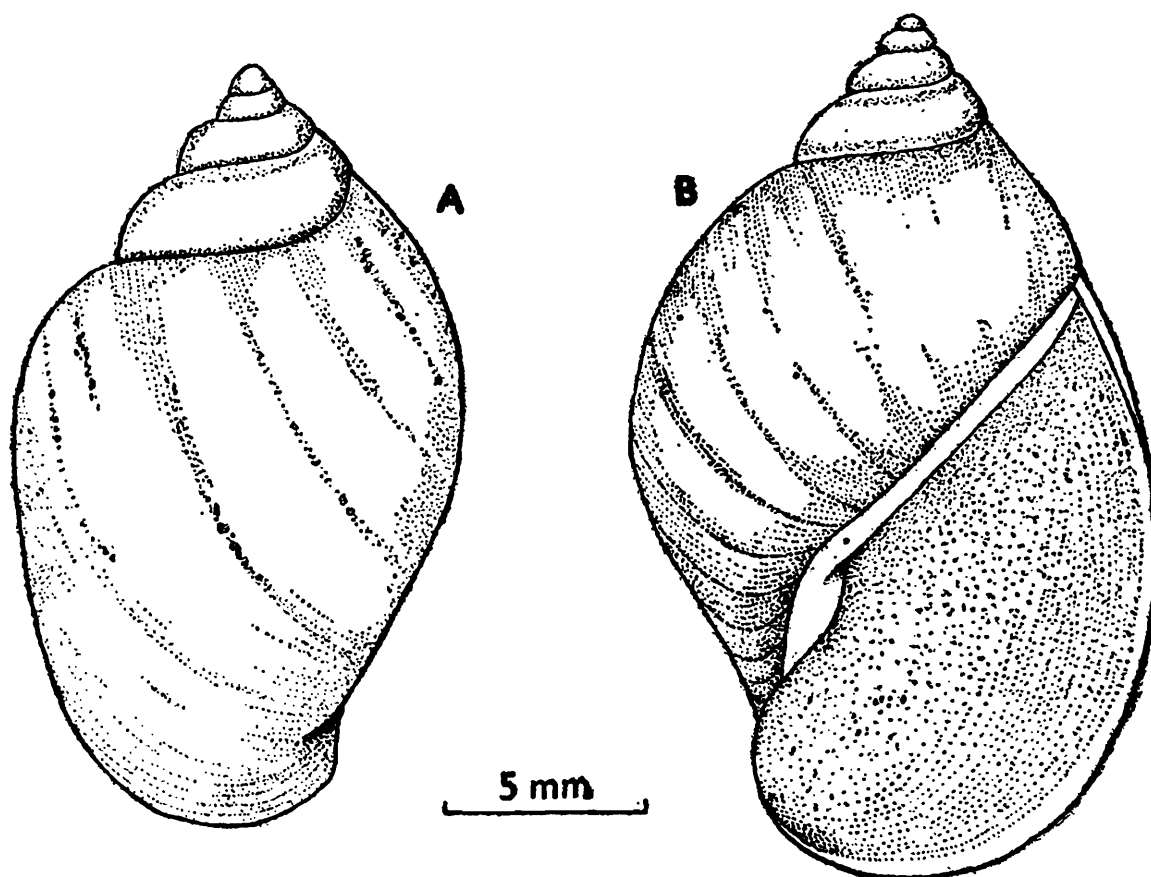


Fig. 10. A. *Lymnaea* (*Pseudosuccinea*) *luteola* f. *typica* Lamarck Dorsal view
B. " " " " " Apertural view

Chilka. Denkanal district : 17 exs., Bagmunda tank, Denkanal. Kalahandi district : 15 exs., Pond at Nowrangpur ; 30 exs., Ditch at Nawapara ; 39 exs., Pond near College, Bhawanipatna. Koraput district : 37 exs., Jagannath Sagar ; 77 exs., Canal at Badchindri village ; 17 exs., Pond at Pottangi ; 8 exs., Paddy field on way to Bagra water falls. Phulbani district : 47 exs., Pond near Kalinga garden ; 8 exs., Pond at G. Udaygiri.

Measurements :

Length	Width	Height of aperture
13.25-25.0	8.28-14.7	10.9-17.62 mm.

Distribution : INDIA : Common throughout, including Orissa (as above).

Remarks : Shell thin and glossy, ovate, body whorl slightly less inflated and laterally compressed. Spire longer than in preceding species and more gradually tapering. Aperture ovate and less expanded, angularly narrowed above, rounded below.

This species is comparatively less particular about its habitat. It is very often found in temporary water bodies, which dry up in summer.

15b. *Lymnaea* (P.) *luteola* f. *australis* Annandale & Rao
(Fig. 8C, D)

1925. *Limnaea* (*Pseudosuccinea*) *luteola* f. *australis* Annandale and Rao, *Rec. Indian Mus.* 27 : 184.

Material examined : Balasore district : 3 exs., Tank at Chandipur. Cuttak district : 1 ex., Cuttack. Ganjam district : 19 exs., Pond at Gopalpur. Koraput district : 9 exs., Paddy field, Patragadda, Jeypore.

Measurements :

Length	Width	Height of aperture
9.14-15.0	6.0-9.15	6.85-11.0 mm.

Remarks : A smaller form, spire comparatively longer, body whorl well rounded, sutures rather shallow.

15c. *Lymnaea* (P.) *luteola* f. *impura* Troschel
(Fig. 8E, F)

1837. *Limnaeus impurus* Troschel, in Weigman's *Arch. f. Naturges.* 3 : 172.

Material examined : Bolangir district : 1 ex., Kasaripara village, Bolangir. Balasore district : 3 exs., Balasore. Ganjam district : 4 exs., Barkuda Island, Chilka. Kalahandi district : 17 exs., Paddy field at Komna. Keonjhar district : 12 exs., 8 kms. E. of Ghatgaon. Koraput district : 13 exs., Koraput.

Measurements :

Length	Width	Height of aperture
11.2-16.26	6.4-8.8	8.12-11.1 mm.

Remarks : Differs from the typical form in being narrower and the spire being a little more elongated and pointed. The apical portion very often appears black.

15 d. *Lymnaea* (P.) *luteola* f. *ovalis* Gray

(Fig 8 G, H)

1820. *Limnaea ovalis* Gray, in Sowerby's *Genera of Shells*, 1 : *Limnaea*, fig. 4.

Material examined : Ganjam : 9 exs.. Rambha, Chilka. Koraput district : 4 exs., Reservoir at Semiliguda ; 4 exs., Chapragon ; 47 exs., Marshy field at Pottangi. Mayurbhanj district : 7 exs., Jheel at Ekastia.

<i>Measurement</i> :	Length	Width	Height of aperture
	12.75-19.1	10.0-18.75	10.0-10.1 mm

Distribution : INDIA : Throughout and Andamans. Elsewhere : Burma and Sri Lanka.

Remarks : Shell subglobose, body whorl inflated without much compression, spire short and abruptly pointed.

Family VII. PLANORBIDAE

Key to genera

Shell comparatively large, (more than 1 cm.)	
whorls convex, aperture ear-shaped	...
	<i>Indoplanorbis</i>
Shell small (less than 1 cm.), disc-like whorls	
flattened, aperture wide	...
	<i>Gyraulus</i>

Genus 9. *Planorbidae* Annandale & Prashad, 192116. *Indoplanorbis exustus* (Deshayes)

(Fig 11 A, B, C)

1834. *Planorbis exustus* Deshayes, *Voyage Belanger Indes Orientales*, Zoologie : 417, pl. 1, figs. 11-13.

1921. *Indoplanorbis exustus* : Annandale & Prashad, *Rec. Indian Mus.*, 22 : 472.

Material examined : Bolangir district : 32 exs., Pond at Kasari-para ; 11 exs., Pond at Chatamakhah village. Cuttack district : 5 exs., Freshwater tank at Cuttack, Denkanal district : 7 exs., Bagmundi tank, Denkanal. Ganjam district : 9 exs., Mahana tank ; 3 exs., Tank at Talcher. Kalahandi district : 12 exs., Jagannath Sagar, Jeypore ; 22 exs., pond at Dimla village ; 36 exs., pond at Malkangiri ; 11 exs., Tank at Kesinga ; 19 exs., pond at Komna. Keonjhar district : 15 exs., Tank at Ghatgaon, Joshipore. Koraput district : 42 exs.,

pond at Pottangi ; 7 exs., pond at Nowrangpur. Phulbani district : 5 exs., S. bank of Mahanadi, Baudh ; 2 exs., Paddy field at Phulbani. Puri district : 9 exs., Balugaon : 7 exs., Pond at Konarak ; 2 exs.,

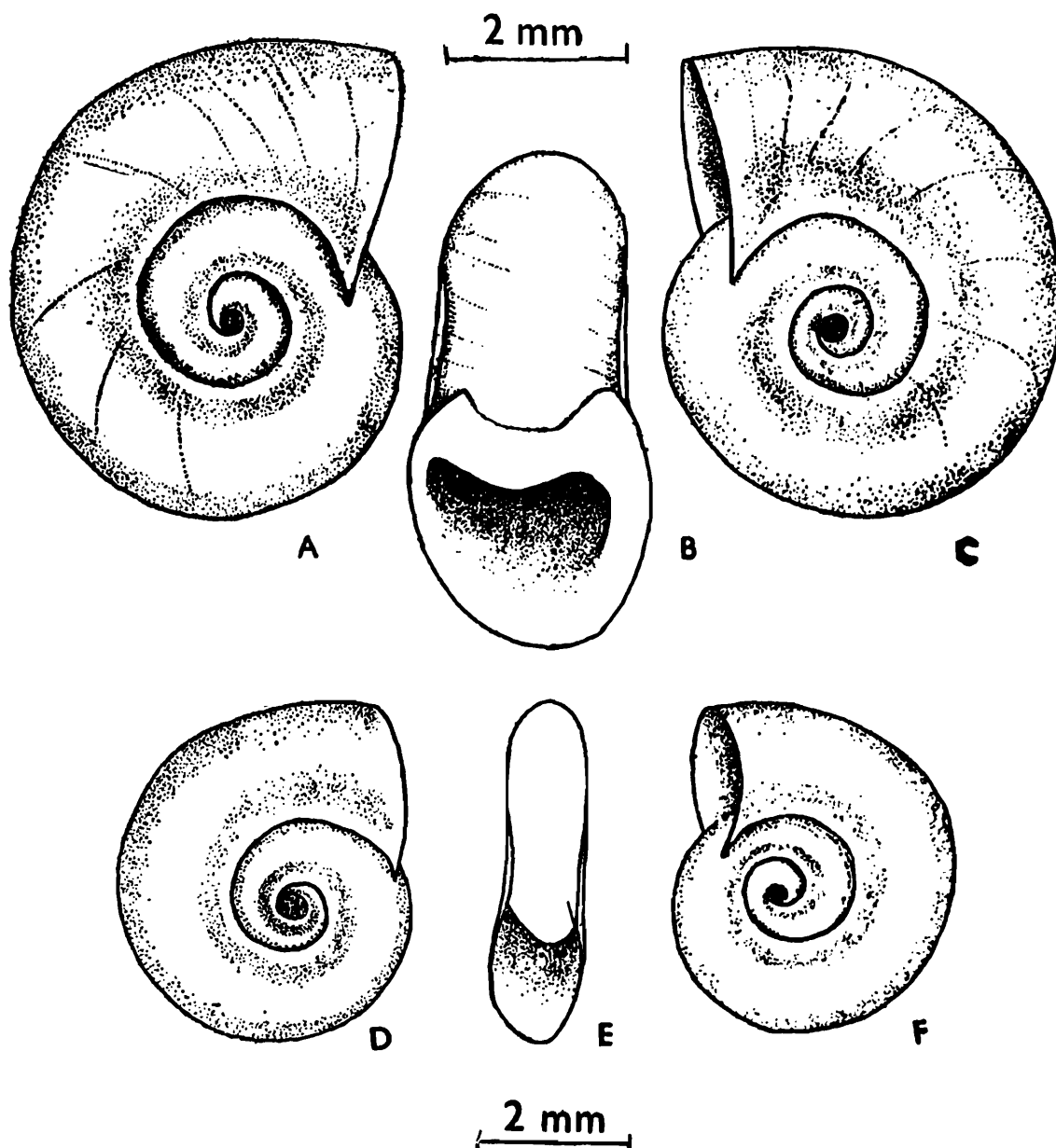


Fig. 11. A, B, C. *Indoplanorbis exustus* (Deshayes)

D, E, F. *Gyraulus convexiusculus* (Hutton)

Gikarpara, Puri, Puri. Sambalpur district : 11 exs., Wet field at Jharsuguda. Sundargarh district : 3 exs., pond near Dhutra Rly. Station ; 8 exs. pond at Bonaigarh.

Measurements :

Height of shell
4.7-6.95

Width of shell
6.35-17 mm.

Distribution : INDIA : Common throughout, including Orissa (as above). Elsewhere : Same as for the genus.

Remarks : This species is a known vector snail and is implicated as intermediate host for the largest number of parasites.

Genus 10. **Gyraulus** Charpentier, 1837

17. **Gyraulus convexiusculus** (Hutton)

(Fig. 11, D, E, F)

1849. *Planorbis convexiusculus* Hutton, *J. Asiat. Soc. Beng.*, 18(2) : 657.

1956. *Gyraulus convexiusculus* : Benthem Jutting, *Treubia*, 23(2) : 463.

Material examined : Kalahandi district : 38 exs., Pratap Sagar, Nowrangpur : 109 exs., Tank at Khariar ; 18 exs., Asha Sagar, Bhawanipatna. Koraput district : 31 exs., Jagannath Sagar, Jeypore ; 11 exs., Patragadda stream, near Jeypore. Puri district : 8 exs., Pond at Puri.

<i>Measurements</i> :	Height of shell	Width of shell
	1.25-1.7	3.3-7.3 mm.

Distribution : INDIA : Common throughout, including Orissa (as above). Elsewhere : Extends from Iran to Philippines.

Remarks : Thin, small, greatly depressed, whorls 4-5, body whorl sub-angulate, widely umbilicate exposing subsequent whorls, aperture ovate-lunate.

These snails are very often seen to float on the water surface in up side down position, with upwardly directed foot.

Family VII. ANCYLIDAE

Genus 11. **Ferrissia** Walker, 1903.

18. **Ferrissia baconi** (Bourguignat)

(Fig. 12 A)

1853. *Ancylus baconi* Bourguignat. *J. Conch. Paris*, 4 : 181.

1921. *Ancylus (Ferrissia) baconi* : Annandale & Prashad, *Rec. Indian Mus.*, 22 : 592.

Material examined : 2 exs., Orissa.

Distribution : INDIA : Orissa (as above) and West Bengal. Elsewhere : Burma, Philippines.

Remarks : Usually occurs in stagnant or moderately flowing waters, attached to stones, pebbles or leaves etc.

Class BIVALVIA

Order ARCOIDA

Family VIII. ARCIDAE

Genus 12. *Scaphula* Benson, 1834

19. *Scaphula celox* Benson

(Fig. 12 B, C)

1836. *Scaphula celox* Benson, *J. Asiat. Soc. Beng.*, 5 : 750, pl. 7, figs. 23.

1915. *Scaphula celox* : Preston, *Fauna Brit. India. Mollusca, Freshwater gastropoda and pelecypoda* : 129.

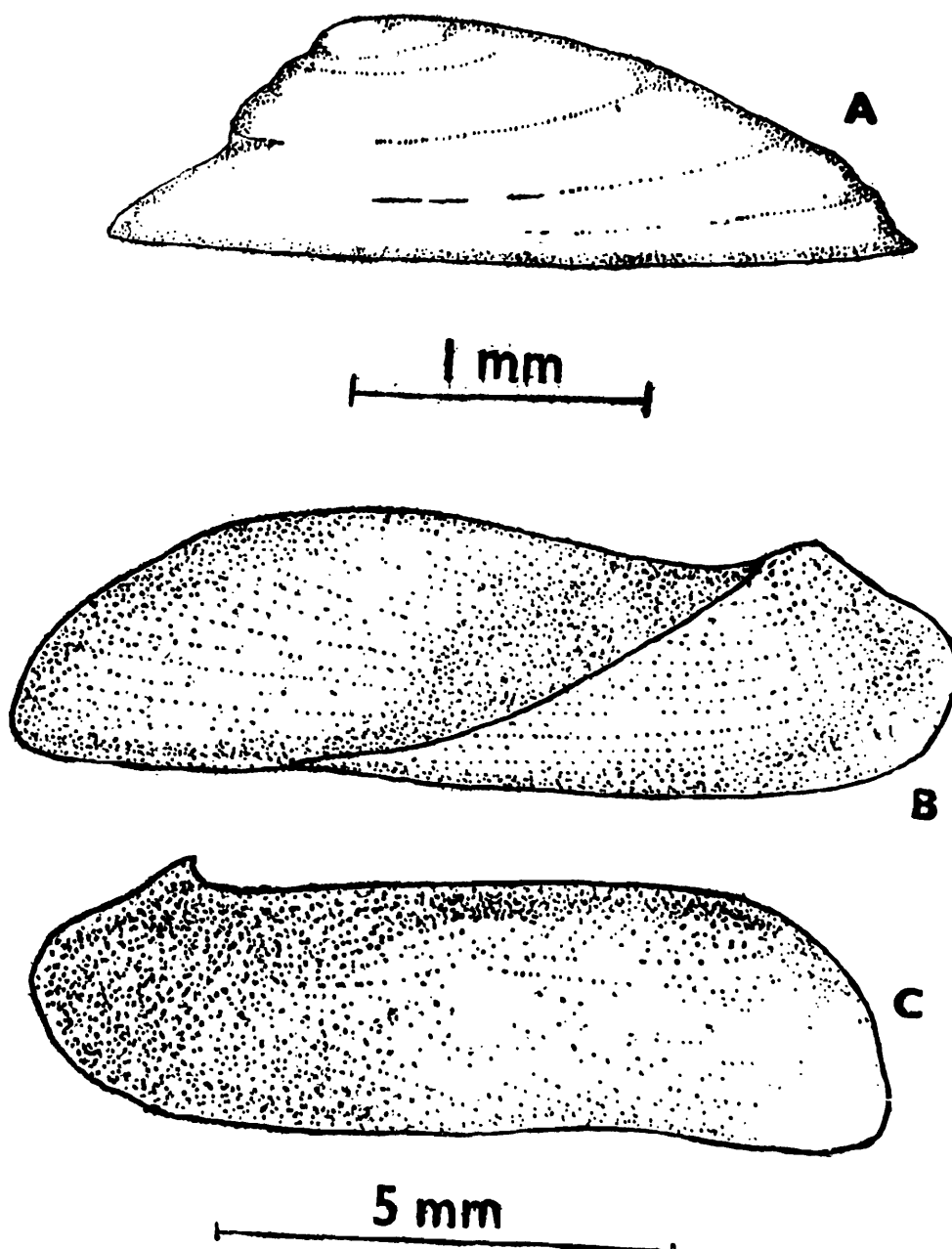


Fig. 12. A, *Ferrissia baconi* (Bourguignat)
B, C, *Scaphula celox* Benson

Material examined : Sambalpur district : 8 exs., Durgapali pond, Mahanadi river, near Sambalpur.

<i>Measurements</i> :	Length	Width	Thickness
	8.27-9.83	3.9-5.18	2.65-3.5 mm.

Distribution : INDIA : Orissa (Mahanadi), Uttar Pradesh and West Bengal.

Remarks : Shell small, elongate, tumid, posterior umbonal carina very distinct, umbo prominent.

Order UNIONOIDA

Family IX UNIONIDAE

Key to genera

Shell thin and broadly elongate, cardinals compressed-elongate, lamellar teeth long ...	<i>Lamellidens</i>
Shell thick and rounded to subrhomboid, tumid, cardinals heavy, vertically striate, lamellar teeth short ...	<i>Parreysia</i>

Genus 13. *Lamellidens* Simpson, 1900

20. *Lamellidens marginalis* (Lamarck) (Fig. 13 A, B)

1819. *Unio marginalis* Lamarck, *Hist. nat. Anim. Sans. Vert.* 4 : 79.

1921. *Lamellidens marginals* : Prashad, *Rcc. Indian Mus.* 22 : 606, fig. 294.

Material examined : Kalahandi district : 2 exs., Asha Sagar, Bhawanipatna ; 16 exs., Nullah at Ambodala. Phulbani district : 4 exs., Fisheries ponds at Masterpada, 3 exs., pond near Balliguda ; 12 exs., Fish farm at Baudh. Puri district : 9 exs., Pond at Konarak. Sambalpur district : 5 exs., Sambalpur.

<i>Measurements</i> :	Length	Width	Thickness
	64.4-93.35	34.0-49.2	20.3-31.6.

Distribution : Widely distributed in India including Orissa (as above). Elsewhere : Bangladesh, Burma and Sri Lanka.

Remarks : Shell oblong ovate, brown to dark brown with a lighter border along the margin, posterior end roundly angular, a short post-

dorsal wing present, anterior end short and rather narrow, ventral margin slightly contracted in the middle.

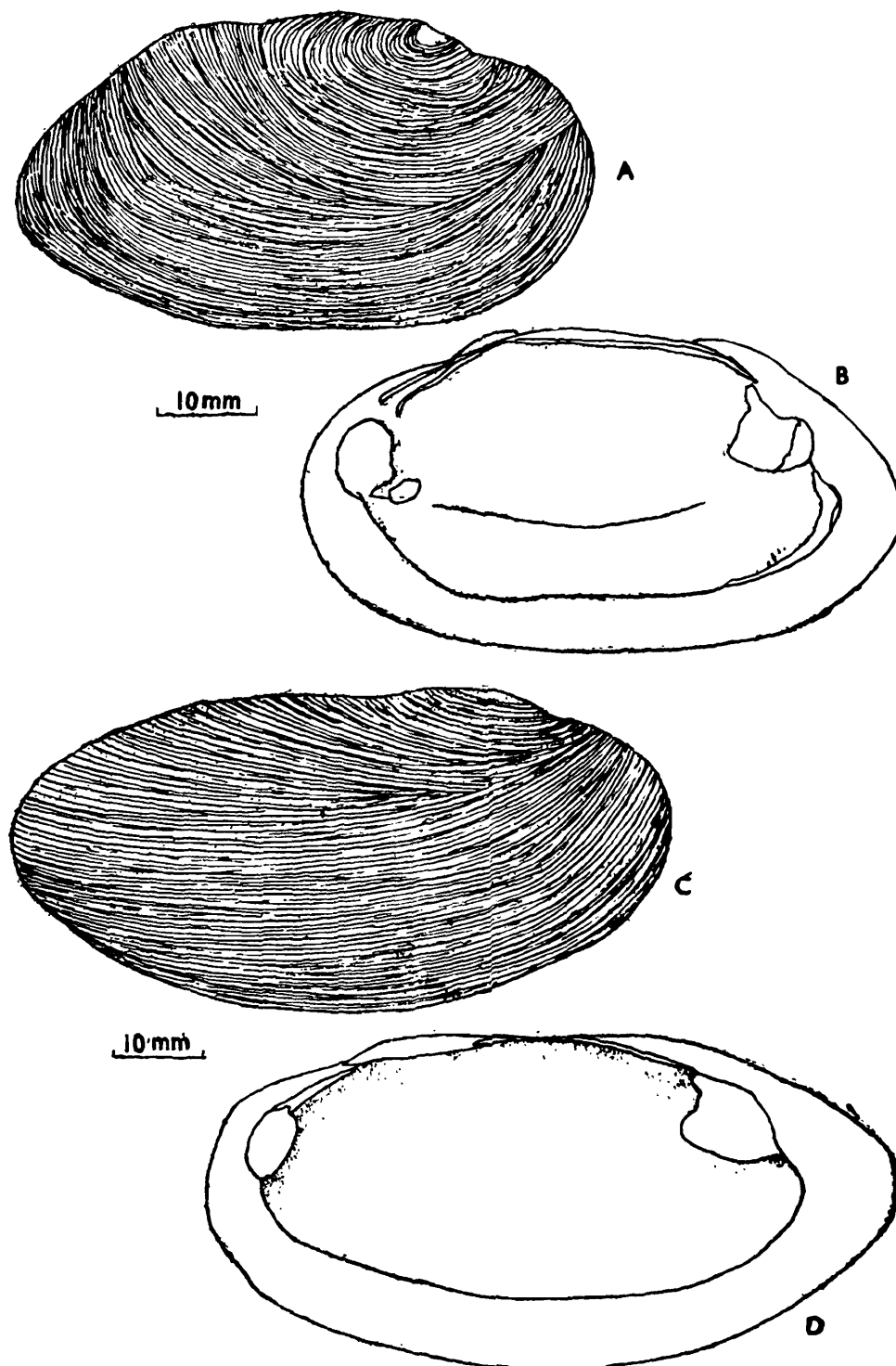


Fig. 13. A, B. *Lamellidens marginalis* (Lamarck)
C, D. „ *corrianus* (Lea)

21. *Lamellidens corrianus* (Lea)

(Fig. 13 C, D)

1834. *Unio corrianus* Lea, *Trans. Amer. Phil. Soc.*, (2) 5 : 65.1922. *Lamellidens corrianus* : Prashad, *Rec. Indian Mus.*, 24 : 106.

Material examined : Kalahandi district : 5 exs., Pond at Nowrangpur ; 4 exs., Pond near Jonk river, Khariar Rd. Koraput district : 14 exs., Nullah at Koraput ; 7 exs., Pond near Jeypore ; 1 valve, Stream at Dimla village, Jeypore. Phulbani district : 1 ex., Fish farm at Baudh ; 5 exs., Ditch at Balliguda, 6 exs., Pond at Phulbani. Puri district : 7 exs., Konark. Sambalpur district : 7 valves, Sambalpur. Sundargarh district : 4 exs. Bank of Brahmani River, Bonaigarh.

<i>Measurements</i> ;	Length	Width	Thickness
	62.75-91.0	34.2-46.0	20.0-32.0 mm.

Distribution : Common throughout India, Bangladesh and Burma.

Remarks : Shell comparatively narrower, dorsal margin more or less straight, posterior end more pointed, umbonal region more inflated, uniformly dark-brown, without lighter border along the ventral margin.

Genus 14. *Parreysia* Conrad, 185322. *Parreysia* (*Parreysia*) *corrugata* var. *nagpoorensis* (Lea)

(Fig. 14 A, B)

1860. *Unio nagpoorensis* Lea, *Proc. Acad. nat. Sci. Philad.*, 6 : 331.1960. *Parreysia* (*Parreysia*) *corrugata* var. *nagpoorensis* : Satyamurthi, *Bull. Madras Govt. Mus.*, 6(4) : 144.

Material examined : Kalahandi district : 3 exs., Tel river bed, Kisinga ; 6 exs., Pond near Jonk river, Khariar Rd. ; 1 ex., Sundari river, Komna. Phulbani district : 3 exs., Chuvaldua river bed, Kotgarh ; 12 exs., Southern Bank of Mahanadi river, Baudh ; 2 exs., Gomadi river, Balliguda. Sambalpur district : 23 exs., Sambalpur.

<i>Measurements</i> :	Length	Width	Thickness
	31.6-50.2	24.1-35	22.7-27.15 mm.

Distribution : INDIA : Orissa (as above), Assam, Gujarat, Maharashtra, West Bengal, Andhra Pradesh and Tamil Nadu.

Remarks : Shell inequilateral, elongately ovate, anterior margin narrow, posterior margin gradually sloping with a broadly rounded end

and oblique divaricating ridges, radial ridges present on beaks. Cardinals strong, compressed and rather crenulated.

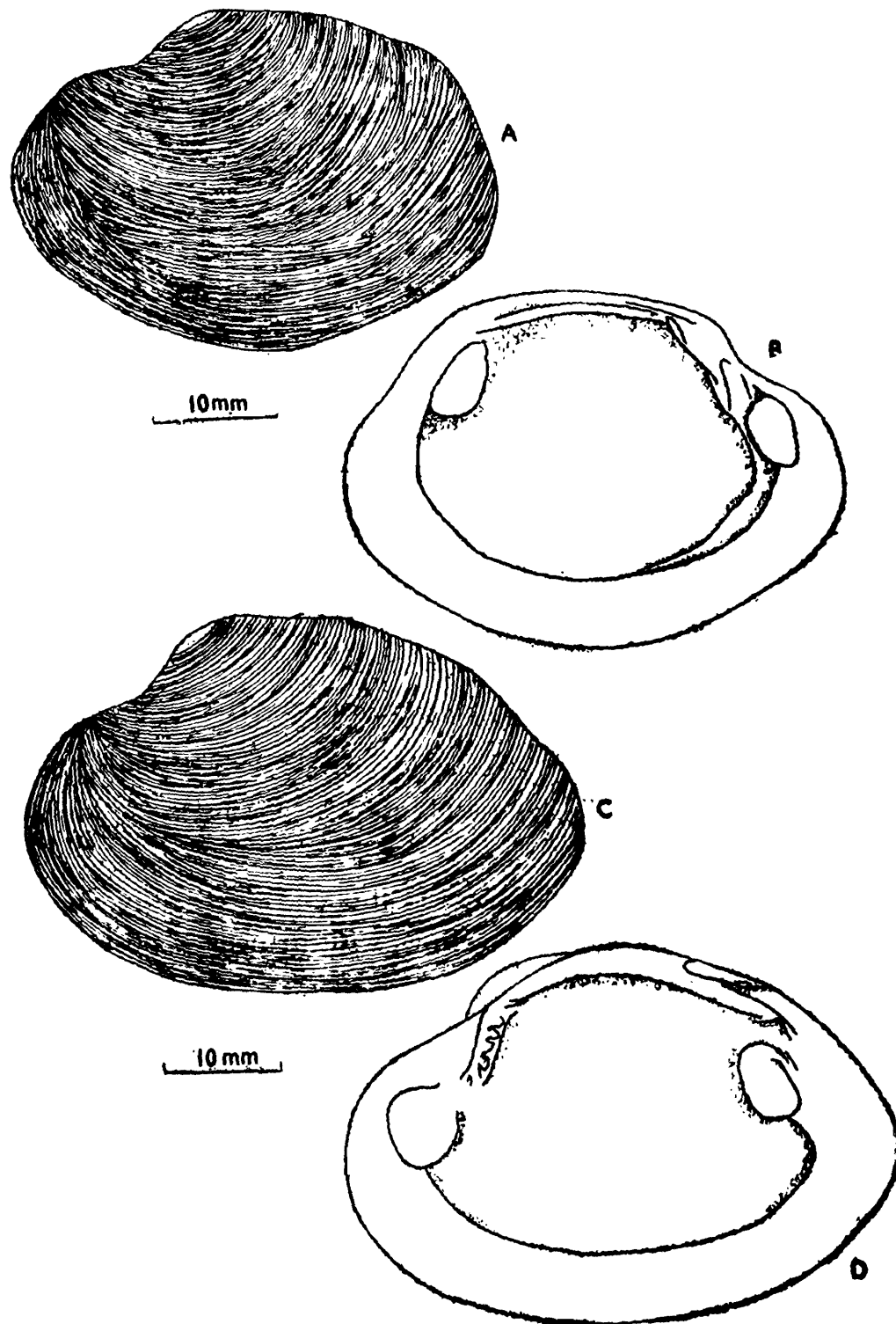


Fig. 14. A, B. *Parreysia (Parreysia) corrugata* var. *nagpoorensis* (Lea)
C, D. " " *favidens* (Benson)

23. *Parreysia (Parreysia) favidens* (Benson)

(Fig. 14 C, D)

1860. *Unio favidens* Benson, *Ann. Mag. nat. Hist.*, 10 : 188.

Material examined : Kalahandi district : 3 exs., Small river, Mundarage village, Balliguda. Sambalpur district : 1 ex., Sambalpur. Sundargarh district : 1 ex., Bank of Brahmani river, Bonaigarh.

Measurements :	Length	Width	Thickness
	43.82-65.3	29.0-41.8	19.33-27 mm.

Distribution : INDIA : Common throughout, including Orissa (as above). Elsewhere : Bangladesh, Burma & Pakistan.

Remarks : Thicker, larger, more inequilateral, both anterior and posterior margins angulate, cardinal teeth strong and broad.

24. *Parreysia (P.) favidens* var. *deltae* (Benson)

(Fig. 15 A, B)

1862. *Unio favidens* var. *deltae* Benson, *Ann. Mag. nat. Hist.*, (3)10 : 189.

Material examined : Phulbani district : 2 exs., 3 valves. S. bank of Mahanadi, Baudh.

Measurements :	Length	Width	Thickness
	13.4-31.65	9.7-23.15	6.05 (single valve)

Distribution : INDIA : Orissa (as above), Uttar Pradesh and West Bengal.

Remarks : Among the material studied, 2 exs, are young and thin, others are typically greenish yellow, with biangulate posterior end and strongly sculptured umbo.

25. *Parreysia (P.) favidens* var. *plagiosoma* (Benson)

(Fig. 15 C, D)

1862. *Unio plagiosoma* Benson, *Ann. Mag. nat. Hist.*, (3)10 : 191.

Material examined : Kalahandi district : 3 exs., Tel river bed, Kesinga.

Measurements :	Length	Width	Thickness
	32.3-46.65	23.26-30.6	13.8-21.6 mm.

Distribution : Assam, Bihar, West Bengal, and Orissa (as above).

Remarks : Shell ovately trigonal, anterior end well rounded, posterior elongately rounded, dorsal margin evenly sloping on both sides.

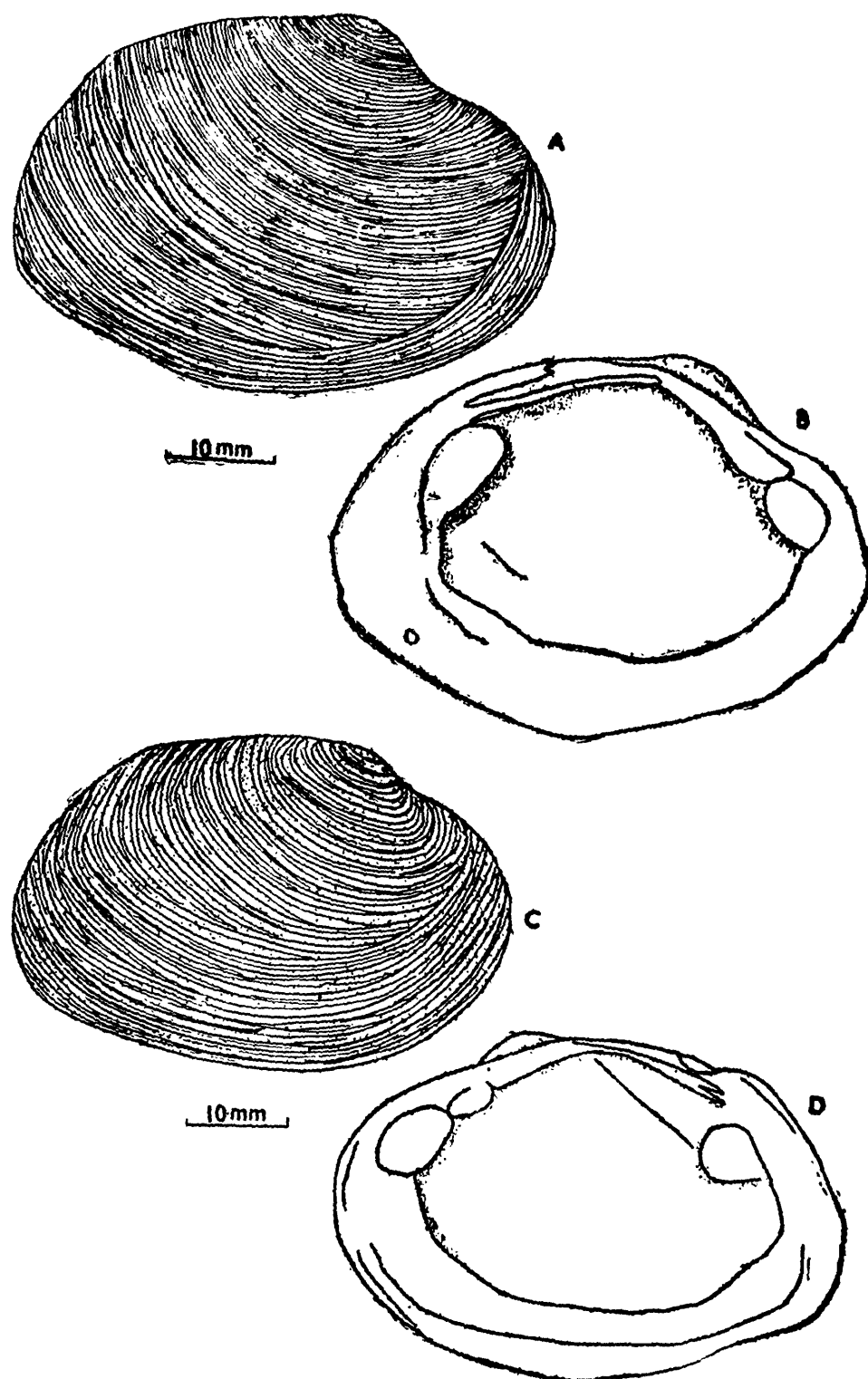


Fig. 15. A, B. *Parreysia (Parreysia) favidens* var. *deltae* (Benson)
C, D. " " " *plagiosoma* (Benson)

26. *Parreysia (Radiatula) caerulea* (Lea)

(Fig. 16 A, B)

1831. *Unio caerulea* Lea, *Trans. Amer. Phil. Soc.*, 4 : 95, pl. 13, fig. 25.
 1915. *Nodularia (N.) caerulea* : Preston, *Fauna Brit. India, Mollusca, Freshwater gastropoda and pelecypoda* : 136.
 1943. *Indonaia caerulea* : Ray, *J. Asiat. Soc. Bengal*, 9 : 78.

Material examined : Kalahandi district : 3 exs. Gotuma village, Khariar Rd., 2 exs., Pond near Jonk river, N. of Khariar Rd ; 5 exs., Sundari river, Komna. Koraput district : 9 exs., Patragadda stream, Jeypore. Phulbani district : 4 exs., Bank of Mahanadi river, Baudh ; 7 exs., Damadai river near Balliguda. Sambalpur district : 14 valves, Sambalpur.

<i>Measurements</i> :	Length	Width	Thickness
	30.0-44.26	16.71-22.8	11.65-12-95 mm.

Distribution : INDIA : Common throughout, including Orissa (as above). Elsewhere : Bangladesh, Burma and Pakistan.

Remarks : Shape of shell variable, grown up shells have strong zig-zag sculpture on umbonal regions only, posterior umbonal carina distinct.

27. *Parreysia (R.) caerulea* var. *gaudichaudi* (Eydoux)

(Fig. 16 C, D)

1838. *Unio gaudichaudi* Eydoux, *Mag. de. Zool. d.* 5 : 10 pl. 118, fig. 3.
 1915. *Nodularia (N.) caeruleus* var. *gaudichaudi* : Preston, *Fauna Brit. India, Freshwater gastropoda and pelecypoda*, p. 137.

Material examined : Koraput district : 90 exs., 7 valves, Stream at Dimla village, S. of Jeypore.

<i>Measurements</i> :	Length	Width	Thickness
	20.9-53.76	13.0-27.26	7.25-15.2

Distribution : INDIA : Orissa (as above) West Bengal.

Remarks : Shell tumid and thick, greenish with shorter anterior end and pointed posterior end, sculpture finer.

28. *Parreysia (Radiatula) shurtleffiana* (Lea)

(Fig. 16 E, F)

1856. *Unio shurtleffianus* Lea, *Proc. Acad. nat. Sci. Philad.*, 8 : 94.
 1915. *Nodularia (N.) shurtleffiana* : Preston, *Fauna Brit. India, Mollusca, Freshwater gastropoda and pelecypoda*, p. 138.

Material examined : Cuttack district : 8 exs., Cuttack.

<i>Measurements</i> :	Length	Width	Thickness
	20.25-32	12.10-17.5	6.72-12.85 mm.

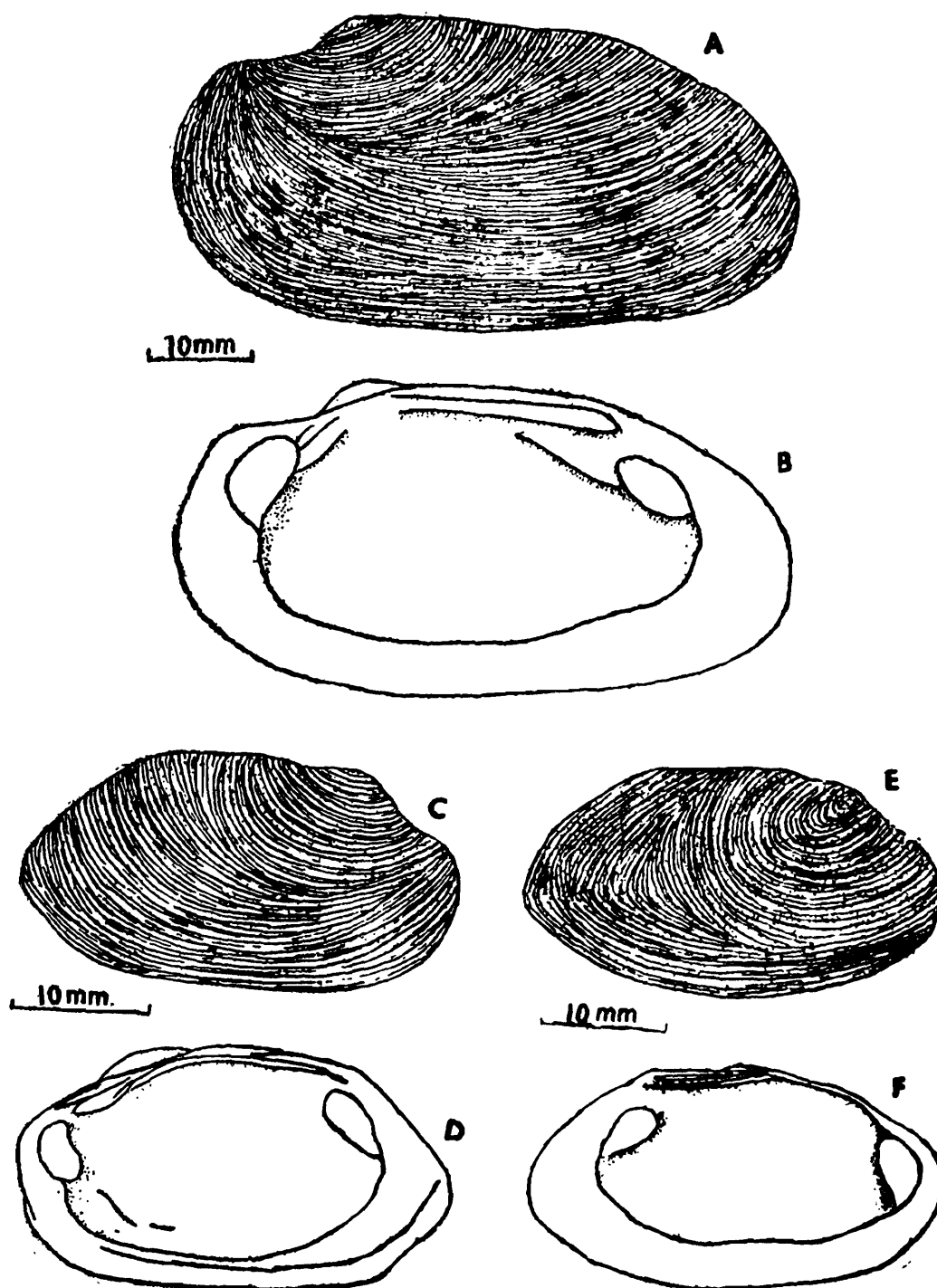


Fig. 16. A, B. *Parreysia (Radiatula) caerulea* (Lea)
 C, D. " " " " var. *gaulichaudi* (Eydoux)
 E, F. " " *shurtleffiana* (Lea)

Distribution : INDIA : Orissa (as above), Bihar, Madhya Pradesh, Maharashtra and Uttar Pradesh. Elsewhere : Burma.

Remarks : Shell thinner, greenish with broader posterior side, typical sculpture on beaks and posterior slope.

Order VENEROIDA

Family X. CORBICULIDAE

Key to genera

Shell smaller (less than 5 cms.), concentric ribb- ings stronger, lateral teeth serrated	...	<i>Corbicula</i>
Shell longer (more than 5 cms.), concentric ribb- ings weaker, lateral teeth smooth	...	<i>Geloina</i>

Genus 15. *Corbicula* Megerle von Mühlfeld, 1811

29. *Corbicula striatella* Deshayes

(Fig. 17 C, D)

1854. *Corbicula striatella* Deshayes, *Proc. zool. Soc.*, London, 22 : 344.

1928. *Corbicula striatella* : Prashad, *Mem. Indian Mus.*, 9 : 18, pl. 3, figs. 9-11.

Material examined : Kalahandi district : 18 exs., Tel river bed, Kesinga ; 16 exs., Indravati river, Nowrangpur ; 2 exs., Pipli Nullah, Khariar Rd. ; 1 ex. Jonk river, near Khariar Rd. Koraput district : 7 exs., Stream at Dimla village, Jeypore ; 56 exs., Patragadda stream, Jeypore. Phulbani district : 12 exs., Damodai river, near Balliguda ; 17 exs., Gomadi river bed, Balliguda.

<i>Measurements</i> :	Length	Width	Thickness
	11.5-21.1	9.2-11.42	5.5-11.25 mm.

Distribution : INDIA : Common throughout, including Orissa (as above), Elsewhere : Pakistan, Burma.

Remarks : Shell thick, of moderate size, tumid, ovately triangular, shining brown, very strongly concentrically ribbed, umbo distinctly raised.

Genus 16. *Geloina* Gray, 1842

30. *Geloina bengalensis* (Lamarck)

(Fig. 17 A, B)

1818. *Cyrena bengalensis* Lamarck, *Hist. nat. Anim. Sans. Vert.*, 5 : 554.

1921. *Geloina bengalensis* : Prashad, *Rec. Indian Mus.*, 22 : 138.

Material examined : Cuttack district : 2 exs., Nearby Paradip sea beach.

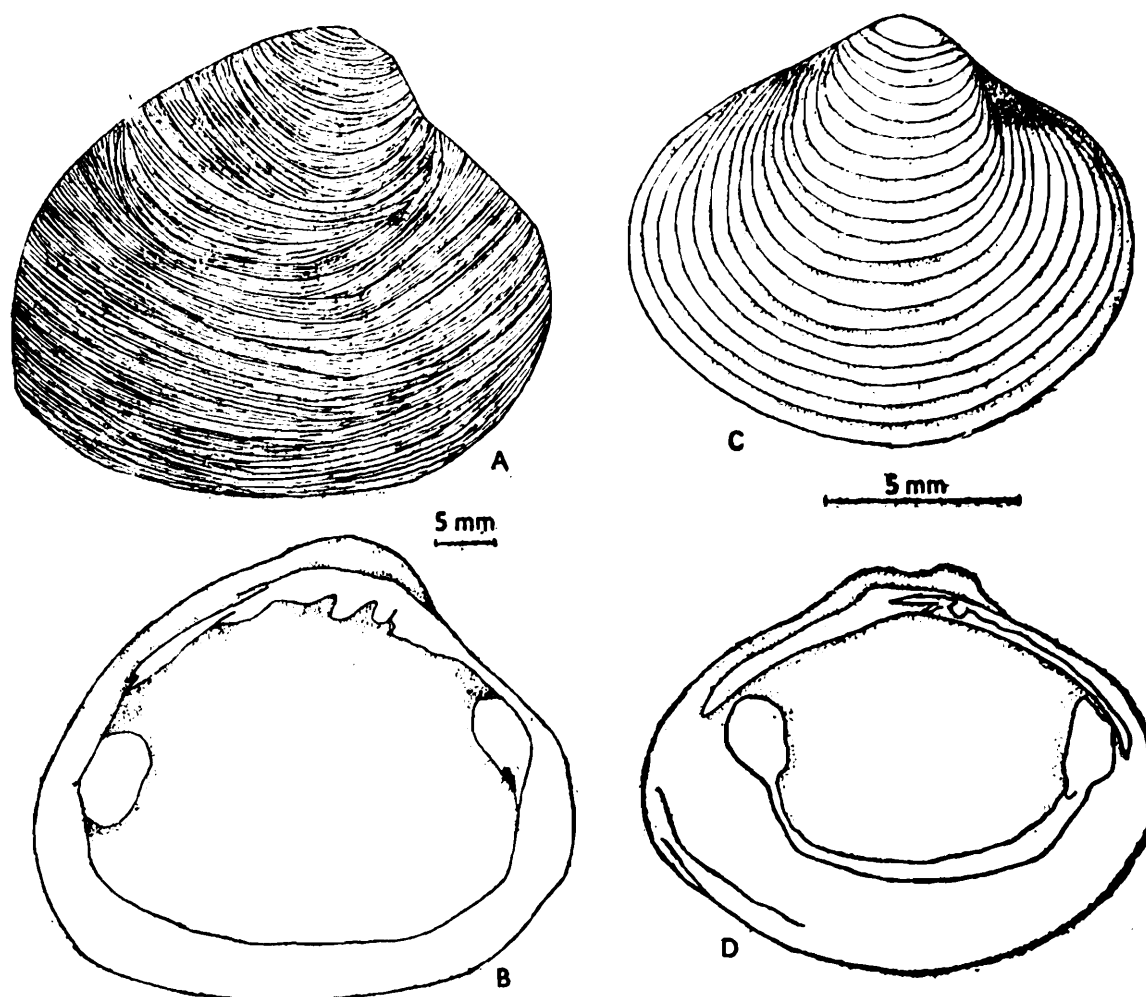


Fig. 17. A, B. *Geloina bengalensis* (Lamarck)
C, D. *Corbicula striatella* Deshayes

Distribution : INDIA : Orissa (Mahanadi river mouth), West Bengal (Gangetic delta). Elsewhere : Common in Indo-Pacific regions.

Remarks : Shell sub-trigonal, heavy, tumid, brownish, concentrically and rather roughly striate, dorsal margin pointed sloping down on both sides, steeply on posterior side and rather concavely on anterior, ventral margin convex.

The material examined, bears a locality label "nearby Paradip sea beach," since this species is estuarine to near fresh-water in habit, the two examples obviously come from Mahanadi river mouth.

GENERAL DISCUSSION

With as many as 14 well distributed major river systems, (Subarna-
rekha, Burhabalong, Salondi, Baitarini, Brahmani, Mahanadi, Tel,
Rushikulya, Bahuda, Vamsadhara, Nagavalli, Indravati, Kolab and
Machkund) draining the entire state, resulting in accumulation of
adequate water in different tanks, reservoirs etc., Orissa has a fairly
rich freshwater malacofauna (though the richness is quantitative rather
than qualitative in nature). The typical stagnant water forms are all
amply represented save, *Thiara* (T.) *scabra* among gastropods and the
family Pisidiidae among bivalves. The conspicuous absence of these
two becomes more puzzling since, the fact that all the species, barring
a negligible one, hitherto recorded from the state, could be studied,
points to the thoroughness of the survey made in that area. Absence
of notable hill-streams has justifiably resulted in non-occurrence of
genus like, *Paludomus*. However, *Ferrissia baconi*, a species of fresh-
water limpet, is represented by two exs. in the reserve collection,
though specific locality is not mentioned. The brackish-water genera
Stenothyra (gastropoda) and *Scaphula* and *Geloina* (bivalve), which rather
abundantly occur in the gangetic delta of West Bengal, are also
represented in the vicinity of Chilka lake and the Mahanadi river.

Among the vector snails, the genus *Lymnaea* has been parasitologi-
cally investigated by Patnaik and Ray (1966, 1967 & 1968). These
studies revealed that *L. auricularia* (= *L. acuminata*) var. *rufescens*
is the most common intermediate host of trematode parasites in
Orissa. Four kinds of larval trematodes were recorded from the
snail, these are i) *Cercaria Echinostoma revolutum* and their encysted
forms ii) Xiphido cercaria of ornate group and their encysted forms.
iii) *Cercaria shrivastavai* Dutta, a furcocercous type and *C. pigmentosa*.
All the different forms of *L. luteola* have been reported to have
parasites of *C. pigmentosa* type group, Xiphido cercariae group, and
Furcocercous group. Trematode parasitic infection is high in the
snails during the summer. Snails collected during winter are reported
to have infection of *Chaetogaster limni*, an oligochaete. A single
snail having mature infection is reported to have shedded as many
as 587 cercariae before it died. This alarming rate of infection is
to be viewed seriously, since these trematodes pose a threat to the
health of the livestock and since all the species of vector snails occur
in all the water bodies of the state at a very high rate.

SUMMARY

The comprehensive list of freshwater molluscs, so far recorded from the state of Orissa, presented here, includes a total of 40 specific and sub-specific forms, involving 16 genera (11 gastropods and 5 bivalves) and 11 families (8 gastropods and 3 bivalves). Out of these 40 species only one, viz. *Ferrissia verruca* Benson is included based on literature records as no recent material has been collected.

ACKNOWLEDGEMENTS

The authors are grateful to Dr. B. K. Tikader, Director, Zoological Survey of India, for necessary facilities to work and also to Dr. O. B. Chhotani, Scientist-SF, for encouragement.

REFERENCES

- ANNANDALE, N. 1924. Fauna of Chilka lake, Mollusca gastropoda (Revision). *Mem. Indian Mus.*, 5 : 853-873.
- ANNANDALE, N. & RAO, H. S. 1925. Materials for a revision of recent Indian Limnaeidae : (Mollusca Pulmonata). *Rec. Indian Mus.*, 27 : 137-189.
- ANNANDALE, N. & SEWELL, R. B. S. 1921. The banded pond snails of India (*Vivipara bengalensis*). *Rec. Indian Mus.*, 22 : 24-42, pls. I-III.
- BAHL, K. N. 1928. On the reproductive processes and development of *Pila globosa* (Swainson). *Mem. Indian Mus.*, 9 : 1-11.
- HANLEY, S. & THEOBALD, W. 1876. *Conchologia Indica*, London, pp. 1-65, pls. 160.
- TAYLOR, D. W. & SOHL, N. F. 1962. An outline of gastropod classification. *Malacologia*, 1 (1) : 7-32.
- NEVILL, G. 1884. Hand list of Mollusca in the Indian Museum, Calcutta, pp. 1-306.
- NEWELL, A. D. 1968. Classification of the Bivalvia. *Am. Museum Novitates*, No. 2206 : 1-25,

- PATNAIK, M. M. 1968a. Notes on glycogen deposits in *Limnaea auricularia* var. *rufescens* and the parasitic larval stages of *Fasciola gigantica* and *Echinostoma revolutum*. A histochemical study. *Annls Parasit hum. comp.*, **43** : 449-456, 8 pls.
- PATNAIK, M. M. 1968b. On the pathological changes in the muscular tissues of a *Limnaea auricularia* var. *rufescens* produced by a microsporidian parasite. *Indian J. anim. Heth.* **7** : 167-171, 4 pls.
- PATNAIK, M. M. 1971. Studies on geographical distribution and ecology of *Fasciola gigantica* with special reference to its intermediate host *Limnaea auricularia* var. *rufescens* in Orissa. *Ind. Jour. Helminth.*, **23** : 115-134, figs. 5.
- PATNAIK, M. M. AND RAY, S. K. 1966. On the life history and distribution of *Echinostoma revolutum* in the Orissa. *Indian Vet. J.*, **43** ; 595-600.
- PATNAIK, M. M. AND RAY, S. K. 1967. A histopathological study of *Limnaea auricularia* var. *rufescens* infested with the larval stages of *Echinostoma revolutum*. *Jap. Journ. Med. Sci.*, **16** : 253-258.
- PATNAIK, M. M. AND RAY, S. K. 1968. Studies on geographical distribution and ecology of *Limnaea auricularia* var. *rufescens* the intermediate host of *Fasciola gigantica* in Orissa. *India J. Vet. Sci.*, **38** : 484-508, 7 figs, 3 tabs.
- PRASHAD, B. 1925. Revision of the Indian Ampullariidae. *Mem. Indian Mus.*, **8** : 69-89, pls. 13-15.
- PRESTON, H. B. 1914. Mollusca from the Chilka lake on the east coast of India. *Rec. Indian Mus.*, **10** 297-310, figs. 1-22.
- PRESTON, H. B. 1915a. A further report on Mollusca from the Chilka lake on the east coast of India. *Rec. Indian Mus.*, **11** : 289-310, figs. 1-25a.
- PRESTON, H. B. 1915b. Fauna of British India, Mollusca, Freshwater Gastropoda, and Pelecypoda, pp. 1-24'.